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*Illinois Weather and Climate Information*

*--Where to Find It*

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ILLINOIS STATE WATER SURVEY

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## **ABBREVIATIONS**

The following abbreviations are used frequently in this text to save space and to allow quick identification of organizations and titles.

<b>CD</b>	<b>Climatological Data</b>
<b>EDS</b>	<b>Environmental Data Service</b>
<b>ESSA</b>	<b>Environmental Science Services Administration</b>
<b>FAA</b>	<b>Federal Aviation Agency</b>
<b>FOS</b>	<b>First-Order Station</b>
<b>ISWS</b>	<b>Illinois State Water Survey</b>
<b>LCD</b>	<b>Local Climatological Data</b>
<b>NOAA</b>	<b>National Oceanographic and Atmospheric Administration</b>
<b>NWRC</b>	<b>National Weather Records Center</b>
<b>NWS</b>	<b>National Weather Service</b>
<b>USWB</b>	<b>United States Weather Bureau</b>

# ILLINOIS WEATHER AND CLIMATE INFORMATION - WHERE TO FIND IT

*by Stanley A. Changnon, Jr.*

## INTRODUCTION

The purposes of this report are 1) to review the types and formats of climatic data for Illinois that exist in either published or unpublished form, and 2) to list where these data can be found. It is intended to inform both scientists and the interested public of the variety of data available and how to locate desired data easily.

The climatic data are classified according to the sources from which they can be obtained: the National Weather Service (previously the U. S. Weather Bureau), the Illinois State Water Survey, and other sources such as the Federal Aviation Agency and the U. S. Air Force. The first part of this report deals with the National Weather Service data, including that of its predecessors — the Weather Bureau and the Environmental Science Services Administration. The second section deals with weather data and climatic information compiled by the Illinois State Water Survey. The third section concerns information from other organizations. The list of references at the end of the text provides titles of many publications concerning Illinois weather and climate, with special notes indicating the types of information they contain. These references are identified in the text discussions by the author and year shown in italics. An appendix lists addresses and telephone numbers where additional weather data may be obtained.

## NATIONAL WEATHER SERVICE DATA

The National Weather Service (NWS) data sources are grouped into five classes. These include data from 1) individual weather station publications, 2) state publications, 3) national publications, 4) general climatic publications, and 5) original data forms. All past publications from 1901 through 1965 are listed under the name U. S. Weather Bureau (USWB). All publications since 1966 are listed under the Environmental Data Service (EDS), a branch of the NWS. Both EDS and NWS are part of the National Oceanographic and Atmospheric Administration (NOAA).

One key to understanding the publication situation of NWS and EDS is that the USWB went from hand processing of data to punch-card entries of all data in 1949. As soon as they were able to process all weather data in digital form, they could mass-produce many

kinds of publications unmanageable prior to that time. Although almost all NWS weather data since 1949 are now on punch cards or magnetic tapes, very few of the pre-1949 data have been put in card or tape form unless they were used for special studies.

### Station Publications

The first source of data discussed is that from the individual weather stations. There are four basic classes of National Weather Service stations. These classes were developed to meet certain requirements for weather data (aviation, hydrology, climatology). These needs are reflected in the amount and type of instrumentation and the manner of station operation, whether operated full time or part time and by professional or volunteer personnel. Over the years,

# U. S. DEPARTMENT OF COMMERCE WEATHER BUREAU

Stations for which Local Climatological Data are issued, as of January 1956

abc ALABAMA abc Birmingham abc Mobile abc Montgomery  abc ALASKA abc Anchorage abc Annette abc Barrow abc Bethel abc Cold Bay abc Cordova abc Fairbanks abc Juneau abc King Salmon abc Kotzebue abc McGrath abc Nome abc Northway abc St. Paul Island abc Yakutat  ac ARIZONA abc Flagstaff abc Phoenix abc Prescott abc Tucson abc Winslow abc Yuma  abc ARKANSAS abc Fort Smith abc Little Rock ac Texarkana  abc CALIFORNIA abc Bakersfield ac Bishop ac Blue Canyon abc Burbank abc Eureka abc Fresno abc Los Angeles ac Mt. Shasta abc Oakland abc Red Bluff abc Sacramento abc Sandberg abc San Diego abc San Francisco abc Santa Maria  ac ALANOSA abc Colorado Springs abc Denver abc Grand Junction abc Pueblo  ac CONNECTICUT abc Bridgeport abc Hartford ac New Haven  abc DELAWARE abc Wilmington  DISTRICT OF COLUMBIA abc Washington  ac FLORIDA abc Apalachicola abc Daytona Beach ac Fort Myers abc Jacksonville ac Key West ac Lakeland abc Miami abc Orlando ac Pensacola abc Tallahassee abc Tampa abc West Palm Beach	abc GEORGIA abc Athens abc Atlanta abc Augusta abc Columbus abc Macon abc Rome abc Savannah  abc HAWAII abc Hilo abc Honolulu abc Lihue  abc IDAHO abc Boise ac Idaho Falls ac Lewiston abc Pocatello  ac ILLINOIS abc Cairo abc Chicago abc Moline abc Peoria abc Springfield  abc INDIANA abc Evansville abc Fort Wayne abc Indianapolis abc South Bend  abc IOWA abc Burlington abc Davenport abc Des Moines abc Dubuque abc Sioux City abc Waterloo  abc KANSAS abc Concordia abc Dodge City abc Goodland abc Topeka abc Wichita  abc KENTUCKY abc Lexington abc Louisville  abc LOUISIANA abc Baton Rouge abc Lake Charles abc New Orleans abc Shreveport  abc MAINE abc Caribou abc Portland  abc MARYLAND abc Baltimore abc Frederick  abc MASSACHUSETTS abc Blue Hill Obs. abc Boston abc Nantucket abc Pittsfield  abc MICHIGAN abc Alpena abc Detroit abc Grand Rapids abc Escanaba ac Flint abc Lansing (East) abc Marquette abc Muskegon abc Sault Ste. Marie	abc MINNESOTA abc Duluth abc International Falls abc Minneapolis abc Rochester abc St. Cloud  abc MISSISSIPPI abc Jackson abc Meridian abc Vicksburg  abc MISSOURI abc Columbia abc Kansas City abc St. Joseph abc St. Louis abc Springfield  abc MONTANA abc Billings abc Butte abc Glasgow abc Great Falls abc Havre abc Helena abc Kalispell abc Miles City abc Missoula  abc NEBRASKA abc Grand Island abc Lincoln abc Norfolk abc North Platte abc Omaha abc Scottsbluff abc Valentine  abc NEVADA abc Elko abc Ely abc Las Vegas abc Reno abc Winnemucca  abc NEW HAMPSHIRE abc Concord abc Mt. Washington  abc NEW JERSEY abc Atlantic City abc Newark abc Trenton  abc NEW MEXICO abc Albuquerque abc Clayton abc Raton abc Roswell  abc NEW YORK abc Albany abc Binghamton abc Buffalo abc New York abc Rochester abc Schenectady abc Syracuse  abc NORTH CAROLINA abc Asheville abc Charlotte abc Greensboro abc Hatteras abc Raleigh abc Wilmington abc Winston-Salem	abc NORTH DAKOTA abc Bismarck abc Devils Lake abc Fargo abc Williston  abc OHIO abc Akron-Canton abc Cincinnati abc Cleveland abc Columbus abc Dayton abc Sandusky abc Toledo abc Youngstown  abc OKLAHOMA abc Oklahoma City abc Tulsa  abc OREGON abc Astoria abc Burns abc Eugene abc Medford abc Medford abc Pendleton abc Portland abc Roseburg abc Salem abc Sexton Summit  abc PACIFIC ISLANDS abc Canton abc Eoror abc Majuro abc Ponape abc Truk (Moon) abc Wake abc Yap  abc PENNSYLVANIA abc Allentown abc Harrisburg abc Philadelphia abc Pittsburgh abc Reading abc Scranton abc Shippingport abc Williamsport  abc RHODE ISLAND abc Block Island abc Providence  abc SOUTH CAROLINA abc Charleston abc Columbia abc Florence abc Greenville abc Spartanburg  abc SOUTH DAKOTA abc Huron abc Rapid City abc Sioux Falls  abc TENNESSEE abc Bristol abc Chattanooga abc Knoxville abc Memphis abc Nashville abc Oak Ridge	abc TEXAS abc Abilene abc Amarillo abc Austin abc Brownsville abc Corpus Christi abc Dallas abc Del Rio abc El Paso abc Fort Worth abc Galveston abc Houston abc Laredo abc Lubbock abc Midland abc Port Arthur abc San Angelo abc San Antonio abc Victoria abc Waco abc Wichita Falls  abc UTAH abc Milford abc Salt Lake City  abc VERMONT abc Burlington  abc VIRGINIA abc Lynchburg abc Norfolk abc Richmond abc Roanoke  abc WASHINGTON abc Olympia abc Seattle abc Spokane abc Stampede Pass abc Tatoosh Island abc Walla Walla abc Yakima  abc WEST INDIES abc San Juan, P.R.  abc WEST VIRGINIA abc Charleston abc Elkins abc Huntington abc Parkersburg  abc WISCONSIN abc Green Bay abc La Crosse abc Madison abc Milwaukee  abc WYOMING abc Casper abc Cheyenne abc Lander abc Sheridan
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- a. Monthly summary issued.
- b. Monthly summary includes 3-hourly observations.
- c. Annual summary to be issued.

FIGURE 1

however, each class of station has had a great variety of equipment.

The first class includes the *first-order stations* which are usually operated 24 hours a day by professional NWS personnel. First-order stations are most often located in major cities in each state, and have a wide variety of instruments.

The *cooperative substations* form the second class. All substations have a nonrecording rain-gage and about 40 percent of them have maximum and minimum thermometers. Sometimes such a station has additional equipment, but the nonrecording stick rain-gage is its basic instrument. A volunteer observer makes once-a-day measurements, and reports the daily rain, snow, and temperature values on a monthly form.

The third station type is classified as *other* and includes several versions of the cooperative station. This type includes the river reporting station where an observer keeps daily rain records (usually with a nonrecording gage like those used at cooperative substations), and he telephones a river district office anytime he has  $\geq 0.5$  inch of rain. Other forms of the cooperative observer station include those that have an evaporation pan and wind equipment, and those that measure soil temperatures. The only Illinois station currently incorporating all these instruments and activities is the Morrow Plots Station in Urbana.

Another version of the cooperative station is that with a recording rain-gage. It usually does not have a stick gage. It is operated by volunteers who generally change recording charts after each rain (or weekly) and mail them to the National Weather Records Center (NWRC) for machine analysis and digitization. Since 1950, Illinois has had about 60 of these stations widely separated throughout the state plus 12 in Chicago to give a high density of gages there.

The fourth class of station is the *special* type operated by NWS personnel. This type includes radiosonde stations and pollution monitoring stations (EMSU, Environmental Monitoring Service Unit). Some special stations co-exist with a first-order station, but others do not.

Salem, Illinois, is a radiosonde station and an EMSU, but it is not a first-order station. Peoria is a radiosonde and a first-order station.

**First-Order Stations.** All the first-order stations (FOS) are listed by states in figure 1. There are monthly *Local Climatological Data* (LCD) publications for each of these stations. On figure 1, the letters (a, b, c) beside each station identify the type of data being published for the FOS.

Since 1964 the monthly LCD issues at most FOS are single sheets listing on one side:

- 1) the daily values of everything measured,
- 2) the hourly rainfall values, and
- 3) the monthly totals and averages (figure 2).

On the back side of this monthly LCD sheet there are 3-hourly values (measurements taken once every 3 hours) of the relative humidity, wet and dry bulb temperatures, cloud cover, ceiling, etc. There is much useful information on the LCD.

From about 1950 (when most Illinois FOS began to have LCD publications prepared) through 1964, the USWB had a different monthly format. During these years, they published two monthly issues:

- 1) the LCD with a blank back page (this was comparable to the daily form sheet used since 1965)
- 2) an LCD supplement (figure 3) which showed the hourly (not 3-hourly) values of all weather conditions

As part of the LCD supplement, the USWB also published one page of summary values, such as the average humidity for each hour during the month. However, at the end of 1964 when the LCD supplement stopped, the hourly data were replaced by the 3-hourly values. These published data give the characteristics of thunderstorms, hail, precipitation, cloud cover, or visibility.

LCDs have been published (for varying periods of time) for the following Illinois FOS: Cairo, Chicago, Moline, Peoria, Rockford, and Springfield. If these are not available in a library, they can be purchased from the U. S. Government, Superintendent of Documents (*see appendix*). Most cost only 10 to 15 cents



**LOCAL CLIMATOLOGICAL DATA**  
**U.S. DEPARTMENT OF COMMERCE**  
 MAURICE H. STANS, Secretary  
**NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION**  
 ENVIRONMENTAL DATA SERVICE

PEORIA, ILLINOIS  
 GREATER PEORIA AIRPORT  
 SEPTEMBER 1970

Latitude 40° 40' N Longitude 89° 41' W Elevation (ground) 482 ft. Standard time used: CENTRAL

Date	Temperature (°F)							Weather types on dates of occurrence 1 Fog 2 Heavy fog 3 Thunderstorm 4 Ice pellets 5 Mist 6 Glaze 7 Duststorm 8 Smoke, haze 9 Blowing snow	Snow ice pellets or ice on ground at 06AM (in.)	Precipitation		Avg. station pressure (in.) Elev. 662 feet m.s.l.	Wind			Sunshine		Sky cover (Tenths)		Date		
	Maximum	Minimum	Average	Departure from normal	Degree days (Base 65°)		Water equivalent (in.)			Snow ice pellets (in.)	Resultant direction		Resultant speed (m.p.h.)	Average speed (m.p.h.)	Fastest mile	Hours and tenths	Percent of possible	Subsides to sunset	Midnight to midnight			
					Heating	Cooling																
1	83	60	72	1	34	0	7											1				
2	86	66	76	3	65	0	11	1 3	8	0	0	29.43	09	8.0	8.2	10	SE	8.7	67	6	6	1
3	81	68	75	3	67	0	10	1 3	8	0	0	29.26	16	8.2	8.6	14	SE	5.3	41	9	9	2
4	76	67	72	-1	63	0	1	1 3	8	0	0	29.00	22	9.1	10.3	18	W	3.8	29	8	8	3
5	78	67	73	-1	65	0	0	1 3	8	0	0	29.10	21	4.4	5.2	11	SE	2.0	20	9	7	4
6	82	70	76	7	67	0	11	3	8	0	0	29.23	18	4.6	5.2	12	SE	3.9	30	9	7	5
7	91a	72	82	13	70	0	17	1 3	8	0	0	29.16	17	10.9	11.4	14	S	0.9	7	10	8	6
8	77	59	68	-1	57	0	3			0	0	29.14	20	10.2	11.7	16	SW	10.6	83	4	5	7
9	85	57	71	2	61	0	6	1 3	8	0	0	29.26	32	6.2	7.1	10	NW	11.3	88	8	5	8
10	70	48	59	-9	49	6	0			0	0	29.19	19	7.5	8.1	40	W	11.2	88	2	4	9
11	73	43	58	-10	43	7	0	3	8	0	0	29.39	29	12.8	13.4	21	NW	10.8	85	2	2	10
12	73	37	55	-12	37	8	0	1 3	8	0	0	29.46	17	4.4	4.8	11	SE	12.7	100	0	0	11
13	63	31	37	-11	30	8	0	1 3	8	0	0	29.28	17	9.0	10.8	15	S	3.7	29	8	9	12
14	62	52	57	-10	32	8	0	1	3	8	0	29.41	03	13.3	13.7	16	NE	0.2	2	10	10	13
15	86	59	73	2	54	8	0	1	3	8	0	29.43	06	4.6	5.6	9	NW	0.0	0	10	10	14
16	89	57	73	5	54	8	0	1	3	8	0	29.38	21	4.5	10.9	17	NW	4.9	39	8	8	15
17	73	61	67	0	60	0	2	1	3	8	0	29.55	04	8.7	9.5	12	NE	6.8	7	10	10	16
18	76	58	67	1	57	0	2	1	3	8	0	29.41	08	1.5	3.8	10	SE	0.0	0	10	10	17
19	81	53	67	1	55	0	2	1	3	8	0	29.38	33	4.7	4.9	12	N	10.9	87	2	3	18
20	86	40	73	8	63	0	8	1	3	8	0	29.36	13	4.5	4.8	11	SE	12.3	100	0	0	19
21	88	67	78	13	67	0	13	3	8	0	0	29.24	18	8.8	9.4	15	S	10.5	85	3	3	20
22	87	57	72	-3	59	3	0	1 3	8	0	0	29.19	21	9.7	11.9	18	SW	10.0	82	4	4	21
23	82	56	69	3	60	0	4	1 3	8	0	0	29.20	05	4.9	8.1	13	NE	0.0	0	10	10	22
24	69	53	61	-3	53	4	0			0	0	29.14	11	8.1	13.1	17	SE	3.7	30	9	9	23
25	81	52	67	3	57	0	2	1 3	8	0	0	29.19	22	6.9	9.8	18	SW	2.1	17	8	6	24
26	85	43	64	-9	45	11	0	1 3	8	0	0	29.36	16	6.9	8.6	14	SE	9.7	81	3	4	25
27	83	38	61	-11	38	13	0	1 3	8	0	0	29.42	21	10.2	10.9	18	NW	6.5	5	10	8	26
28	66	34	52	-11	39	13	0			0	0	29.49	30	4.9	7.6	20	N	12.0	100	1	0	27
29	78	44	60	-2	44	5	0			0	0	29.62	36	4.5	6.2	12	NW	10.2	85	4	0	28
30	70	51	61	-1	46	4	0			0	0	29.47	18	8.6	11.1	16	S	11.5	100	0	0	29
30	70	51	61	-1	46	4	0			0	0	29.33	01	5.3	8.8	13	W	11.8	100	0	0	30

Sum	Sum				Total	Total				Total	Total	For the month:	Total	%	Sum	Sum					
2282	1661			84	109					11.49	0	22,21	19	2.0	8.8	40	W	197.8	for	177	189
Avg.	Avg.	Avg.	Dep.	Avg.	Dep.	Dep.				Precipitation	Dep.				Date:	09	Possible	month		Avg.	Avg.
76.1	55.4	69.8	-0.6	56	-2					18	8.44					23	5.9	23	5.9	23	

Date	A. M. Hour ending at												P. M. Hour ending at												Date	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12		
1																									1	
2																									2	
3	T	.08	.14	.01	.03	T			.02	.01	.01	.02			.01										3	
4																									4	
5																									5	
6																									6	
7																									7	
8																									8	
9																									9	
10																									10	
11																									11	
12	T	.02	T	T						T	T	.02			T	T	.10		.02	.04	.39	.99	.14	12		
13	.02	.02	.36	.40	.11	.05	.03			T	T	T	T		T	T	.10		.02	.04	.39	.99	.14	13		
14	.08	T	.01	.01	.02	.01	.06	.04	.18	.04	.02	.04	.08	.03	.03	.03	.01	.03	T	T	.02	.04		14		
15	.07	.01																							15	
16																									16	
17											.05	.01	T	T	T	T					.02			17		
18																									18	
19																									19	
20																									20	
21																									21	
22	1.34	.58	.08	.21	.12	.03	.07	.22	.10	.03	.01	T		.04	.03	T	T	.04	T	.03	.03	.01	T	.26	22	
23	.06	T	.02	T	T	T	.01	.01	T	T											.02	.39	.64	.78	.24	23
24	T	.01																								24
25																										25
26	T	T	.02	.14	T	.01				T	T	T														26
27																										27
28																										28
29																										29
30																										30

\* Extreme temperatures for the month. May be the last of more than one occurrence.  
 - Below zero temperature or negative departure from normal.  
 † Also on an earlier date, or dates.  
 X Heavy fog restricts visibility to 1/4 mile or less.  
 T In the Hourly Precipitation table and in columns 9, 10, and 11 indicates an amount too small to measure.  
 The season for degree days begins with July for heating and with January for cooling.  
 Data in columns 6, 12, 13, 14, and 15 are based on 8 observations per day at 3-hour intervals.  
 Wind directions are those from which the wind blows. Resultant wind is the vector sum of wind directions and speeds divided by the number of observations.  
 Figures for directions are tenths of degrees from true North: 16 = East, 18 = South, 27 = West, 36 = North, and 00 = Calm. When directions are in tenths of degrees in Col. 17, entries in Col. 16 are fastest observed 1-minute speeds. If the / appears in Col. 17, speeds are gusts.

Any errors detected will be corrected and changes in summary data will be annotated in the annual summary.  
 Subscription Price: Local Climatological Data \$1.00 per year including annual Summary if published. Single copy: 10 cents for monthly Summary; 15 cents for annual Summary. Checks or money orders should be made payable and remittances and correspondence should be sent to the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.

Hour (Local time)	Sky cover (10 tenths)	AVERAGES												Resultant wind		
		Station pressure (in.)	Dry bulb (°F)	Wet bulb (°F)	Wind speed (m.p.h.)	Direction	Speed (m.p.h.)	Direction								
00	6	29.30	62	58	78	55	7.9	16	1.2							
03	6	29.20	60	56	80	53	7.7	13	.8							
06	6	29.32	58	53	83	59	7.7	16	1.3							
09	6	29.34	60	60	72	56	10.6	20	3.1							
12	6	29.33	71	63	84	58	11.3	20	3.1							
15	6	29.29	74	64	90	58	10.7	21	3.0							
18	6	29.28	69	63	88	58	7.1	19	2.4							
21	5	29.30	64	60	76	56	7.2	16	1.6							

I certify that this is an official publication of the National Oceanic and Atmospheric Administration, and is compiled from records on file at the National Climatic Center, Asheville, North Carolina 28801.  
 William J. Haggard  
 Director, National Climatic Center

FIGURE 2

# HOURLY OBSERVATIONS:

PEORIA, ILLINOIS  
GREATER PEORIA AIRPORT  
JULY 1963

HOUR	SKY COVER	DIRTY	WIND	TEMP	DEW	REL. HUM.	PRES.	WIND DIR.	WIND SPC.	VISIB.	CLOUDS	MOON	PHASE	DAY	STATION		WIND
															NO.	NAME	
00	0			74	64	86	30.00	0	0	10				1	1	1	0
00	0			74	64	86	30.00	0	0	10				2	1	1	0
00	0			74	64	86	30.00	0	0	10				3	1	1	0
00	0			74	64	86	30.00	0	0	10				4	1	1	0
00	0			74	64	86	30.00	0	0	10				5	1	1	0
00	0			74	64	86	30.00	0	0	10				6	1	1	0
00	0			74	64	86	30.00	0	0	10				7	1	1	0
00	0			74	64	86	30.00	0	0	10				8	1	1	0
00	0			74	64	86	30.00	0	0	10				9	1	1	0
00	0			74	64	86	30.00	0	0	10				10	1	1	0
00	0			74	64	86	30.00	0	0	10				11	1	1	0
00	0			74	64	86	30.00	0	0	10				12	1	1	0
00	0			74	64	86	30.00	0	0	10				13	1	1	0
00	0			74	64	86	30.00	0	0	10				14	1	1	0
00	0			74	64	86	30.00	0	0	10				15	1	1	0
00	0			74	64	86	30.00	0	0	10				16	1	1	0
00	0			74	64	86	30.00	0	0	10				17	1	1	0
00	0			74	64	86	30.00	0	0	10				18	1	1	0
00	0			74	64	86	30.00	0	0	10				19	1	1	0
00	0			74	64	86	30.00	0	0	10				20	1	1	0
00	0			74	64	86	30.00	0	0	10				21	1	1	0
00	0			74	64	86	30.00	0	0	10				22	1	1	0
00	0			74	64	86	30.00	0	0	10				23	1	1	0

FIGURE 3



per monthly issue. An amazing amount of weather data is summarized and published from the first-order stations.

Operations at individual first-order stations in Illinois have always differed considerably, and this is reflected in their LCD publications. A great amount of information is published for stations at Springfield and Chicago, but for Cairo, where operations have dwindled in recent years, many weather conditions are no longer measured. For example, Cairo publications have rain and temperature data but lack cloud, wind, and visibility values. FOS operations at many smaller cities were restricted during the last 20 years because of budget limitations, and hourly or 3-hourly observations were eliminated during certain periods of each day (usually at night).

Some LCDs contain unusual data. For example, the daily rainfall values for the dense recording and stick raingage network in Chicago are published in each of their monthly LCD issues.

Monthly LCDs issued during periods when two stations were operated in one city bear special attention. At St. Louis during the 1950-1958 period, one station was operated at Lambert Airport and another in the central city area (identified as City Office). The USWB published LCD issues for both stations. At some large cities where the USWB ran two first-order stations simultaneously, the data for both were published in the same issue. In other instances, data for only one of the two stations were published. The published records for double stations have been valuable in recent comparative studies of urban and rural climates (*Changnon, 1970c*).

The annual version, *Local Climatological Data, Annual Summary with Comparative Data*, is another interesting FOS publication. Annual issues became available at various times for the individual FOS, generally in the 1949-1952 period. This annual summary contains:

- 1) a short narrative description of the climate of the station and its area
- 2) the monthly means and annual totals for various weather conditions in the past year

- 3) a table called "Normals, Means and Extremes" based on past data
- 4) tables showing past monthly values of temperature, precipitation, and degree days

At the head of the data columns for normals and means, the periods of record used to determine the values are given. The record period should be noted because it can vary dramatically with time. For instance, in 1954 the precipitation normals for St. Louis were based on 118 years of past record, whereas more recently the St. Louis normals have been based on the last 30 years. Such changes in base periods can produce dramatic changes in normals and hence in monthly departures from normal.

On the back of the annual LCD is a rather complete listing of the various sites of the station through the years and the locations of the instruments installed. Ironically, though the first-order stations have the most extensive data available for North America, much of their data is unusable for studies of long-term historical climatic trends because of location changes. Almost every FOS in the country has been moved significant distances and/or has had sizeable shifts in the heights or placement of its instruments. For example, the Chicago FOS was in the downtown business area from 1900-1925, was moved to the University of Chicago from 1926-1944, and then went to Midway Airport from 1945 to the present. A second Chicago area FOS is now located at O'Hare Airport.

The *Summary of Hourly Observations* is a publication based on data from some of the FOS. These summaries have been published for 5- or 10-year base periods (1951-1955, 1956-1960, and 1951-1960), and they present, by month and year, the hourly frequencies of wind speed, temperature, humidity, and precipitation by class intervals, plus various combinations of these data. An example of the data available is shown in figure 4. Issues available for the FOS in and near Illinois include those for Chicago (O'Hare and Midway), Moline, and Springfield in Illinois; St. Louis, Missouri; Des Moines, Iowa; Madison, Wisconsin; and Evansville and Indianapolis, Indiana.



Another publication available for a few FOS is the *Climatic Guide*. This was published for the Chicago area in 1962, and is the only *Guide* available in the Midwest. It contains an extremely large amount of summarized information for Chicago FOS, and some data for nearby substations.

**Cooperative Substations.** These stations are basically once-daily temperature (maximum and minimum) and rainfall measuring stations, although as noted earlier only 40 percent of them record temperature data. Users of their data, at least for certain analyses, should be aware that the once-daily time of measurement can occur anytime in the day, but is usually in the morning or afternoon. This becomes a problem if one tries to determine daily rainfall totals for a discrete date or storm period. However, the times of observation for each station are published in the monthly state publications.

Some LCDs for substations have been produced in various states, generally by interested state institutions. The Water Survey has produced and published substation LCDs for 16 cooperative substations scattered throughout Illinois. A problem is that such LCDs are not always 'current' because they are not updated and re-issued often. These state-sponsored LCDs are not easily found in libraries, but some may be found by writing the National Weather Records Center (NWRC) in Asheville, North Carolina.

### State Publications

There are four classes of state-oriented NWS publications. These include the *Climatological Data* (CD) state series, the *Hourly Precipitation* publication, the *Weekly Weather and Crop Bulletin*, and various climatic summaries published for each state. Some problems and limitations need attention before these publications are discussed.

**Problems and Limitations.** First, much of the data in the state-oriented publications of the Weather Bureau (now EDS) is assembled and summarized by the regions of the state. For instance, in Illinois from 1900 through 1956

the state was divided into 3 regions — north, central, and south (figure 5). In all of the state publications for this 57-year period the stations in the northern third, for example, were listed together along with regional means of temperature, rainfall, etc. In 1957 the USWB changed the regions in all states and used crop-reporting districts as divisions with most states having 7, 8, or 9 districts. Since then the listing of the stations with their data summarization has been by crop-reporting districts. These districts vary in size, and were partially chosen according to combinations of different kinds of cropping practices and weather. There are 9 districts in Illinois, as shown in figure 5. In general, the districts chosen for Illinois were not realistic climatic divisions. As one example, there is no climatic reason that the southern end of Illinois should be divided into a southwest and a southeast portion. Furthermore, the crop-reporting districts in Illinois are not comparable in size to those in many other states, and such differences result in mean values that are not truly comparable.

The second problem common to all of the state publications and one to be particularly aware of is the 'normals.' Normals vary and can be misleading because they have been computed on base periods of varying length. From 1920 until 1952 the USWB used a base period of 1900-1944 (or portions thereof) for calculating substation normals. The USWB developed normals for short-term operations of new stations, even if they were for only 5 or 10 years. These were calculated from a comparison of the short-term substation's data with that of other nearby stations that had longer records in the 1900-1944 period. Importantly, every station had a monthly normal for rainfall and temperature (if measured).

In 1952 the USWB issued a new state publication that contained a different set of monthly normals, based on data from the 1931-1952 period. These normals were used in some climatic studies because they covered a more current data period than the old normals (*Changnon, 1968b*).

The USWB revised their publications and their normals again in 1956. They changed to a nor-

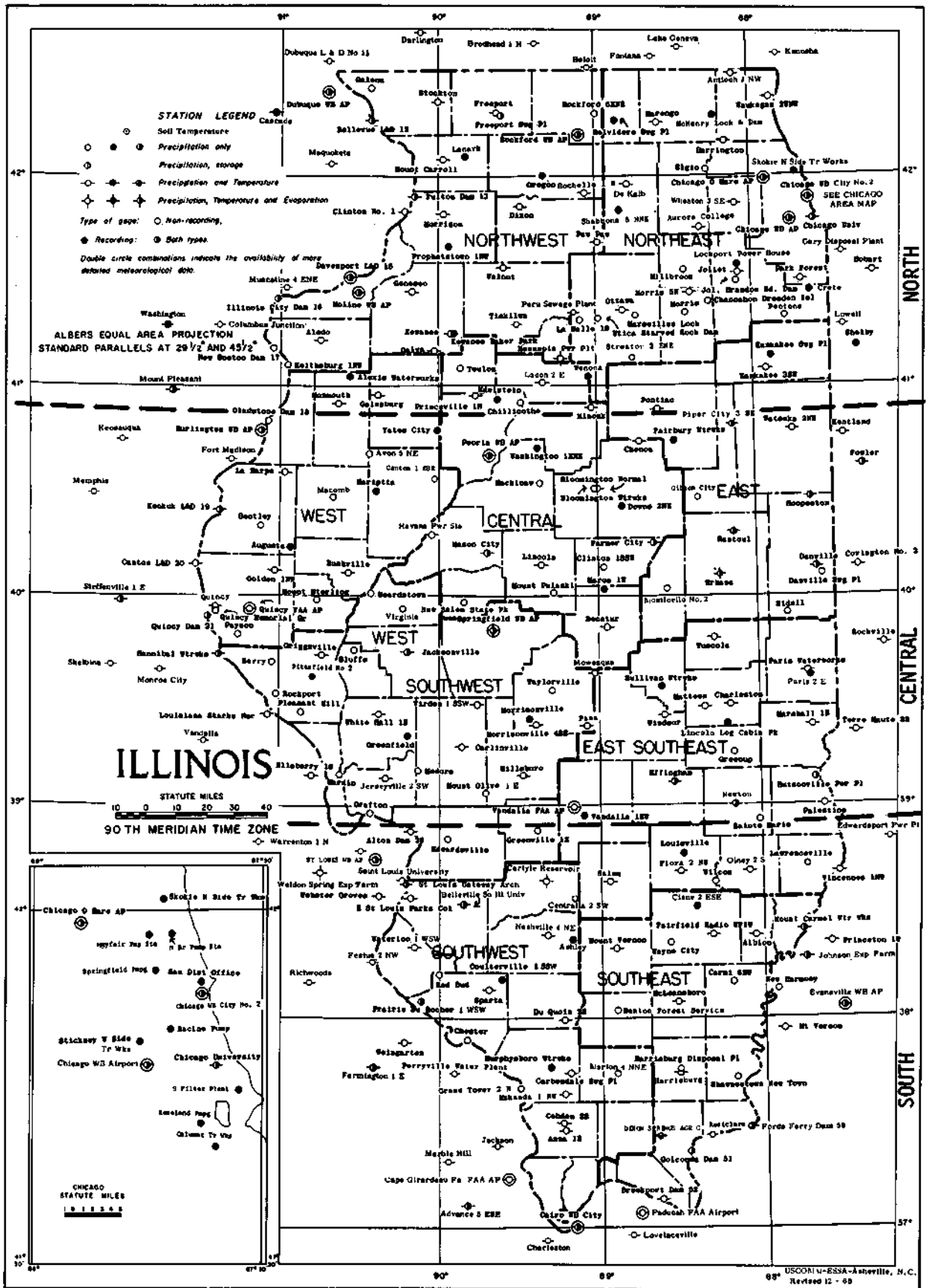


FIGURE 5

mal based on the 1931-1955 period, and these normals appeared in their state publications issued during 1956-1960. Then in 1961 the USWB issued new normals based on the 1931-1960 period. Because studies had shown that the best estimate of the 'normal condition' for any year was that based on the past 30 years of record, the USWB planned to update their normals once every 5 years. Thus, there would be a 1931-1960 normal that would be in use through 1965, and then a 1936-1965 normal, etc. However, the state publications for the EDS in 1974 are still based on the normals of the 1931-1960 period. Illinois normals for 1941-1970 would show sizeable shifts in the rainfall values since they would not contain the low values of the droughts of the 1930s. One must be aware of these 'shifting normals' when using state annual publications that span several years.

Climatic normals are sometimes chosen especially for a specific study. For example, most of the Water Survey studies in climatology have been oriented toward sampling extreme values, and hence the normals have been calculated from the longest period of available record. Thus, many Water Survey publications have used 50- or 60-year normals (*Changnon, 1959; Changnon, 1969a; Huff and Changnon, 1959; Huff and Changnon, 1963*).

**Climatological Data Publications.** The most commonly used state publication is the *Climatological Data-State* (name) which is issued for all states on a monthly and annual basis. Publication began in 1906, but was discontinued in one period from July 1909 through December 1913; monthly data for these 4½ years appeared in the *Monthly Weather Review*.

The state *Climatological Data* (CD) publications largely consist of the data reported from cooperative substations. A monthly issue contains, for selected substations and FOS:

- 1) the monthly average maximum and minimum temperatures
- 2) the monthly total precipitation values
- 3) the departures from the normals in use
- 4) other data such as the number of days of rain for different daily intensity classes

For all state substations with raingages (other than those with recording raingages) the CD

contains the daily and monthly precipitation values, as well as the daily snowfall and snow depth values for most stations. The daily maximum and minimum temperature values (where measured) appear along with miscellaneous data including any soil temperature, evaporation, or wind data from sites in operation at the time of the publication. Every issue contains a station index that lists for each cooperative substation the name of the observer, the daily observation time, the latitude and longitude of the station, its elevation, its instruments, and its distance and direction from the nearest post office as a means to locate the site precisely.

The annual issue of the state CD differs slightly from the monthly issue. The annual summary contains the monthly temperature means (and departures), total precipitation (and departures), total snowfall, temperature extremes, dates of fall and spring freezes, evaporation totals, plus maps showing the state's annual precipitation and average temperature. It also includes a list of all the state stations.

The contents of the monthly and annual CD issues have changed greatly with time. Prior to 1949, before the weather data were entered on punched cards (the punch-card era), the CD was the key state Weather Bureau publication. All computations were done manually for every station in each state, by the state offices. For example, the Section Director for Illinois (then located in Springfield) had the responsibility for checking and summarizing all the daily and monthly weather data for Illinois. The Section Director, because of his responsibility for the cooperative substations, usually had a close personal liaison with the volunteer cooperative observers. Thus, they had somebody to answer to. After the punch-card era began in 1949, the observers had less personal contact with USWB supervisory personnel. Consequently, the quality of Illinois substation data in the 1970s is lower than that in, say, 1910, 1925, or 1940.

Illinois had particularly good Section Directors. The efforts of two men, C. J. Root and S. Holcomb, covered a period of more than 40 years, during which they developed and sustained an outstanding group of observers who provided high quality Illinois data. These Direc-

tors wrote unusually detailed and informative summaries of the state's weather for the monthly CD. For example, the Illinois CD issues prior to 1949 contain much useful storm data, as seen in the summary for April 1925 in figure 6. Mr. Holcomb also recorded in a table by days of the month, the number of state stations reporting heavy fog, dust, frost, glaze, winds, hail, sleet, and thunderstorms.

**Hourly Precipitation Data.** This publication is based on rainfall data from the 72 recording raingages in Illinois serviced by cooperative observers. Such publications are issued for each state. The observers generally change the rain-gage charts once or twice a week, and then mail the chart with the rainfall trace on it (amount vs time) to the NWRC where it is analyzed to derive hourly amounts. The published data often contain mistakes because of the analysts' inability to determine rain time correctly (AM vs PM), and light rains are frequently missed because of overlapping rain traces. Recently, new recording gages which record amounts on paper tape that is less prone to analytical errors are being installed. However, amounts recorded are only to the nearest 0.1 inch, and again many light rains are missed.

Since 1951 there have been annual and monthly issues of the hourly precipitation data. The data for 1940-1947 were published in the *Hydrologic Bulletin* (by drainage areas), and hourly data for 1948-1951 appeared in the state CD issues. The annual issues contain the daily and monthly totals and a station index, but there are generally many missing data. In the monthly issues the hourly values are shown by date for those stations with rain (figure 7). The recording raingages in Illinois outside of Chicago form a very sparse network (raingages are located 30 to 40 miles apart), and data interpreters cannot estimate missing amounts adequately because they do not have comparable nearby data by which to check reports.

These hourly rainfall data must be used with caution. Comparison of annual values from the recording gages with those from nearby non-recording gages in Illinois shows that recording gages appear to be 'missing' about 4 to 6 inches of precipitation (10 to 20 percent) per year.

This is apparently due to chart editing problems and to a lack of good measurements of snow-fall (water). Thus, the hourly recording rain-gage data of the NWS are not useful in deriving climatological means and extremes, particularly for the colder months.

**Illinois Weekly Weather and Crop Report.** A third state publication has been issued on a weekly basis since the mid-1940s. It contains weekly rainfall values for many substations in Illinois and temperatures for a few selected first-order stations. It is a joint effort of the Federal and State Departments of Agriculture and the EDS. It is published only during the crop season (March-October), but it is a handy publication for monitoring the current rainfall status.

**Climatic Summaries.** Over a period of years the USWB and EDS published summaries of the station data for all stations in each state. All state summaries are published under one of three series headings: *Climatic Summary of the United States*, *Climatology of the United States*, and *Key to Meteorological Records Documentation*.

*Climatic Summary of the United States*, often referred to as *Bulletin W*, was published in 1930. *Bulletin W* was the USWB's first attempt at summarizing state data. There are three *Bulletin W* issues for Illinois, one for each of the weather-climate regions (figure 5). Most other states also had 3 or 4 divisions. Weather data from all stations in the different regions through 1930 (or until operations terminated before 1930) were summarized. The annual and monthly rainfall, humidity, monthly temperatures, excessive rainfall values, etc. are shown in tables by year.

Shortly after the punch-card era began, the Weather Bureau issued *Climatic Summary of the United States - Supplement for 1931-1952* for each state, often called *Supplement to Bulletin W*. It presented the available monthly rainfall amounts during the 1931-1952 period from all stations. Unfortunately, the individual monthly temperature data were not published in this supplement, but it does contain the revised (1931-1952) monthly mean temperatures.

# CLIMATOLOGICAL DATA

## ILLINOIS SECTION

CLARENCE J. SOOT, Meteorologist

VOL. xxx SPRINGFIELD, ILL., APRIL, 1925 No. 4

### GENERAL SUMMARY

A warm April, following a mild March, caused a rapid advance of vegetation and resulted in a season eight to ten days earlier than the average. For the State as a whole April was slightly warmer in 1896 and 1915, but Peoria, with 70 years record, had a higher average temperature in 1915 only. The absolute state maximum for the month was higher in 1896 and 1899, and the absolute minimum was higher on three occasions. April maximum temperature records were exceeded at six stations. There was practically no snowfall, and sunshine was in excess of the normal. Dubuque, Iowa, reports a low relative humidity of 16 per cent on the 3d. Conditions were very favorable for farming operations, and the work was kept well up in every particular. Oats seeding was completed, and much progress was made in planting corn. Rain was needed in parts of the State at various times, but when ample amounts fell growing crops were much benefited. Practically no frost damage was reported during the low temperature of the last three days. Wind squalls and hail storms occurred in a number of areas over the north half of the State but in most instances the damage was not severe. On the 13th a severe wind and rain squall struck Springfield shortly before 2 p. m. The fastest mile of wind recorded was at the rate of 58 miles per hour; 0.33 inch of rain fell in two minutes. There was scattered damage to roofs, plate glass windows, signs, automobiles, trees, etc.; it was not heavy at any point, but in the aggregate amounted to \$15,000. Eight persons were injured, none seriously. Riverton and Spaulding, 7 miles northeast, reported a property loss of \$1,000. On the 18th there was slight damage to windows and roofs by hail at Mt. Carroll. The Weather Bureau Official at Peoria reports a line squall at 3:03 a. m. of the 19th. A four-story business building was struck by lightning and then pushed over by the gale, crushing an adjoining public garage. Two men in the larger building were killed. The storm caused minor damage to porches, roofs, trees, etc., chiefly in the south part of the city. The total estimated damage was \$500,000, about four-fifths being due to the collapse of the large building. In Pekin, south of Peoria, the property of three corporations suffered a combined loss of \$60,000. The losses at Canton amounted to \$10,000. In Adams County chimneys and trees were damaged at Golden, and at Quincy hail caused much injury to fruit blossoms and about \$5,000 loss to property, largely greenhouses. Hail six inches in circumference fell at White Hall on the 21st. There was damage to roofs, greenhouses, and automobile tops. On the 24th there was local wind damage in Adams, Carroll, De Kalb, Knox, and Will counties. A plant at De Kalb had a \$5,000 loss, and the other reported damage totals a like amount. On the same date windows were broken by hail at Waukegan, and in Kane, Knox, and McHenry counties, and gardens and fruit were reported injured about Quincy. Lightning losses were reported on several dates in various parts of Illinois. An earthquake of intensity 2 to 4 was felt over the south half of the State on the 26th.

### TEMPERATURE

Temperature was below normal on only one day prior to the 27th, but there was a deficiency of 14° and 15° on the 29th and 30th. It was more than 10° above normal on the 7th, 8th, 11th to 14th, 18th, and 22d to 26th, and there was an excess of

20° to 21° from the 22d to 24th. The highest station readings ranged from 81° to 94°, and occurred during the last decade. The lowest station readings ranged from 21° to 41°, and occurred during the first decade.

### PRECIPITATION

The rainfall totals ranged from 1 to 5 inches, but in general they were greater over the west half of the State. South and east of the Illinois River the precipitation was below normal with departures up to 2 inches. Elsewhere there were both positive and negative values, but as a rule they were less than one inch. The rains were quite well distributed through the month after the 8th, as indicated by the table on page 15. Measurable snowfall was recorded on the 29th at Galva, Henry, La Salle, and Walnut; several other stations reported traces on that date.

### PRESSURE, WIND, HUMIDITY, AND SUNSHINE DATA

Stations	Atmospheric pressure (reduced to sea level)				Wind				Relative humidity		Percentage of sunshine	
	Mean	Highest	Date	Lowest	Date	Average hourly velocity	Maximum velocity	Direction	Date	Mean 7 a. m.		Mean 7 p. m.
Calro.....	29.97	30.29	16	29.56	18	10.2	35	ne	27	73	47	78
Chicago.....	30.02	30.43	5	29.39	19	11.7	37	ne	19	70	70	64
Peoria.....	30.30	30.43	5	29.31	18	7.5	42	w.	19	76	76	76
Springfield.....	29.96	30.31	5	29.40	19	8.8	37	nw.	13	74	54	76

### COMPARATIVE APRIL DATA FOR THE STATE

Year	Temperature				Precipitation				Number of days				
	Mean	Departure	Highest	Lowest	Average	Departure	Greatest in 24 hours	Avg snowfall	Precipitation .01 inch or more	Clear	Partly cloudy	Cloudy	Prevailing wind direction
1878.....	56.1	+4.3			4.15	+4.74							
1879.....	51.1	-6.7			2.62	-1.39							
1880.....	52.4	-5.4			3.79	+0.38							
1881.....	45.4	-6.5			2.49	-0.92							
1882.....	53.5	+1.7			3.75	+0.34							
1883.....	52.5	+0.7			4.17	+0.76							
1884.....	59.4	+7.4			2.51	-0.69							
1885.....	51.9	+1.1			4.06	+0.64							
1886.....	51.7	+0.9			3.20	-0.21							
1887.....	53.0	+2.2			2.82	-0.89							
1888.....	52.9	+1.1			1.83	-1.58							
1889.....	52.9	+1.1			1.96	-1.45							
1890.....	51.1	+1.3			3.64	+0.23							
1891.....	53.8	+2.0			3.18	-0.23							
1892.....	49.4	-2.4			6.43	+2.02							
1893.....	50.6	-1.2			7.09	+4.28							
1894.....	51.8	+0.6			2.75	-0.66							
1895.....	54.8	+3.6	94	30	2.08	-1.33	1.65	T.	7	12	9	8	no.
1896.....	59.0	+7.2	95	13	2.96	-0.45	2.25	0.9	8	11	12	7	s.
1897.....	50.4	-1.4	85	18	4.26	+0.65	2.43	0.2	13	7	10	13	nw.
1898.....	49.6	-2.2	86	15	3.26	-0.15	2.50	T.	10	11	9	10	nw.
1899.....	53.8	+2.0	95	8	1.54	-1.07	2.44	1.5	7	11	11	8	s.
1900.....	51.5	+1.7	88	19	1.54	-1.37	3.67	1.9	7	12	9	9	no.
1901.....	50.0	-1.8	83	21	1.65	-1.78	1.78	0.2	7	14	8	10	d.
1902.....	50.8	-1.0	80	18	2.39	-1.02	2.67	T.	7	13	10	7	nw.
1903.....	52.8	+1.0	86	16	4.29	+0.88	2.93	1.2	11	11	8	11	s.
1904.....	46.3	-6.0	57	13	3.71	+0.30	3.20	1.6	5	13	9	8	nw.
1905.....	51.9	+0.1	92	20	3.64	+0.23	2.88	0.5	9	12	10	8	nw.
1906.....	55.3	+3.5	93	20	2.07	-1.34	2.00	T.	7	16	7	7	sw.
1907.....	44.1	-7.7	83	11	2.75	-0.66	1.85	0.6	9	10	7	13	nw.
1908.....	52.5	+0.7	83	19	4.40	+0.99	3.45	T.	11	12	7	11	nw.
1909.....	50.3	-1.5	88	11	6.24	+2.83	3.28	0.2	11	11	8	11	s.
1910.....	53.4	+1.6	92	12	3.44	+0.63	2.03	3.9	13	12	6	12	sw.
1911.....	50.9	-1.8	84	17	5.06	+1.65	6.21	1.3	12	11	6	13	sw.
1912.....	53.4	+1.6	86	20	4.90	+1.49	3.32	2.2	11	13	6	9	sw.
1913.....	52.4	+0.6	90	23	2.83	-0.58	2.86	T.	9	15	6	9	sw.
1914.....	52.7	+0.9	90	15	2.22	-1.19	2.05	T.	8	10	9	11	nw.
1915.....	58.9	+7.1	92	18	1.36	-2.06	1.75	T.	6	15	9	6	sw.
1916.....	50.9	-0.9	86	19	1.64	-1.07	1.76	0.3	10	10	8	12	nw.
1917.....	49.8	-2.0	87	19	4.76	+1.35	3.82	0.9	11	11	7	12	no.
1918.....	47.9	-3.9	84	21	5.39	+1.98	2.88	T.	12	10	7	13	no.
1919.....	53.4	+1.6	89	19	2.50	-0.91	1.66	T.	11	11	8	11	s.
1920.....	47.3	-4.5	80	8	4.42	+1.01	2.70	4.8	18	10	8	16	nw.
1921.....	55.6	+3.8	86	22	4.80	+1.39	3.03	1.2	12	12	8	10	s.
1922.....	53.9	+1.1	85	24	5.05	+1.64	3.89	T.	11	13	6	11	s.
1923.....	61.2	+6.6	89	16	2.89	-1.02	2.21	1.4	9	13	8	9	sw.
1924.....	54.0	+2.2	90	14	2.18	-1.23	2.62	0.3	10	13	9	8	s.
1925.....	58.6	+6.8	91	21	2.66	-0.74	2.08	T.	9	14	8	8	no.

FIGURE 6

# HOURLY PRECIPITATION

ILLINOIS  
FEBRUARY 1971

Station	A. M. Hour Ending												P. M. Hour Ending												Total	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12		
	<b>-4th-</b>																									
PIPER CITY 3 SE																										
PITTSFIELD NO 2																										
RAIRIE DU ROCHER 1WSM																										
PROPHETSTOWN 1 NW																										
QUINCY DAM 21																										
RANTOUL																										
ROCKFORD WSO																										
SHABDONA 5 NNE																										
SKOKIE N SIDE TR WORKS																										
SPARTA NO. 2																										
SPRINGFIELD WSO																										
STICKNEY W SIDE TR WKS																										
SULLIVAN WATERWORKS //																										
URBANA																										
VANDALIA 1 SW																										
WASHINGTON 1 WSM																										
WENONA																										
WEST SALEM																										
YATES CITY																										
<b>-5th-</b>																										
ARGONNE NATIONAL LAB.																										
CHICAGO O MARE WSO																										
CHICAGO ROSELAND PMPG																										
CHICAGO SAN DIST DPF																										
CHGO SPRINGFIELD PMPG																										
CHICAGO UNIVERSITY																										
CHICAGO WSO																										
DANVILLE																										
DOWN 2 NE																										
EFFINGHAM																										
FAIRBURY WATERWORKS //																										
FAIRBURY WATERWORKS																										
PREPDRY SEWAGE PLANT																										
ILLINOIS CITY DAM 10																										
LAMARK																										
MCHENRY LOCK AND DAM																										
MDLINE WSO																										
NEWTON 2 NE																										
OREGON																										
PEGDIA WSO																										
PROPHETSTOWN 1 NW																										
RANTOUL																										
ROCKFORD WSO																										
SHABDONA 5 NNE																										
SHELBYVILLE DAM																										
SKOKIE N SIDE TR WORKS																										
STICKNEY W SIDE TR WKS																										
URBANA																										
VANDALIA 1 SW																										
<b>-7th-</b>																										
CAIRO WSO																										
DIXON SPRINGS AGR C.																										
ODLCUNDA DAM 31																										
HARRISBURG DISPOSAL PLANT																										
MURPHYSBORO 2 SW //																										
MURPHYSBORO 2 SW																										
SPARTA NO. 2																										
<b>-8th-</b>																										
CAIRO WSO																										
<b>-11th-</b>																										
BELLEVILLE SD ILL UNIV																										
CAIRO WSO																										
CARLYLE RESERVOIR																										
CHICAGO SAN DIST OFF																										
DIXON SPRINGS AGR C.																										
EFFINGHAM																										
MT CARMEL 1 NNN																										
MURPHYSBORO 2 SW //																										
MURPHYSBORO 2 SW																										
PEGDIA WSO																										
ROCKFORD WSO																										
STICKNEY W SIDE TR WKS																										
URBANA																										
WEST SALEM																										
YATES CITY																										
<b>-12th-</b>																										
ASHLEY																										
BELLEVILLE SD ILL UNIV																										
BELVIDERE SEWAGE PLANT																										
CAIRO WSO																										
CARLINVILLE NO. 2																										
CARLYLE RESERVOIR																										
CHICAGO O MARE WSO																										
CHICAGO ROSELAND PMPG																										
CHICAGO SAN DIST DPF																										
CHICAGO S FILTER PLANT																										
CHICAGO UNIVERSITY																										
CHICAGO WSO																										
CISNE 2 ESE																										
EQUILTERVILLE 1 SSM																										
CRETE																										
DANVILLE																										
DIXON SPRINGS AGR C.																										
EFFINGHAM																										
FAIRBURY WATERWORKS //																										
FAIRBURY WATERWORKS																										
FARMER CITY																										
ODLCUNDA DAM 31																										
HARRISBURG DISPOSAL PLANT																										
MOPESTON																										
MUTTONVILLE POWER PL //																										
MUTTONVILLE POWER PL		</																								



Two more state summaries (which are in essence 10-year supplements of the *Climatic Summary*) are also commonly referred to as *Supplement to Bulletin W*. They cover the 1951-1960 and 1961-1970 periods, respectively. These supplements contain monthly rainfalls for all Illinois stations, monthly temperatures, the record high and low temperatures, number of rain days, and generally more information than in the 1931-1952 supplement. The supplements since 1949 reveal the advantages of digitizing weather data onto punch cards and subsequently onto magnetic tape.

The *Key to Meteorological Records Documentation* series offers a number of useful summaries. The titles of *Key* series relevant to Illinois are listed in table 1. Titles in the *Key* series, the *Climatic Summaries*, and the *Climatology of the United States* series should be used in a search for various other kinds of climatic summaries dealing with specific weather conditions. Several useful publications relevant to specific weather conditions in Illinois are listed in table 2. Interested readers should consult a recent EDS publication for added information (*U. S. Department of Commerce, 1969*).

The *Decadal Census of Weather Stations* is a useful USWB summary. A map for each decade year (1900, 1910, etc.) shows the stations that were in operation. Most of the 58 Illinois substations operating in 1900 are still in operation today.

The *Substation History* which was done for each state is a summary publication relating to cooperative substations. It contains particularly useful information for climatological analyses involving time series analyses. For each substation it presents a complete station history — who the observers were, where the station was located in relation to the nearest post office and by latitude and longitude, the kinds of instruments used, and why each observer quit (moved, died, etc.). Unfortunately, most of these state summaries were published in the middle 1950s and they are now out-of-date for changes in recent years.

Another set of climatic summaries for each of the states is the *Climates of the States* which

was issued in 1960. Each issue has a 2-page text describing the weather and climate of the state, a short bibliography of weather-related publications, freeze date information for the state, mean temperature values, and mean precipitation values. It also contains annual LCD tables which show the normals, means, and extremes for each first-order station. Included also are a few of the mean monthly rain and temperature maps for the state represented.

*Heating Degree Day Normals* is a publication showing monthly values of heating degree days for 1931-1960. Degree-day normals have been calculated for every substation in Illinois that has had long-term temperature records. Another useful publication is the *Monthly Normals of Temperature, Precipitation, and Heating Degree Days*, showing the monthly and annual normals for the 1931-1960 period at the FOS and substations.

### **National Publications**

**National Summary.** The *Climatological Data National Summary* (NS), which began in 1950, is probably the most well-known of the national (all states) weather-related publications. Prior to that year, much of the information and data appeared in the *Monthly Weather Review* and the *U. S. Meteorological Yearbook*. The NS is published on both a monthly and annual basis. The NS monthly issues contain a general weather description for the country. They also contain values for all the U. S. first-order stations (mean maximum and mean minimum temperatures, rainfall, number of days of rainfall, thunderstorms, and other items). The NS monthly issues have the heating degree days and cooling degree days for all the FOS in the country, and a text on floods. There are rawinsonde values that are summaries (by station) for the month of the average temperatures and dew points for every 50-mb level. There are also solar radiation data for the nation and maps of 1) the cyclone and anticyclone tracks for the month, 2) tropical disturbances, and 3) typhoons. Issues for the 1949-1959 period contained detailed data on loss caused by all types of storms (sorted by states), but these data became the

Table 1. Publications Relevant to Illinois in the EDS Series  
'Key to Meteorological Records Documentation'

*Substation Histories* (issued for each state or combination of states, such as Maryland-Delaware and New England, and for Puerto Rico and Virgin Islands; 45 separate issues)  
*The Cooperative Weather Observer*  
*History of Verification of Weather Records in the U. S. Weather Bureau*  
*History of Climatological Record Forms 1009 and 612-14*  
*History of Climatological Record Books*  
*Excessive Precipitation Techniques*  
*Temperature Recordings*  
*History of Tornado Observations and Data Sources*  
*History of Weather Bureau Wind Measurements*  
*History of Climatological Publications*  
*Decadal Census of Weather Stations*  
*The Decennial United States Census of Climate 1960 and its Antecedents*

Table 2. NWS Publications Relevant to Illinois for Specific Weather Conditions

NWRC = National Weather Records Center, EDS, ESSA, Federal Building, Asheville, N. C. 28801  
 GPO = Superintendent of Documents, Government Printing Office, Washington, D. C. 20402

*Average Precipitation in the United States, 1944*, NWRC.  
*Climates of the States*, GPO.  
*Climatic Atlas for the United States*, June 1968, GPO.  
*Daily Normals of Temperature and Heating Degree Days*, GPO.  
*Heating Degree Day Normals, 1931-1960 Data*, GPO.  
*Maximum Recorded United States Point Rainfall* (Weather Bureau Technical Paper No. 2), GPO.  
*Maximum Station Precipitation for 1, 2, 3, 6, 12, and 24 Hours* (Weather Bureau Technical Paper No. 15), GPO.  
*Monthly Normals of Temperature, Precipitation, and Heating Degree Days, 1931-1960*, GPO.  
*Normal Pressures and Tendencies for the United States* (Weather Bureau Technical Paper No. 1), NWRC.  
*Sunshine and Cloudiness at Selected Stations in the United States* (Weather Bureau Technical Paper No. 12), 1951, NWRC.  
*Temperatures at Selected Stations in the United States* (Weather Bureau Technical Paper No. 9), 1949, NWRC.  
*Upper-Air Climatology of the United States* (Weather Bureau Technical Paper No. 32), Three Parts, GPO.  
*Mean Monthly and Annual Evaporation from Free Water Surface for the United States, Alaska, Hawaii, and West Indies* (Weather Bureau Technical Paper No. 13), 1950, Out of Print.  
*Mean Number of Thunderstorm Days in the United States* (Weather Bureau Technical Paper No. 19), Out of Print.  
*Mean Precipitable Water in the United States* (Weather Bureau Technical Paper No. 10), 1949, Out of Print.  
*Tornado Occurrences in the United States* (Weather Bureau Technical Paper No. 20, Revised 1960), 1916-1958, GPO.  
*Weekly Mean Values of Daily Total Solar and Sky Radiation* (Weather Bureau Technical Paper No. 11), 1949, NWRC.  
*Climatic Guide For Chicago, Ill. Area* (1962)

material for a new USWB publication, *Storm Data*, which began in 1959.

The NS annual issue contains about the same material as the monthly issues. The annual issue does include the excessive short-duration (5-, 10-, 15-minute) rainfall data for all first-order stations in the country. It also contains the monthly sunshine amounts and percentages for each FOS as well as the monthly and annual frequencies of thunderstorm days and national extremes of various weather conditions.

**Storm Data.** This national publication is used frequently because it summarizes damaging storms in the nation. As mentioned previously, before it was started in 1959, the 1950-1958 storm data appeared in the *National Summary*. *Storm Data* presents by state all the storm dates, the kind of storm, the number of people killed and injured, time of the event (if known), and a gross estimate of dollar loss (figure 8). These data should be used with caution because the data for any state reflect the interest and efforts of its USWB State Climatologist. The degree of reporting has varied, and the reporting can often be late, as noted for Illinois in figure 8. One should always search issues after the month of interest for delayed data and corrections.

**Weekly Weather and Crop Bulletin.** This is a national publication, not to be confused with the *Illinois Weekly Weather and Crop Report*. It is issued each week, and has been published since 1872. It has short weather and crop status summaries for each state. The more interesting items in it are the weekly rainfall, the growing degree days tabulations, and the Crop Moisture Index map (figure 9) which shows the status of soil moisture, as calculated from weather data. The 30-day outlooks for rainfall and temperature also appear in this publication.

**Daily Weather Map.** These are published weather maps that show the detailed national surface weather conditions at midnight, the 500-mb upper air pattern at noon, the highest and lowest temperatures on a third map, and the selected 24-hour rain amounts on another map. Starting in 1968 these were changed from daily publications to weekly issues which contain the maps for each day of the week.

## General Climatic Publications

**Technical Papers.** There are about 40 of these publications (USWB, NWS, or EDS). They deal with a variety of subjects, ranging anywhere from sunshine in Puerto Rico to the U. S. maximum record point rainfall amounts for periods of 5 minutes to 48 hours. Certain technical papers containing information relevant to Illinois appear in table 2. Others of possible interest in this state are Technical Papers 25, 29, 30, 34, 37, and 40.

**Technical Memorandums and Research Papers.** These usually are not in the all encompassing form of the technical papers. Technical Memorandums are usually oriented toward presenting specialized information useful to forecasting and internal NWS applications. However, some do contain useful Illinois climatic data unavailable elsewhere.

**Climatic Atlas of the United States.** This national climatic atlas is another useful EDS publication. It contains a large number of maps of normal, mean, or extreme values of weather conditions such as the normal precipitation patterns for each month in the United States. It also contains monthly maps of temperature, snowfall, wind, mean relative humidity, pressure, sunshine, radiation, evaporation, etc.

**Northern Hemisphere Data.** This 2-part publication began in 1899 but was revised in 1955. Part 1 includes daily surface synoptic weather maps from around the northern hemisphere and 500-mb maps for each day. Part 2 contains surface synoptic reports and all available upper air data for one or two times a day, 0000 and/or 1200 hours Greenwich Mean Time. Also presented are relative humidity, temperature, wind speed, wind direction, and pressure data for five levels in the atmosphere. Since 1964, the data in Part 2 are not in published format but are available on microfilm.

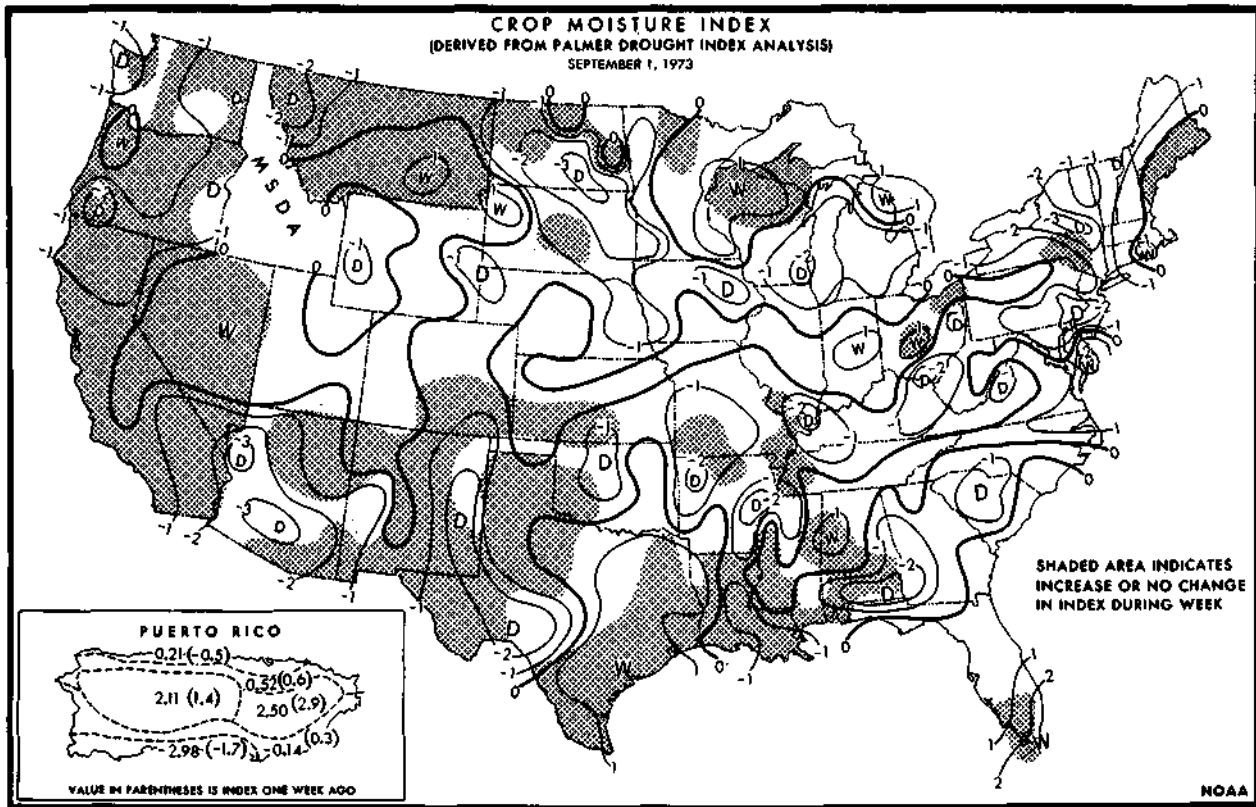
**Thunderstorm Rainfall.** This is a 2-part (text and figures) publication printed in 1947 as Hydrometeorological Report 5. It contains a large volume of information on rainfall, thunderstorms, and hailstorms that is unavailable in any other USWB-EDS publication, although thunderstorm data were more recently summarized in Technical Paper 19 (table 2).

# STORM DATA AND UNUSUAL WEATHER PHENOMENA

OCTOBER 1971

PLACE	DATE	TIME - LOCAL STANDARD	LENGTH OF PATH (MILES)	WIDTH OF PATH (YARDS)	NO. OF PERSONS		ESTIMATED DAMAGE		CHARACTER OF STORM
					KILLED	INJURED	PROPERTY	CROPS	
<b>HAWAII (continued)</b>									
South of Lohaina, Maui	28	5:05 p.							Waterspout
Three waterspouts were reported by pilot and shore observer as about 7 miles west of Makaha. Movement unknown. Large cumulonimbus clouds and showers in vicinity.									
Reported by pilot and shore observer as 2 miles south of Lohaina. Heavy showers in vicinity.									
<b>IDAHO</b>									
11 1/2 miles northeast Mountain Home, Elmore County	1	8:15 a.			1	1	3	0	Ice
Car skidded on ice and ran head-on into a cattle truck.									
Seven counties north through east of Pocatello	1	a.m.			0			4	Snow
Heavy snowfall stopped potato digging resulting in loss to some 25,000 acres of potatoes in the ground that could not be harvested productively. Many crews were damaged. Traffic accidents increased in area.									
Boonville, Owyhee County	2	4:30 p.			0	0	3		Lightning
Four small animals were killed when lightning struck a residence. A fire was set causing considerable damage before controlled.									
Hamer, Jefferson County	13	3:25 p.			0	0	3		Strong wind
A freak windstorm passed through the Hamer community leaving a nearly completed warehouse a mass of broken wood and metal. The wind lifted the northeast end of the building and dropped it in the middle of the structure. Possible circular motion reported by some observers.									
Eastern Idaho	17-18	Night			0	7	4	4	Snow
A heavy snowstorm left depths to 10 inches. More in higher elevations broke thousands of tree limbs and caused many power outages similar to the first of the month. Airline traffic, highways and schools were affected as well as reducing hope of salvaging potatoes in the ground.									
Southwest Idaho northward into Idaho and Valley counties	27	a.m.			2		3		Snow
Snow above 2,000 ft. elevation and heavy snow above 3000 to 4000 ft. rode on gusty winds and cold temperatures spanning hunters. Snow depth reports ranged from less than an inch in the Boise area to 8 inches at Grangeville. Traffic was disrupted, roads were closed in some areas and some utility lines were damaged.									
<b>ILLINOIS</b>									
Data not received by publication deadline.									
<b>INDIANA</b>									
Fayette County	13	evening	?	?	0	0	4	3	Lightning, Hail
House was gutted by fire about 1/2 mile south of Milton after being hit by lightning. Scattered wind damage in surrounding area. Hailstones the size of golf balls were reported in the Whitewater area.									
Logansport, Cass County	23	4:30 p.m.	1/4	30	0	0	2	0	Tornado
Small tornado touched ground briefly at Tall Sycamore Campground. Few outbuildings damaged. Debris carried 1/4 mile.									
<b>IOWA</b>									
Fosteria, Clay County	1	1:00 p.			0	0	4	0	Lightning
E O'Brien and NW Clay Counties	1	1:30 p.			0	0	4	4	Hailstorm
One inch hail O'Brien County and 1 3/4 inch hail in Clay County.									
4N Sutherland, O'Brien County	1	1:53 p.	3	3500	0	0	4	5	Windstorm
Swath two miles wide destroyed buildings and corn crop. Hail to 2 inches diameter caused about 10% of damage. Extensive damage to soybeans.									
4N Sutherland, O'Brien County	1	1:55 p.	10		0	0	5	4	Tornado
Buildings leveled at three farmsteads. Tornado moved NE. Losses about 75,000 dollars. Damage path ended near Everly.									
Duncombe, Webster County	30	2:15 p.			0	0	2	4	Windstorm
Bode, Humboldt County	30	3:00 p.			0	0	4	0	Windstorm
Pope Joy, Franklin County	30	3:00 p.			0	0	4	0	Windstorm
<b>IOWA (continued)</b>									
Northwood, Worth County	30	3:40 p.			0	0	4	0	Windstorm
Wyoming, Jones County	30	5:45 p.			0	0	4	0	Windstorm
Mobile home heavily damaged, two-car garage destroyed and several homes damaged.									
<b>KANSAS</b>									
Garden City (near)	17	10:25-10:40 p.	5	50-200	0	7	4	0	Tornado
Tornado, moving NE, had an intermittent path from 2 mi. west to 1/2 mi. north of Garden City. Path width varied from 50 to 200 yards.									
Logan County	17	7:45 p.	1/2	250-300	0	0	4	0	Tornado
Tornado, moving from southeast to northwest, touched down about 5 miles NW of Winona destroying a farm home.									
Rawlins County	17	9:07 p.	4	2 1/2	0	0	4	3	Tornado
Tornado, moving north, hit a farm about 12 mi. NW of Atwood.									
Cheyenne County	17	10:15 p. (MST)	1/2	100	0	0	4	0	Tornado
Tornado, moving NW, hit the southern edge of St. Francis, destroying a mobile home and exploding the east wall of a café outwards.									
Western one-third	17-18	eve of 17-18			0	0	5	4	Wind, hail
Heaviest wind damage occurred north of Brewster, southeast of Syracuse, southeast of Montezuma, north of Ensign, and in northwestern Decatur County. Hail damage was scattered; heaviest hail occurred in northeast Stanton County where 4 to 5 inches accumulated on the ground.									
Ellis County	26	2:50 p.							Funnel sifo
Funnel sifo observed 10 mi. west of Hays.									
<b>KENTUCKY</b>									
State	18				0	0	4	0	Lightning
There were scattered thunderstorms over the State, a greater number being reported in the western and central sections than elsewhere. In southeastern Kentucky, near Murray in Calloway County, a barn and outbuildings were destroyed by fire set by lightning about noon. In northwest Kentucky, in Henderson, in Henderson County, a home was damaged by lightning about 1 p.m. In south-central Kentucky, Scottsville in Allen County, lightning damaged two adjacent homes.									
<b>LOUISIANA</b>									
Plaquemines Parish	6	11:15a							Waterspouts
Pilot reported sighting waterspouts in heavy thunderstorms in the vicinity of South Pass and Southeast Pass, mouth of Mississippi River.									
<b>MAINE</b>									
State	6	Late afternoon, evening			0	0	3	0	Lightning, wind, hail
Thunderstorms in many sections with mostly minor local damage from wind and lightning. Small hail in some areas.									
State	10	Afternoon			0	0	4	0	Heavy rain
Rainfall generally 1 to 3 inches, causing local flooding and water damage, especially in the Portland area.									
Port Kent	12	3:40 p.	0.1	2	0	0	2	0	Tornado
Very narrow funnel moved eastward. Damage only to trees and utility lines.									
<b>MARYLAND</b>									
Eastern portion	9-10	p.m.-p.m.			0	0	4	0	Rain, flooding
Steady rain for many hours caused minor flooding in scattered areas, especially along streams and in low-lying streets and highways. Many over two inch totals were reported on the 10th. Some of the three-inch totals included 3.41 inches at Elkton, 3.11 inches at Eastern Neck Island and 3.02 inches at Chesterton. During this period some temporary power and telephone failure was noted. In Cecil County, firemen reported numerous requests to pump out flooded basements.									
State, especially eastern portion	23-26				0	0	5	0	Rain, flooding
Four days of rain over the "Veterans Day Weekend" brought minor flooding and at times flash flooding to scattered areas. There									

FIGURE 8



SHADED AREAS: Index increased or did not change last week

Index

- Above 3.0 Excessively wet, some fields flooded
- 2.0 to 3.0 Too wet, some standing water
- 1.0 to 2.0 Prospects good, some fields too wet
- 0 to 1.0 Moisture adequate for present normal needs
- 0 to -1.0 Prospects improved, but rain still needed
- 1.0 to -2.0 Some improvement, but still too dry
- 2.0 to -3.0 Drought eased, but still serious
- Below -4.0 Not enough rain, still extremely dry

UNSHADED AREAS: Index decreased last week

Index

- Above 3.0 Some drying, but still excessively wet
- 2.0 to 3.0 More drying weather needed, work delayed
- 1.0 to 2.0 Favorable, except still too wet in spots
- 0 to 1.0 Normal growth and fieldwork
- 0 to -1.0 Topsoil moisture short, germination slow
- 1.0 to -2.0 Abnormally dry, prospects deteriorating
- 2.0 to -3.0 Too dry, yield prospects reduced
- 3.0 to -4.0 Potential yields severely cut by drought
- Below -4.0 Extremely dry, most crops near ruin

The map gives a general picture of how wet or dry the Nation was last week. It shows areas where abnormal wetness or dryness have hindered crops and areas where moisture conditions have favored them.

The lines show the crop-moisture situation according to an index computed from values of temperature and precipitation by areas...350 climatological divisions, which correspond roughly to SRS's crop reporting districts. Previous weekly computations of soil moisture account for the effects of prior weather.

Shaded areas are those where precipitation increased the index last week or where soils did not dry. Unshaded areas dried last week.

The centers of wet or dry areas are marked: W=wet; D=dry. The map lines mark off crop situations. Use the legend to interpret.

Local variations caused by isolated rain or by soil differences are not shown. While shallow rooted crops in poor soils may suffer more than the map shows, conditions may be better where soils are good. Also, legends apply to growing rather than mature plants. Any map interpretation must consider both the growth stage and moisture status and trend. In irrigated regions, the index values reflect only departures from ordinary irrigation requirements.

FIGURE 9

## Original Data Forms

The original data log sheets of FOS and cooperative substations (*see samples on figures 10 and 11 for two kinds of cooperative stations*) are generally available at the National Weather Records Center (NWRC) in Asheville, North Carolina. However, reproduction can be expensive. The Water Survey also maintains at its Champaign office a set of those from all Illinois substations for the period 1887 to the present.

Practically all weather data in the United States since 1948 have been digitized onto punched cards and/or magnetic tape by the Weather Bureau and its successors, ESSA and NOAA. Samples of the data formats on some of the commonly used card types are shown on figure 12. Any efforts to enter pre-1949 data on cards were accomplished on a state basis under cooperative agreements with the Weather Bureau. The amount of pre-1949 data entered on cards was decided by the state groups. The Water Survey entered into such a cooperative agreement with the Weather Bureau (as did the University of Missouri and Purdue University in our neighboring states), and punched all daily

data for 60 Illinois stations for 1901-1948, as is explained in more detail in the section on Water Survey data. Punched cards or tapes of these data are maintained at the NWRC and the Water Survey.

The recent data (1949 to present) from FOS, substations, and the Federal Aviation Agency (FAA) stations are usually available on cards, tape, or on original data sheets. These can be obtained at NWRC for varying costs, according to each format. Some original data sheets may contain hourly or daily information not digitized on cards or tape. For instance, when the NWS digitizes the cooperative substation data, they often do not enter the observer's indications of sleet, hail, thunder, damaging winds, and time of rain.

The teletype form of synoptic weather data, the original radiosonde data from Peoria and Salem, and the facsimile weather maps from 1950 to the present are available on microfilm for purchase from the NWRC. Photocopies of the rain-gage charts from NWS recording rain-gages also can be obtained from the NWRC.

## ILLINOIS STATE WATER SURVEY

There are two general goals for the Water Survey's work in climatology. One is to provide climatic information, both in original formats and as processed data, to answer requests. A part of this service-related activity is the operation of the Morrow Plots Weather Station in Urbana which the Survey has operated since 1948. The station operation serves to provide 1) weather data for our studies, 2) a source of weather information to the general public (*as an example see Changnon, 1959*), and 3) data for the NWS and EDS since this is their Urbana cooperative substation (*Changnon and Boyd, 1963*).

The other general goal of the Survey's climatology program is to analyze data and prepare special climatic research reports on topics such as hourly rainfall (*Huff, 1971*), other weather conditions associated with rainfall (*Changnon,*

*1968a*), effects of Lake Michigan on rainfall (*Changnon, 1968b*), thunderstorms (*Changnon, 1957b*), and clouds (*Changnon and Huff, 1957*). The climatology program of the Water Survey began before its weather research group was developed in 1949. The Survey had an Engineering Section (now the Hydrology Section), and when the engineer-hydrologists performed groundwater and surface-water analyses, they often employed some basic climatic analyses.

The Survey launched its cooperative punch-card project, mentioned earlier, with the USWB in 1954. All the 1901-1948 historical weather data for the 55 Illinois cooperative substations with long records were carefully edited, and the daily values were then entered on punch cards (*Changnon, 1957a*). As part of this project, the raw daily data of four FOS (Chicago, Moline, Peoria, and Springfield) for the same period



U.S. DEPARTMENT OF COMMERCE  
ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION, WEATHER BUREAU  
RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

MONTH May 19 56

STATION Quincy (Climatological) RIVER Mississippi TYPE OF RIVER GAGE Staff  
 COUNTY Adams TIME (local) OF OBSERVATION RIVER, PRECIPITATION 0700 TEMPERATURE  STANDARD TIME IN USE Central  
 STATE Illinois ELEVATION OF RIVER GAGE ZERO 458.22 Ft. FLOOD STAGE 170 Ft. NORMAL POOL STAGE \_\_\_\_\_ Ft.

Date	River Stage (Feet and hundredths)			Temperature °F.		Precipitation				Special Observations of Precipitation and River Stages									
	Condition	Gage Reading at _____ A.M.	Tendency	24 Hrs. Ending at Observation		At Obsn.	Time of Beginning	Time of Ending	Time of Beginning	Time of Ending	24-Hr. Amounts		At Obsn.	Date	Time of Observation	Precipitation Since 7 A.M.	River		Crest Stage, Date and Time, Depth of Snow or Ice, State of Weather at Time of Observation
				Max.	Min.						Rain, Melted Snow, etc. (In. and Decimals)	Snow, Sleet, Hail (In. and Decimals)					Stage	Tendency	
1	H	11:50	S								✓	✓	✓						
2	H	11:40	F				0705	0715			✓	✓	✓						
3	H	11:50	R								✓	✓	✓						
4	H	11:50	S				1830	1930											
5	H	11:40	F				1000	1010			.05	✓	✓						
6	H	11:30	F								T								
7	H	11:40	R				0130	0230			.12	✓	✓						
8	H	11:40	S																
9	H	11:40	S				1250	1305											
10	H	11:60	R								T	✓	✓						
11	H	11:30	F																
12	H	11:50	R																
13	H	11:50	S				2115	2140											
14	H	11:50	S								T	✓	✓						
15	H	11:40	F				0710 0720	0740 1030	1645	1715	.04	✓	✓						
16	H	11:40	S				2205	2230			.10	✓	✓						
17	H	11:30	F								T								
18	H	11:30	S				2130	2215	2220	2230									
19	H	11:40	R								.08	✓	✓						
20	H	11:40	S																
21	H	11:20	F				0110	0125			T								
22	H	11:30	R				2045	2130	2315	2345									
23	H	11:20	F				2400	0240			.17	✓	✓						
24	H	11:30	R								✓	✓	✓						
25	H	11:10	F				2300	-											
26	H	11:40	R				-	0240			.23								
27	H	11:50	R				0530	0545	0550	0600	.01								
28	H	11:50	S				1230	1300			.33								
29	H	11:40	F				1630	1730	1800	2030	.01								
30	H	11:50	R								.44								
31	H	11:60	R								✓	✓							
Sum			✓																

IF MORE SPACE IS NEEDED, USE ADDITIONAL FORM

Remarks: 5/27/56 - 1715 to 1755 rain

Observer Henry G. Volbracht Station Quincy  
 River District Office \_\_\_\_\_ Month May

FIGURE 11





were entered on punch cards. Card decks for St. Louis and Cairo (1901-1948) punched by the Missouri cooperative project also were obtained. Almost all of these substation cards have temperatures (daily maximum and minimum), as well as snowfall and 'days with' entries. All precipitation data are complete. The Survey staff made estimates for all the nearly 10,000 missing daily values out of a total of 330,000 entries.

The Survey's extensive effort totaled over two million cards and took three years to complete. This digitized climatic daily data bank includes data for 55 substations and 6 FOS, as shown in figure 13. The process of editing and digitizing the historical records revealed the high quality of Illinois weather records. This project and the resulting punch-card data led to considerable research and many climatic oriented publications.

### Publications

Survey reports considered to be largely of a climatological nature are briefly reviewed.

**Card Data.** Initially, four progress reports for the Illinois Cooperative Punch-Card Project were prepared during the digitization of the 1901-1948 data (*Changnon, 1955, 1956, 1957a, and 1963a*). These punch-card data reports contain complete listings of how the data were edited, the material punched on the cards, where the stations are, and what card duplicates were supplied to the USWB. Circulars 57 and 64 describe some of the first climatic analyses to use the punch-card data (*Changnon, 1956, 1957a*).

**Substation LCDs.** Other early climatic publications were substation LCDs. Four were produced in 1955 (Monmouth, Mt. Vernon, Rockford, and Urbana) based on the punch-card data for the 1901-1954 period. In 1963, LCD issues were prepared and published for other Illinois substations (Aurora, Bloomington-Normal, Carbondale, Charleston, Danville, Decatur, Havana, Hillsboro, Kankakee, Ottawa, Quincy, and Rushville).

**Severe Weather Climatology.** The editing of the historical records revealed that several of the Illinois substations had excellent 'days with'

records, at least during periods when certain outstanding observers served. A technique for evaluating the records was developed (*Changnon, 1967a*), and the data were eventually used to develop climatologies of several severe weather events in Illinois.

A circular describing the climatology of tornadoes in Illinois (*Changnon and Stout, 1957*) was an initial severe storm study. It was subsequently revised and enlarged in a newer publication, *Illinois Tornadoes (Wilson and Changnon, 1971)*. Other climatologies on severe weather events cover:

- thunderstorms, a statewide climatology (*Changnon, 1957b*)
- relations between thunderstorms and hailstorms (*Changnon, 1962a*)
- structure of thunderstorm rainfall (*Stall and Huff, 1971*)
- preferred days of occurrence of severe weather (*Changnon, 1962b*)
- damaging lightning, a climatology (*Changnon, 1964a*)
- damaging lightning, reasons for regional differences (*Changnon, 1970a*)
- hail climatology (*Huff and Changnon, 1959; Changnon, 1963b*)
- hail intensity (*Changnon, 1967b*)
- characteristics of individual hailstorms (*Changnon, 1970b*)
- climatic aspects of severe rainstorms (*Stout and Huff, 1962; Huff, 1967, 1968*)
- severe winter storms (*Changnon, 1969a*)
- drought climatology (*Huff and Changnon, 1963*)

**Precipitation Climatology.** The precipitation climatology of Illinois has been thoroughly studied. Publications concern spatial variations of rainfall (*Huff, 1969; Huff and Shipp, 1969*), temporal variations of rain (*Huff, 1967*), the major causes of rain (*Huff and Changnon, 1961*), and the diurnal variation of rain (*Huff, 1971*) and of atmospheric conditions related to rain (*Changnon, 1968a*). Precipitation climatologies of specific places of interest like Lake Michigan (*Changnon, 1968b*) and southern Illinois (*Changnon, 1963c*) were prepared. The climatology of clouds in Illinois was developed (*Changnon and Huff 1957*), along with the climatology of evapotranspiration in the state (*Jones, 1966*).

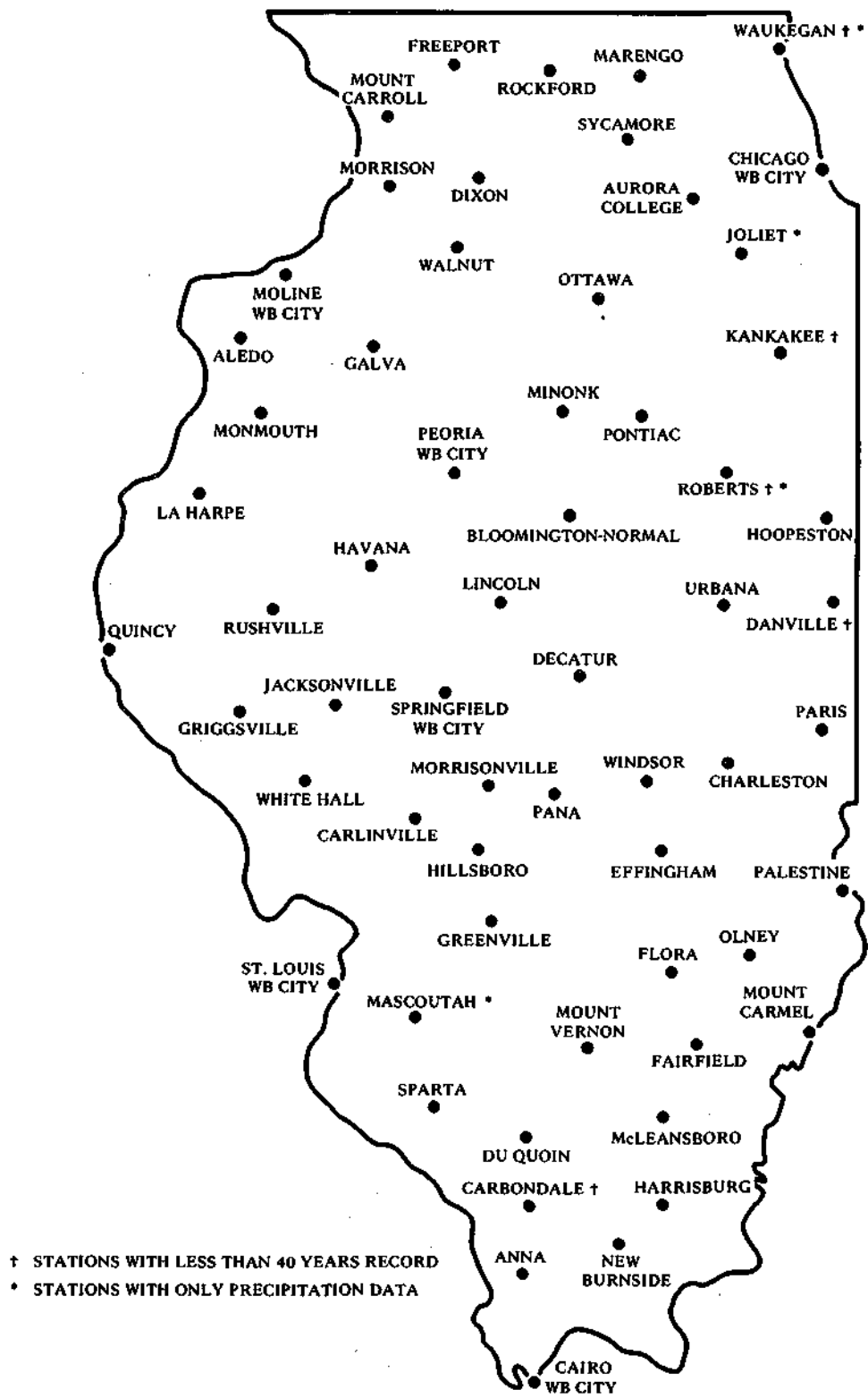


FIGURE 13

**Applied Climatology.** In addition to topical climatologies, several climatic studies were oriented toward specific applications, such as agricultural interests and building design. Publications include:

- temperature and rainfall probabilities relevant to farming (*Changnon, 1969b*)
- relations of climate factors to corn yields (*Changnon and Neill, 1967*)
- irrigation estimates for Illinois from climatic data (*Changnon, 1969c*)
- physical relation of hail to crop damages (*Changnon, 1971*)
- impact of weather modification on agriculture (*Huff and Changnon, 1972*)
- use of climatic data in certain phases of building design (*Changnon and Jones, 1964*)
- economic losses from hail, on local, state, and national scales (*Changnon, 1972*)
- impacts of urban-produced weather changes at St. Louis (*Changnon, 1973*)

**Weather Modification.** Several climatic studies of inadvertent weather modification evolved over a 12-year period (*Changnon, 1962c, 1968c, and 1970c; Huff and Changnon, 1973*). These concerned several cities in and near Illinois.

Climatic-type studies of planned weather modification were also performed. Studies included rainfall modification (*Huff, 1969; Schickedanz and Huff, 1971*) and hail suppression (*Changnon and Schickedanz, 1969; Schickedanz and Changnon, 1970*).

**General Climatic Data.** During the 1958-1960 period, the state published several atlases concerning natural resources in Illinois. One was the *Atlas on Water Resources and Climate* (1958). This atlas contains several types of statewide basic climatic data in the form of maps or graphs including 1) annual precipitation extremes for 5- and 50-year periods, 2) average annual and monthly rainfall, 3) long-term precipitation trends, mean snowfall, etc. A similar, but more extensive general state summary of

climatic factors was prepared and published in 1967 (*Water for Illinois — a Plan for Action, 1967*).

In 1957 the Water Survey began a series of reports concerning the potential surface water resources for various areas in Illinois. These were prepared and published for four areas, one for each major division of the state (*Roberts et al., 1957; Dawes and Terstriep, 1966a, 1966b, and 1967*). Each contains a section on the region's climate and includes the probabilities of any given date being in a dry period.

Extensive interest in the climatic data from the Urbana weather station has resulted in several publications. The first summarized in-depth the climatic records in the 1901-1956 period (*Changnon, 1959*). It contains statistical summaries for standard weather elements plus those for soil temperatures, sky cover, humidity, and solar radiation. A history of the Morrow Plots station was published (*Changnon and Boyd, 1963*), and long-term climatic change has also been investigated with the use of Urbana temperature records (*Changnon, 1964b*).

## Data

In addition to the publications, the Water Survey has many punched cards and tapes containing climatic data. Besides the two million daily weather cards already described, the Survey has assorted radiosonde (upper air) cards and a large volume of 'analyzed' card decks. Monthly rain and temperature cards for all long-term stations in Illinois have been machine-calculated from the daily cards. These monthly cards have been used to produce climatic printouts for each station. The monthly total rainfall cards were then used to produce cards with running totals for periods of 3 months, 6 months, etc. The Survey also has prepared weekly summary cards of rain and temperature data for 10 Illinois stations (*Changnon, 1963a*).

## OTHER SOURCES OF ILLINOIS DATA

Early research and summarization of state data by two climatologists resulted in two publications dealing with the general climate of Illinois (*Mosier, 1918; Page, 1949*). Each contains considerable monthly data in tabular form.

The North Central Committee for Weather and Agriculture [initially identified as North Central (NC)-26 and more recently as NC-94] has produced several useful climatic summaries for Illinois and the Midwest. This is one of several regional committees established under the Agricultural Experiment Stations of the Land Grant universities in the United States. Their publications can be obtained through the University of Illinois College of Agriculture. Those relevant to Illinois include:

- 1) *Precipitation Probabilities in the North Central States (Shaw et al., 1960)*. This report contains regional maps showing the weekly rainfall probability for most weeks of the year and for different amounts of weekly rainfall.
- 2) *Probabilities of Sequences of Wet or Dry Days in Illinois (Feyerherm et al., 1966)* presents probabilities for sequences of days having various daily rain amounts for 10 Illinois stations.
- 3) *Temperatures Critical to Agriculture (Decker, 1967)* contains probability maps for runs of days (5, 15, or 25 or more) with maximum and minimum temperature above different selected levels. These are given for each week.
- 4) *Solar Radiation and Sunshine Duration Relationships in North Central Region and Alaska (Baker and Haines, 1969)*. This NC Region publication presents extensive radiation and sunshine data for the region, largely in probabilistic format (tables) and by weeks of the year (maps).

The Argonne National Laboratory at Lemont, Illinois, has operated an excellent weather station, and its data have been used to produce a 15-year climatic summary (*Moses and Bogner, 1967*). It is a valuable summary of soil temperature data, surface and low level winds, temperature, and dew point data for that locale.

Surface weather data have been collected at the various U. S. Air Force bases in Illinois. These data are usually sent to the NWRC, but they are often not available in published formats. During World War II, the U. S. Air Force operated several air bases in Illinois for short periods between 1941 and 1947, and such weather records provide considerable climatic data for 3- to 5-year periods where there are no other detailed observations available. Such complete weather stations at the Lawrenceville and Park Ridge bases, for example, have provided data for extensive climatic research by the Air Weather Service. They used the data from Lawrenceville to summarize all the frequencies for different wind directions and speeds.

The hourly weather observations at FAA airport stations (such as Champaign, Decatur, Mattoon, Mt. Vernon, and Quincy) are labeled as 'second-order' station data. These data are hard to obtain because they are not 'official' by NWS standards and are not card-punched. To obtain the data, one must purchase photo copies of the daily log sheets from the NWRC, Asheville, North Carolina.

In the 1960s the Illinois State Climatologists of EDS developed *Climates of \_\_\_\_\_ County*, for 58 Illinois counties. Each contains a climatic summary that is based on the historical USWB data for every station in the county. These can be obtained from the Water Survey or from the Illinois Department of Agriculture in Springfield.

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| <p>Baker, D. G., and D. A. Haines. 1969. <i>Solar radiation and sunshine duration relationships in the north central region and Alaska.</i> University of Minnesota, Minneapolis, Agricultural Experiment Station, NC-Regional Publication 195, 372 p.</p> | <p>Solar radiation, sunshine</p>    |
| <p>Changnon, S. A., Jr. 1955. <i>Illinois cooperative project in climatology, first progress report.</i> Illinois State Water Survey Circular 51, 44 p.</p>  | <p>Punch-card data</p>              |
| <p>Changnon, S. A., Jr. 1956. <i>Illinois cooperative project in climatology, second progress report.</i> Illinois State Water Survey Circular 57, 24 p.</p>   | <p>Punch-card data</p>              |
| <p>Changnon, S. A., Jr. 1957a. <i>Illinois cooperative project in climatology, third progress report.</i> Illinois State Water Survey Circular 64, 12 p.</p>   | <p>Punch-card data, climatology</p> |
| <p>Changnon, S. A., Jr. 1957b. <i>Thunderstorm-precipitation relations in Illinois.</i> Illinois State Water Survey Report of Investigation 34, 24 p.</p>  | <p>Precipitation, thunderstorms</p> |
| <p>Changnon, S. A., Jr. 1959. <i>Summary of weather conditions at Champaign-Urbana, Illinois.</i> Illinois State Water Survey Bulletin 47, 95 p.</p>   | <p>Climatic change, climate</p>     |
| <p>Changnon, S. A., Jr. 1962a. <i>Areal frequencies of hail and thunderstorm days in Illinois.</i> Monthly Weather Review, v. 90(12):519-524. (ISWS Reprint 27).</p>   | <p>Hail, thunderstorms</p>          |
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| <p>Changnon, S. A., Jr. 1963c. <i>Precipitation in a 550-square mile area of southern Illinois.</i> Transactions Illinois Academy of Science, v. 56(4):165-187. (ISWS Reprint 33).</p>   | <p>Precipitation, climate</p>       |

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## APPENDIX

### Sources of Additional Weather Information

#### *Environmental Data Service*

For information on EDS publications or original records

Telephone: Area Code 301 495-2424  
Mail: National Weather Records Center  
Federal Building  
Asheville, North Carolina 28801

For copies of government publications

Mail: Superintendent of Documents  
Government Printing Office  
Washington, D. C. 20402

#### *Illinois State Water Survey*

For special weather information or advice

Telephone: Stanley A. Changnon, Jr.  
Area Code 217 333-4260

For local (Champaign-Urbana) weather data or information

Telephone: Weather Observer  
Area Code 217 333-4963

For copies of Water Survey publications

Telephone: Information Desk  
Area Code 217 333-2211  
All mail: Illinois State Water Survey  
Box 232  
Urbana, Illinois 61801