

## THE ILLINOIS WEATHER RECORD PUNCH CARD PROJECT

STANLEY A. CHANGNON, JR.  
*Illinois State Water Survey, Urbana*

### INTRODUCTION

The Illinois Weather Record Punch Card Project is a cooperative arrangement between the Illinois State Water Survey, the University of Illinois, and the U. S. Weather Bureau for entering past Illinois weather records on IBM cards. This paper includes a history of the project, operational procedures, and suggested research uses of these cards. Availability of the IBM cards to scientific personnel throughout Illinois should prove useful for research in climatology, meteorology, agriculture, architecture, engineering, and many other related fields where the effects of weather are felt.

### HISTORY

The circumstances which enabled the origin of this program occurred in 1948 when the U. S. Weather Bureau started to enter all climatological and meteorological observations on various types of IBM cards. However, Congress did not provide funds for preparation of cards of the data prior to 1948. The Weather Bureau then promoted a cooperative, working agreement between the Weather Bureau and any given state's university or state agency to prepare cards of the past records of that state. In this arrangement the Weather Bureau would furnish

the cards, instructions, and the original past records. The cooperating state institution would edit the records, punch and verify the cards. The state would then produce duplicate card decks for the Weather Bureau, and in turn, the Weather Bureau would match in equal numbers, year for year, duplicate cards for all future weather records to match the state's production prior to 1948.

Soon after 1948, various state universities initiated agreements with the Weather Bureau, among the first being Iowa and South Dakota. The Weather Bureau approached the Illinois State Water Survey five years ago. The Survey recognized the benefits from the availability of such cards, but did not have sufficient funds at that time. In the fall of 1954 limited funds became available to initiate the project. An agreement was signed in November, 1954, and the project began in early December.

### PROCEDURES OF THE ILLINOIS PROJECT

The selection of stations for which data were to be recorded on cards was based on several considerations. The stations were selected for the best areal distribution and only if there were records beginning no later than 1905; this was to have 50 years of records available on cards

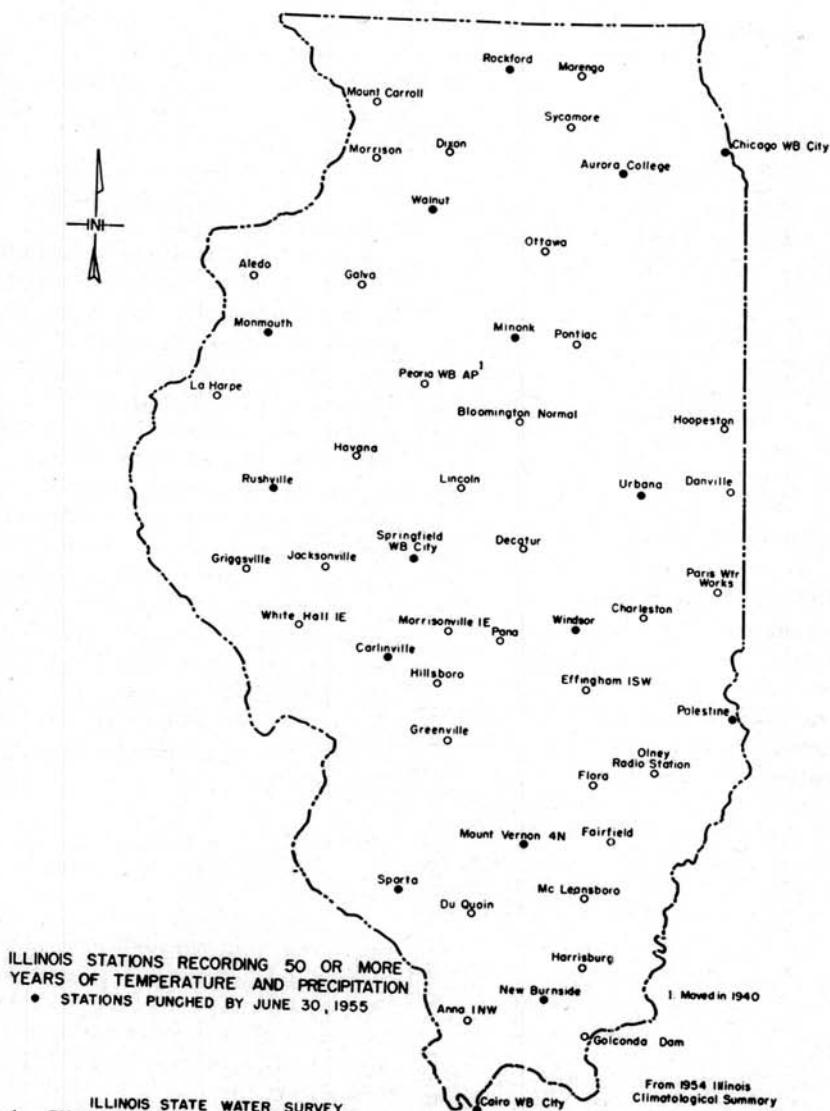


FIG. 1.—Illinois stations recording 50 or more years of temperature and precipitation.

in 1955. Both the available stations and the selected stations are indicated in Figure 1. Current progress indicates that 13 Weather Bureau climatological sub-stations (handled by a volunteer cooperative observer who makes weather observations

once daily) and 3 First Order Weather Bureau Stations (operated by full time Weather Bureau personnel taking observations at frequent intervals during each 24-hour period) will be completed by June 30, 1955. The completed sub-

stations in the northern portion (defined by the U. S. Weather Bureau in climatological records) will be Aurora, Monmouth, Minonk, Rockford and Walnut. The sub-stations in central Illinois will be Carlinville, Palestine, Rushville, Urbana, and Windsor; and the southern sub-stations will be Mt. Vernon, New Burnside, and Sparta. The three First Order Stations will be Cairo (furnished by the Missouri Punch Card Project), Chicago, and Springfield. The climatological sub-stations were also selected for the legibility, completeness, and reliability of the data. Records of the other sub-stations shown in Figure 1 will be entered on IBM punch cards during 1955-1956.

The data being selected for punching in Illinois are strictly of a climatological nature. No attempt is being made to punch past records of other meteorological data, such as winds aloft, conditions at various pressure levels, or detailed hourly and six-hourly records from the First Order Stations. At present, the project is using the daily cards (No. 1009) for the sub-stations, the daily summary cards (No. 3) for the First Order Stations, and the Monthly Summary Cards. The card types in use are shown in Figure 2.

On the No. 1009 card, all data available at each station are being edited and punched, including the "Days With" columns. Several other state projects, doubting the value and reliability of the "Days With" entries, have not included this information. However, it was decided to put these entries on the Illinois cards for possible future use. The reliability of data varies from

station-to-station and from observer-to-observer, but to be available for future use, these entries are being edited and punched while the original records are available.

The information punched on the No. 3 cards will be principally as shown on the cards in Figure 2.

Certain stations are being selected to have Monthly Summary Card Decks prepared for use in particular research projects. The Monthly Summary Card and its data are shown in Figure 2, with the addition of the summarized "Days With" entries in card columns 74-80.

The Survey's card production procedure begins with the editor working over the original records and making any corrections or additions as prescribed by Weather Bureau instructions. Then, the edited records are transferred to the University Statistical Service Unit where the personnel produce the punched cards. The cards are then machine checked.

#### EXAMPLES OF CARD DECK RESEARCH PROJECTS

A few projects using the cards have been inaugurated, even though only a few stations are completed. One of these is a sorting of precipitation intensity intervals for each station. This project consists of making a monthly count of the number of 24-hour precipitation totals occurring in various classes of precipitation intervals. These arrayed tabulations from each station will be compared to analyze differences in number and magnitude by area and season.

It is also planned to produce a climatological brochure for each sta-



for research projects using the cards. The outstanding feature of having IBM cards for climatological research is the reduction of time of computation. For example, if the climatic years classification method is applied to a station with 35 years of weather records, manual analysis requires approximately four hours. By use of IBM cards the same analysis would require approximately 15 minutes. Consequently, a climatic years classification for an area with 70 stations would require 280 hours manually and only 18 hours by IBM equipment. The Iowa project and the Missouri project have both specialized in the agricultural aspects in their card research projects. Many studies have been in relation to different crops' growth parameters.

The University of Wisconsin is also using IBM weather card decks intensively, but the interests are more meteorological. It is attempting to establish cause-and-effect relationships between meteorological phenomena and the occurrence of

precipitation in the Wisconsin River Valley.

The information on the cards may be printed on a tape and fed into the ILLIAC, a high-speed, electronic digital computer at the University of Illinois, thus enabling projects requiring complex multiple correlations of associated weather phenomena to be accomplished quite rapidly.

#### SUMMARY

Many volumes of Illinois weather data may be condensed for research studies, if funds are available. Some weather record cards are now available at the State Water Survey for research and educational use.

Meteorology and climatology are sciences containing immense quantities of simple numbers difficult to handle because of their bulk, but yet requiring only relatively simple mathematical compilations. Weather IBM cards can eliminate this problem and assist in encouraging research, not only in climatology and meteorology but in related fields of endeavor.

#### LITERATURE CITED

MISSOURI CLIMATOLOGICAL RESEARCH PROJECT. 1949-1954. Univ. Mo., Progress Reports, Nos. 1-7, pp. 1-142.  
 RUSSELL, R. J. 1934. Climatic years. *Geog. Rev.*, 24:92-103.  
 SOUTH DAKOTA COOP. PROJECT IN CLIMATOLOGY.

1952. First Annual Progress Report. Brookings, S. D., S. Dak. State College, pp. 1-33.  
 UNITED STATES WEATHER BUREAU. 1951. Manual of card punching. U. S. Print. Office, Wash., pp. 1-78.