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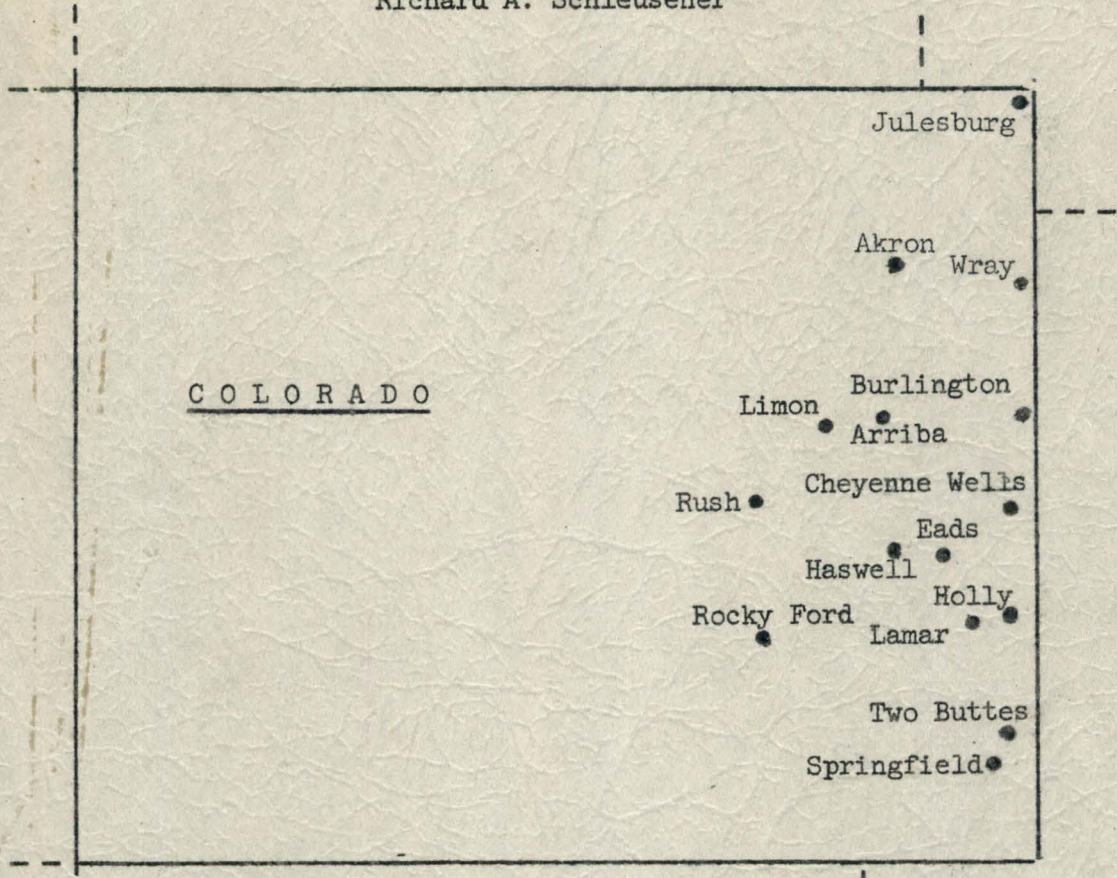
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STATUS REPORT
on
COLORADO COOPERATIVE PROJECT IN CLIMATOLOGY
through 30 June 1959

ENGINEERING RESEARCH
APR 16 '74
FOOTHILLS RESEARCH

by
Richard A. Schleusener

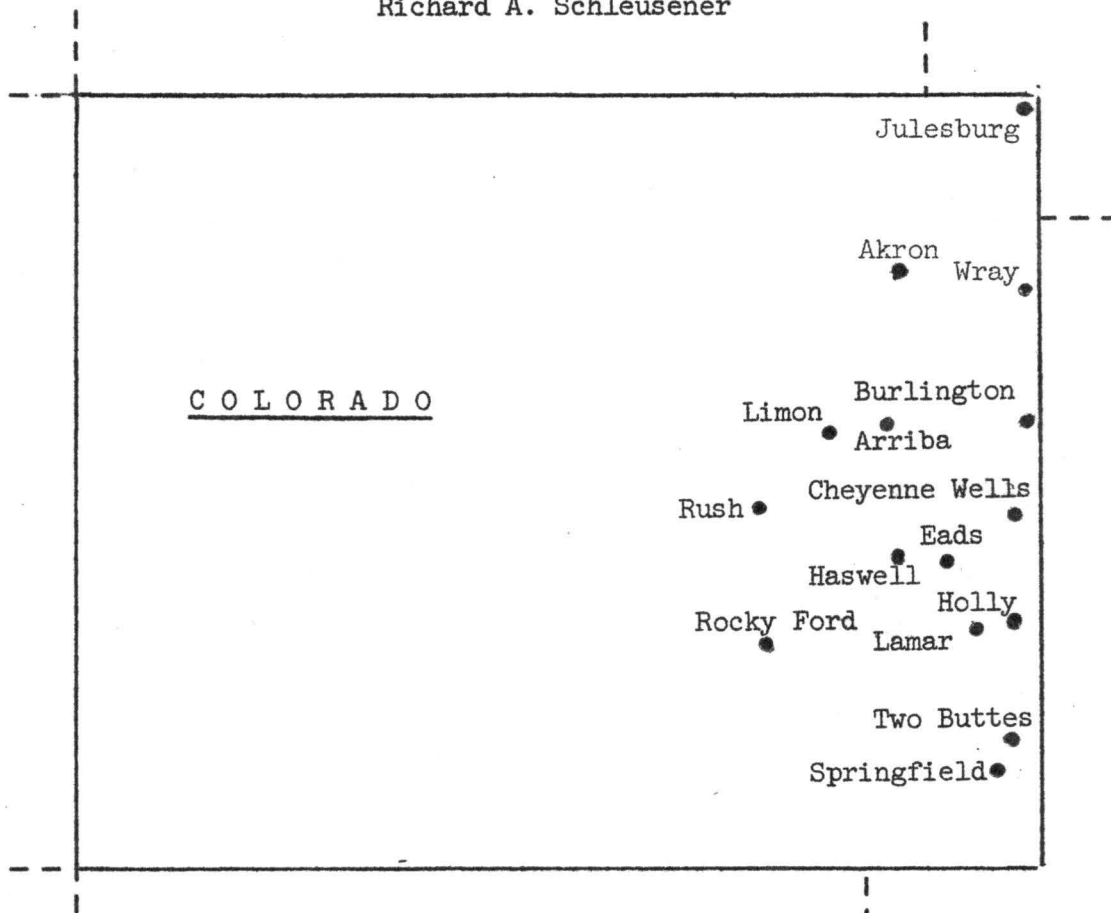


Civil Engineering Section, Colorado Agricultural Experiment Station
in cooperation with
The United States Weather Bureau
and
The U.S. Department of Agriculture, Soil Conservation Service

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ABSTRACT

This report is a summary of progress on the status of the Colorado Cooperative Project in Climatology. Primary emphasis in this project has been to place certain weather data on I.B.M. punched cards. The history of the project is given, and the types of data included in the punched card program are described. A listing of the stations and years for which weather data are punched is included and procedures for processing the data are described. Detailed instructions are given for processing of weather records from individual stations. No analyses of the punched card data have been possible to date.

INTRODUCTION

Development of electronic data-processing equipment during recent years has given new impetus to efforts to glean added information from the accumulated mass of weather records that have accumulated throughout all of the United States. Recognition of the benefits to be gained from use of such equipment led the U. S. Weather Bureau to initiate in 1948 a program of recording climatological and meteorological observations in punched card form. Since funds were limited for processing weather records obtained prior to 1948, the U. S. Weather Bureau encouraged state universities to accomplish the punching of these records. A mutual concern over this problem led to a memorandum of understanding between the U. S. Weather Bureau and the Colorado Agricultural Experiment Station, dated February 1, 1957.

Under this agreement, Colorado State University agreed to provide personnel and facilities for placing of climatological data on punched cards, to furnish the Weather Bureau with duplicates of the cards punched, and to prepare an annual report of progress. Under the same agreement, the Weather Bureau agreed to provide records and blank cards, to furnish Colorado State University with advice on punching problems, and to supply decks of available cards from other stations in Colorado in an amount equal to the backlog records punched by Colorado State University.

Another agreement was reached on April 1, 1957, between the Colorado Agricultural Experiment Station and the United States Department of Agriculture, Soil Conservation Service. Under this agreement the Soil

Conservation Service agreed to pay the Experiment Station for punching back records for fifteen (15) stations in eastern Colorado for thirty (30) years prior to 1948.

Work commenced on this project shortly thereafter, using I.B.M. equipment in the University Business Office on a part-time basis. Because of the limited time available on the card punching machines under this arrangement, progress was slow until a card-punching machine was made available on a full-time basis in September 1958.

Punching of the records under the Soil Conservation Service contract was completed in January 1959. Processing of the records for accuracy and preparation of duplicate decks of cards for the Weather Bureau were completed in April 1959.

SCOPE OF WORK ACCOMPLISHED

Type of Data

Weather records placed on punched cards included a variety of daily observations. Most of the data were taken from original weather records recorded on U. S. Weather Bureau Form 1009. Data transferred to the punched cards included some or all of the following information:

1. Station identification and date.
2. Maximum and minimum temperatures.
3. Set maximum temperature.
4. Precipitation amounts.
5. Days with certain meteorological phenomena, such as
thunder, fog, sleet, and other phenomena.
6. Evaporation.

The exact elements transferred to cards for each station depended on the quality of the record. In some instances, data were sufficiently complete to permit transfer of all of the above elements to the cards. In most cases, however, not all of the elements were suitable for punching for all stations. Table 1 gives a detailed listing of the elements transferred to cards for each station.

Location of Stations

Stations for which weather data were punched are listed in Table 1. Locations of these stations are shown in Figure 1.

TABLE I

Weather Elements Transferred to Punch Cards for Period 1918 - 1948

Inclusive Dates Show Periods of Missing Data of More Than One Year[#]

Station	Station No.	Max. Temp.	Min. Temp.	Set Maximum	Precipitation	Snow Fall	Snow Depth	Days With Weather Phenomena	Evaporation
Akron	0109-3 0114-3	5-24 to 6-25	5-24 to 6-25	5-24 to 6-25 1-27 to 12-48			no obs.		10-18 to 4-20 10-35 to 12-48
Arriba	0348-3	1-18 to 2-28	1-18 to 2-28	1-18 to 2-28	1-18 to 2-28			1-18 to 2-28	no obs.
Cheyenne Wells	1564-3								no obs.
Eads	0446-1	9-18 to 10-20 5-22 to 5-23	9-18 to 10-19 5-22 to 5-23	9-18 to 10-19 5-22 to 5-23	9-18 to 10-19 5-22 to 4-23			9-18 to 10-19 5-22 to 4-23	no obs.
Haswell	3828-1	no obs.	no obs.	no obs.			no obs.		no obs.
Holly	4076-1	9-45 to 5-48	9-45 to 5-48	9-45 to 5-48	9-45 to 4-48			9-45 to 4-48	no obs.
Rush	7287-1	no obs.	no obs.	no obs.			no obs.		no obs.
Springfield	7862-1	no obs.	no obs.	no obs.	1-20 to 10-21		no obs.	1-20 to 10-21	no obs.
Two Buttes	8510-1	1-20 to 2-21 8-23 to 7-24 7-26 to 9-27	1-20 to 2-21 8-23 to 7-24 7-26 to 9-27	1-20 to 2-21 6-23 to 1-24 7-26 to 9-27	1-20 to 2-21 6-23 to 1-24	no obs.	no obs.	1-20 to 2-21 6-23 to 1-24 7-26 to 9-27	no obs.
Burlington	1121-3	Periods of missing data were not tabulated for these stations.							no obs.
Julesburg	4413-4								no obs.
Lamar	4770-1								no obs.
Limon	5015-1								no obs.
Rocky Ford	7167-1								no obs.
Wray	9243-3								no obs.

[#] Periods of missing data were not tabulated for 24-hour snowfall amounts or depths of snow on the ground.

PROCEDURES

Editing

Editing of the original U. S. Weather Bureau records was accomplished under the supervision of the Weather Bureau State Climatologist for Colorado. The original records were checked for consistency and accuracy. Appropriate notations were made on the original records for the guidance of the punch-card operators.

In addition, specific punching instructions for each station were supplied for each of the 15 stations. Significant portions of the instructions are included in Appendix 2.

Punching

Punching of the records was accomplished in accordance with the specific punching instruction as described above. Considerable difficulty was experienced by the operators in reading some of the entries on the original records.

Verification

The stations of Wray, Burlington, Rocky Ford, Lamar, Julesburg, and Limon were verified by use of the I.B.M. 056 Card Verifier, using the original records for the verification process. For the remaining stations, daily cards were listed and monthly totals were obtained on the I.B.M. 402 Tabulator. Verification was accomplished by comparing monthly computed totals of temperatures, precipitation and "days with" certain phenomena with totals as listed on the original records. For those cases in which the computed totals did not correspond to the totals indicated on the original records, the listings from the I.B.M. 402 Tabulator were compared with the original records to determine the error. If the discrepancy was caused by erroneous punching, a notation was made to re-punch the card. Erroneous cards were then re-punched from the original records, and verified using the I.B.M. 056 Verifier. Corrected cards were then inserted into the main deck of cards using the I.B.M. 085 Collator.

Use of the collator offered an additional benefit in that this step provided a check to assure that individual cards were placed in their proper sequence, and that no duplicate cards had been erroneously inserted in the deck.

Duplication

Duplicate cards for the U. S. Weather Bureau were prepared by duplication of the corrected card decks, using the I.B.M. 514 Reproducing Punch. The original cards were shipped to the National Weather Records Center at Asheville, North Carolina, and duplicate cards were retained on file in the Civil Engineering Section at Colorado State University.

Establishment of Card Library

Climatological data as indicated in Table I form the beginning of a library of climatological data in punched card form for stations in eastern Colorado. It is hoped that funds will become available for analyses of these data to gain greater insight into the climate of the state -- an important natural resource.

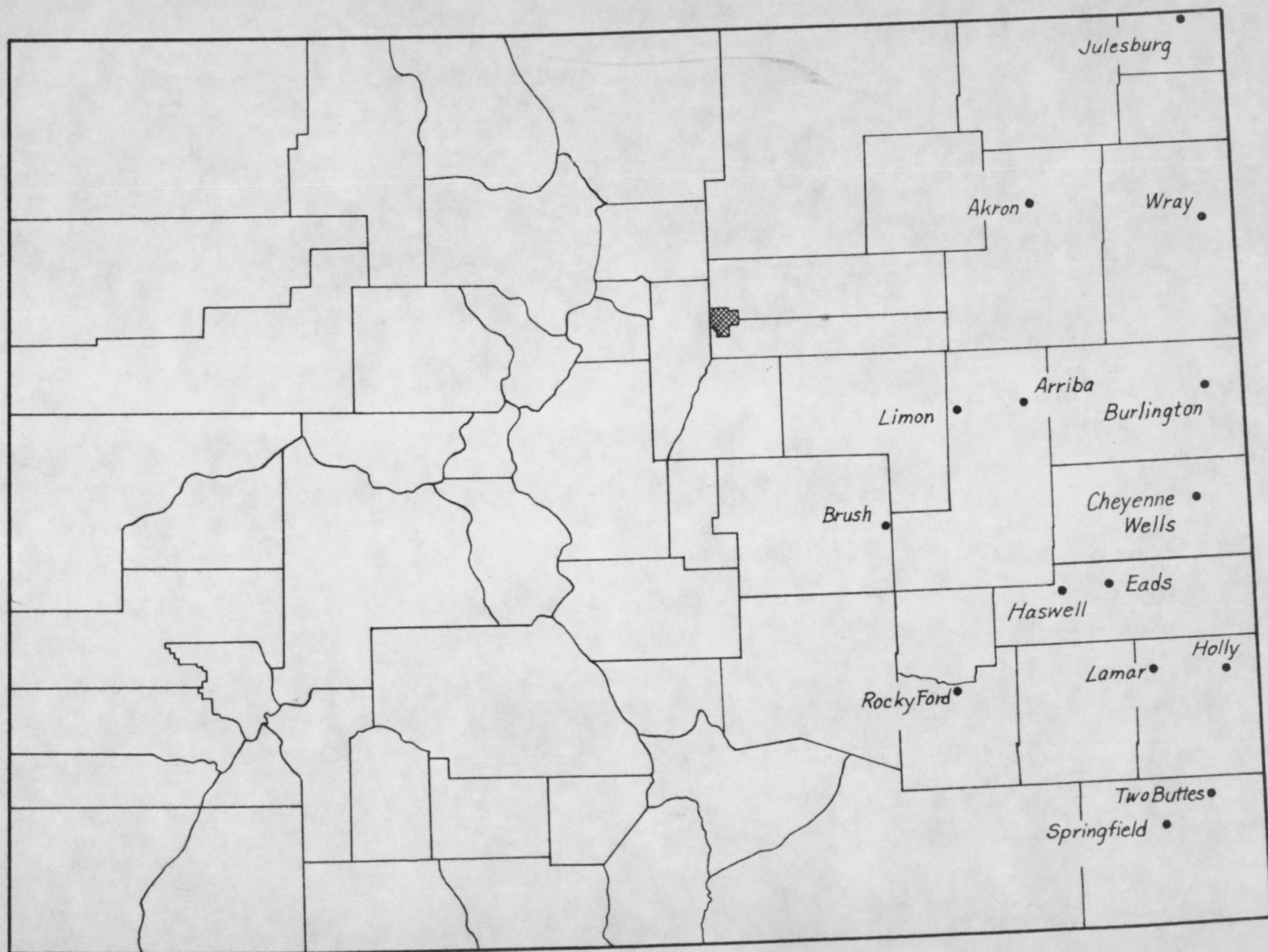


Fig. 1 Locations in Colorado for which back weather records were placed on punched cards

APPENDIX I

GENERAL PUNCHING INSTRUCTIONS

<u>Field</u>	<u>Columns</u>	<u>Number of Columns</u>	<u>Punch Instructions for Daily 1009 Card</u>
STATION NUMBER	1-6	6	As coded.
DATE (YR., MO., DAY)	7-12	6	Punch 1950 as 50, etc. Punch Jan. as 01, Dec. as 12, etc. Punch first day as 01, 21st day as 21, etc.
DIVISION	13	1	Division as coded.
Time of Temp. Obs.	13	1	"X" overpunch if a.m., leave blank if p.m.
MAX TEMPERATURE	14-16	3	Punch 35 degrees as 035, 110 degrees as 110, etc. "X" in column 14 for minus temp; that is, -14 (14° below zero) punch as X14. Leave all columns blank if missing or not reported.
MIN TEMPERATURE	17-19	3	Same as MAX TEMPERATURE
TEMPERATURE AT TIME OF OBS	20-22	3	Same as MAX TEMPERATURE
PRECIP	23-26	4	(a) 00.01 or more. Punch as entered (for 1.26 inches, punch 0126). (b) <u>Trace</u> 000X (c) <u>PRECIP</u> included in measurement reported on subsequent day 00X-. (d) No PRECIP (observation taken but no rain had fallen, punch X in 23) X---. (e) <u>PRECIP definitely missing</u> (no observation reported), leave blank.

<u>Field</u>	<u>Columns</u>	<u>Number of Columns</u>	<u>Punch Instructions for Daily 1009 Card</u>
SNOWFALL	27-29	3	(a) <u>00.1</u> or more, punch as entered (b) <u>Trace</u> OOX (c) SNOWFALL included in measurement on subsequent day OX-. (d) Observation reported but no snow had fallen X--. (e) <u>Snow definitely missing</u> (no observation reported), blank all columns.
SNOW DEPTH	30-32	3	(a) <u>1" or more</u> , punch as entered (b) <u>Trace</u> OOX (c) <u>No snow</u> on ground X--. (d) No observation reported- blank all columns.
DAY WITH	33-45	13	"1" in appropriate column for each check. Leave blank otherwise. Since counts of DAYS WITH rain or snow can be readily obtained from the amounts fields on the cards, cols. 33, 34 on the 1009 card should be left blank.
AMT OF EVAPORATION	67-69	3	Punch as entered to hundredths blank if not reported. AMT. OF EVAPORATION included in total reported on subsequent day OX-.

Note: A dash, "-", is used in the above to denote no punch in the column.

APPENDIX II
SPECIAL PUNCHING INSTRUCTIONS

NOTES:

1. Appendix II contains information that is in addition to, or different from, the general punching instructions given in Appendix I.
2. Columns 1-2 were punched with 05, the state number for Colorado for all stations.

AKRON 4 E, COLORADO 05-0109-3
and
AKRON CAA 05-0114-3

Col	3-6	0109 is the number for Akron 4 E for 1918-35; 0114 is the number for March 1, 1937 and later for Akron CAA.
Col	7-8	Year (1918-35, 1937-48).
Col	13	Division for Akron is 3. Jan 1918-35 a.m. observation-overpunched. Mar 1937-48 p.m. observation-not overpunched.
Col	20-22	Not punched.
Col	27-29	Not punched for 1924-1935.
Col	30-32	Not punched.
Col	33-45	Not punched for 1918 thru 1935.
Col	46-80	Not punched except for Col 67-69.
Col	67-69	Punched for the months for which there were data, usually April (or May) through September or October. Original records in thousandths of an inch were converted to hundredths of an inch. The entries were to thousandths; such as 0.189. These were converted to hundredths; thus, the above .189 would be converted to 0.19.

SPECIAL NOTES:

Evaporation records were obtained from Akron Experiment Station Forms.

Other records were obtained from Weather Bureau Form 1009, 1918-23,
1937-48; from Akron Experiment Station Forms, 1924-35.

No records were available for Akron 4 E after 1935.

Akron CAA records beginning in 1937 were used to tie in with records
punched by the Weather Bureau after 1948.

ARRIBA, COLORADO 05-0348-3

Col 3-6 0348 is the number for Arriba.
Col 7-8 Year (1907-17, 1928-48).
Col 13 Division 3.
FM observations -- not overpunched.
Col 20-22 Not punched, Jan 1928 - May 1934.
Col 30-32 Not punched, May 1911-1948.
Col 46-80 Not punched.

SPECIAL NOTES:

May and June 1910: MIN temps. were not punched. "Set MAX"
was punched.

July thru Sept. 1910: MAX and MIN temps. were not punched.
"Set MAX" was punched.

April thru Aug. and Oct. 1916: MAX temps were not punched.

Nov. 1916, Sept 1931, Jan 1932, March 1934, June and July 1947:
All temperature data were omitted.

Missing months: Dec 1909; April, Nov and Dec 1917; Jan-Mar 1928;
April and May 1934; and Dec. 1946.

BURLINGTON, COLORADO 05-1121-3

Col 3-6 1121 is the number for Burlington.

Col 7-8 Year (1918-48).

Col 13 Division for Burlington: punched 3.
Jan. 1918 - Dec. 1925 p.m. observations - not overpunched.
Jan. 1926 - Nov. 1929 a.m. observations - X overpunched.
Dec. 1929 - June 1948 p.m. observations - not overpunched.

Col 20-22 Not punched.

Col 30-32 Not punched.

Col 46-80 Not punched.

SPECIAL NOTES:

MIN TEMPERATURES not punched for Sept. 1921.

CHEYENNE WELLS, COLORADO 05-1564-3

Col 3-6 1564 is the number for Cheyenne Wells.

Col 7-8 Year (1918-48).

Col 13 Division for Cheyenne Wells: 3.
FM observations -- not overpunched.

Col 30-32 Not punched.

Col 46-80 Not punched.

EADS, COLORADO 05-2446-1

Col 3-6 2446 is the number for Eads.
Col 7-8 Year (1918-48).
Col 13 Division for Eads is 1.
Col 20-22 Missing for some months.
Col 30-32 These data were punched for the periods Jan. thru Aug. 1918;
June 1923 thru Dec. 1931. Spotty data were punched as
missing.
Col 46-80 Not punched.

SPECIAL NOTES:

Oct. 1918 thru Oct. 1919: Missing record.
Nov. 1919: Dec. 1919: MAX TEMPERATURES were omitted.
Jan. 1920 thru Oct. 1920: MAX TEMPERATURES were omitted.
Nov. 1920 thru the 22nd: MAX and MIN TEMPERATURES were omitted.
May 1922 thru April 1923: Missing record.
May 1923: Temperatures not punched.
May 1930: Missing records.
June thru Sept. 1930: All temperatures were omitted.
Feb. 1932: MIN TEMPERATURES were omitted.
Sept. 1932: Missing record.
April 17 thru July 1933: Temperatures were omitted.
Nov. and Dec. 1933: Missing record.
Jan. 1934: Temperatures were omitted.
Sept. 1934: MAX TEMPERATURES were omitted.
Jan. and Feb. 1935: Temperatures were omitted.
July 1936: Missing record.
Jan. 1937: Temperatures were omitted.
June 1937: MIN TEMPERATURES were omitted.
Nov. 1937: Missing record.
Mar. 1938 thru Aug. 1938: Missing.
Sept. 1938: PRECIP incomplete.

HASWELL, COLORADO 05-3828-1

Col 3-6 3828 is the number for Haswell.
Col 7-8 Year (1922-48).
Col 13 Division for Haswell is 1.
(Record begins with June 1922)
June 1922 - thru June 1941 a.m. observation.
Col 13 overpunched.
July 1941-48 p.m. observations - not overpunched
Col 14-22 Not punched.
Col 30-32 Not punched.
Col 46-80 Not punched.

SPECIAL NOTES:

Missing record: Dec. 1923 - April 1924; August 1924; Sept. - Dec. 1927;
Feb. and Mar. 1929

HOLLY, COLORADO 05-4076-1

Col 3-6 4076 is the number for Holly.
Col 7-8 Year (1918-48).
Col 13 Division 1
Punched throughout as p.m. observations - not overpunched.
Col 14-22 MAX, MIN, AND SET MAX (at obs.) Temperatures.
Col 30-32 Not punched.
Col 33-34 Not punched.
Col 46-80 Not punched.

SPECIAL NOTES:

Missing record: Sept.-Dec. 1918; Sept.-Dec. 1919; Jan., Feb., Oct., 1920;
Oct. 45 - May 48.
SET MAX. July 1919 - not punched.
No SET MAX June thru Nov. 1921.
Temperatures Dec. 1921, August. 1923 - not punched.
Precipitation Jan., Oct., Dec. 1925 - not punched.

JULESBURG, COLORADO 05-4413-4

Col 3-6 4413 is the number for Julesburg.
Col 7-8 Year (1918-48).
Col 13 Division for Julesburg: 4.
Not overpunched, p.m. obs.
Col 46-80 Not punched.

SPECIAL NOTE:

"SET MAX." for Dec. 16-21, 1945 are not punched.

LAMAR, COLORADO 05-4770-1

Col 3-6 4770 is the number for Lamar.
Col 7-8 Year (1918-48).
Col 13 Division for Lamar: Punch 1.
p.m. observations throughout; not overpunched.
Col 20-22 Not punched.
Col 46-80 Not punched.

SPECIAL NOTES:

The following months were not punched:

January, February, March 1920
August, September, October 1929
November, December, 1935
April, October 1936

LIMON 8 SW, COLORADO 05-5015-1

Col 3-6 5015 is the number for Limon 8 SW.
Col 7-8 Year (1918-48).
Col 13 Division for Limon 8 SW: 1.
Jan. 1918-Oct. 1929 p.m. obs. - not overpunched.
Nov. 1929-June 1930 a.m. obs. - overpunched.
July 1930-Dec. 1948 p.m. obs. - not overpunched.
Col 30-32 Jan. 1918 thru Feb. 1935 - not punched.
Col 46-80 Not punched.

SPECIAL NOTES:

MAX TEMPERATURES Jan. 1927 were not punched.
Temperatures Feb. 1927 were not punched.
Temperatures Feb. 1925 were not punched.
Oct. 1926 SET MAX & MIN not punched.
Missing Record: Oct. 1927 - Oct. 1929.

ROCKY FORD 2 ESE, COLORADO 05-7167-1

Col 3-6 7167 is the number for Rocky Ford 2 ESE.
Col 7-8 Year (1918-48).
Col 13 Division for Rocky Ford, 2 ESE: 1.
FM observations throughout; not overpunched.
Col 20-22 Oct. 1932 through Dec. 1940 not punched.
Col 30-32 Not punched.
Col 46-80 Not punched.

RUSH 2 NNE, COLORADO 05-7287-1

Col	3-6	7287 is the number for Rush 2 NNE.
Col	7-8	Year (1924-48).
Col	13	Division for Rush 2 NNE: 1. Record begins May 1924. Punched as p.m. observation 1924-48 - not overpunched.
Col	14-22	Not punched.
Col	30-32	Not punched.
Col	46-80	Not punched.

SPECIAL NOTE:

Missing record: Nov. 1930; Feb. 1936; Oct. 1937; Nov. 1939.

SPRINGFIELD, COLORADO 05-7862-1

Col	3-6	7862 is the number for Springfield.
Col	7-8	Year (1918-48).
Col	13	Division for Springfield: 1 Jan. 1918 - March 1938 p.m. obs. - not overpunched. April 1938 - July 1948 (AM) Overpunched.
Col	14-22	Not punched.
Col	30-32	Not punched.
Col	46-80	Not punched.

SPECIAL NOTE:

Missing Record: Jan. 1920 - Oct 1921.

TWO BUTTES 1 NW, COLORADO 05-8510-1

Col 3-6 8510 is the number for Two Buttes.
Col 7-8 Year (1918-48).
Col 13 Division 1
Oct. 1927 - a.m. observations, overpunched
All other months p.m. observations, not overpunched.
Col 30-32 Not punched.
Col 46-80 Not punched.

SPECIAL NOTES:

Missing records: Jan-Dec 1920;
Jan, Feb, 1921; Aug 1923 thru July 1924;
June, Dec 1925; Jan, Mar, thru May, July thru
Dec 1926; Jan thru Sept, Nov, Dec 1927;
Jan thru May 1928.
Oct. 1930: Temperatures were omitted.
Dec. 1930: SET MAX was omitted.
March 1931: Temperatures were omitted.
Feb. 1933: MAX TEMPERATURES were omitted.
Feb. and March 1945: Temperatures were omitted.
July 1945: MIN TEMPERATURES were omitted.
Nov. 1946: PRECIP was omitted.
Jan. 1948: Temperatures were omitted.

WRAY, COLORADO 05-9243-3

Col 3-6 Alpha number for Wray: 9243.

Col 7-8 Year (1918-48).

Col 13 Division number for Wray is 3.
January 1918 - October 1925 - p.m. observations - not
overpunched.
November 1925 - December 1926 - a.m. observations
X overpunched col. 13.
January 1926 - July 1948 - p.m. observations - not
overpunched.

Col 20-22 Temperature at time of observation ("Set Max.").
These data were punched except for the following months:
February, March, April, November 1922
March 1934.

Col 46-80 Not punched.

SPECIAL NOTES:

July 1924 and November 1924 not punched.
MAX TEMPERATURE for November 1926 not punched.
Punched PRECIP for April 1924 as missing.
PRECIP for October 1921 not punched.

Missing record: Nov-Dec 1918; Jan-Nov 1919; May, Aug-Oct, Dec 1922;
Mar-June, Sept-Dec 1923; Jan-Mar 1924; Aug-Oct, Dec 1925;
Jan-Apr. 1926.