

National Climatic Data Center

DATA DOCUMENTATION

FOR

DATA SET 3240 (DSI-3240)

Hourly Precipitation Data

March 18, 2003

National Climatic Data Center
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Asheville, NC 28801-5001 USA

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1. Abstract: The observations in the Hourly Precipitation Data (HPD) database were taken by observers at principle (primary) stations, secondary stations, and cooperative observer stations operated by the National Weather Service (NWS) and the Federal Aviation Agency (FAA). Approximately 5,500 stations have recorded precipitation data through the period of this digital file. Initially (from August 1948 to September 1951) data were keyed on punched cards by the regional Weather Records Processing Centers. Then the task was transferred to the National Climatic Data Center (NCDC) in Asheville, NC. The hourly precipitation data file was transferred from punched cards to magnetic tape (TD-9657) during the late 1960s. This data file was then converted to the element file structure during 1984.

Several recording (weighing) rain gauge instruments were used in measuring hourly precipitation, but by September 1963 many Fischer-Porter precipitation gauge instruments with automated readout, recorded on paper tape, were phased in. By early 1965, about 200 of these were in operation and they became the primary recording instrument. In 1996, there were approximately 2,400 Fischer-Porter gauges in operation. The Universal Rain gauge is the other primary instrument used to create this data file. It has an automated readout recorded on paper charts. In 1996, there were approximately 100 Universal Rain gauge stations in the HPD system. Station and dates of commissioning of weighing rain gauges are in the Station History listings available at the NCDC in Asheville, NC.

Fischer-Porter precipitation gauges record data on punched paper tapes. A device known as the Mitron reader translates the data at NCDC. The Universal Rain gauge records data on paper charts. The precipitation recorded on the charts is then digitized. The data from the Surface Climate Information Archive and Dissemination System (SCIADS) or primary stations is also entered into DSI-3240.

The data in this file are a combination of original observations of hourly and daily accumulated precipitation. Precipitation values are checked and edited as necessary by an automated and manual edit. It must be noted that NCDC has the observations from the time the station opened, but the [NWS](#) has the current data. Official surface weather observation standards can be found in the [Federal Meteorological Handbook](#).

2. Element Names and Definitions:

<u>FIELD</u>	<u>RECORD POSITION</u>	<u>ELEMENT NAME</u>	<u>CODE DEFINITIONS AND REMARKS</u>
001	1-3	Record-Type	The type of data stored in this record. Value is "HPD".
002	4-11	Station-ID	This 8-character station identifier is assigned by the National Climatic Data Center. See State Code Table.
	4-5	State-Code	As indicated below. Range of value is 01 to 48, 50, 51, 66, 67, and 91.

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STATE CODE TABLE

01	Alabama	28	New Jersey
02	Arizona	29	New Mexico
03	Arkansas	30	New York
04	California	31	North Carolina
05	Colorado	32	North Dakota
06	Connecticut	33	Ohio
07	Delaware	34	Oklahoma
08	Florida	35	Oregon
09	Georgia	36	Pennsylvania
10	Idaho	37	Rhode Island
11	Illinois	38	South Carolina
12	Indiana	39	South Dakota
13	Iowa	40	Tennessee
14	Kansas	41	Texas
15	Kentucky	42	Utah
16	Louisiana	43	Vermont
17	Maine	44	Virginia
18	Maryland	45	Washington
19	Massachusetts	46	West Virginia
20	Michigan	47	Wisconsin
21	Minnesota	48	Wyoming
22	Mississippi	49	Not Used
23	Missouri	50	Alaska
24	Montana	51	Hawaii
25	Nebraska	66	Puerto Rico
26	Nevada	67	Virgin Islands
27	New Hampshire	91	Pacific Islands

	6-9	Cooperative Network Index Number	Assigned by NCDC (station List) Range 0001 thru 9999.
	10-11	Cooperative Network Division Number	Will always be 00 for data prior to November 1993. Since Nov. 93 the number ranges from 01-10.

003	12-15	Element-Type	The type of data element stored in this record. Range of values is listed below.
		HPCP	Hourly precipitation data. This is the only data type reported. (Includes the daily total.)

004	16-17	Element-Units	The units and decimal position of the data value for this record. Range of values is listed below.
		HI	Hundredths of inches. Data stored and observed to the same accuracy.
		HT	Data stored as hundredths of inches, but is observed to tenths only.

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(Example, 0.2 inches stored as 00020). Primarily for Fischer-Porter gage sites.

005	18-21	Year	This is the year of record. Range of values is generally from 1948-current year processed. (A few stations begin as early as 1900.)
006	22-23	Month	Month of record. Range of value is 01-12.
007	24-27	Day	Day of record. Range of value 0001-0031.
008	28-30	Number-Reported-Values	This denotes the actual number of values. Range of values is 2 to 25.

NOTE: A record may contain fewer or more data values than you might expect. A daily record of hourly values may contain as few as 2 data values or as many as 25 data values. Only hours which have recorded precipitation are included (no entry for zero precipitation). There are some exceptions: 1) the begin and end hours of a missing, accumulation or deleted period are reported, 2) the first day and hour of each month that a site is in operation, whether precipitation occurs or not is included. See Flag 1 definitions for further details.

009	31-34	Time-Of-Value	This contains the ending time of precipitation 0100-2500. (Example, hour 0200 is defined as the period 0101-0200) The hour is left justified, zero filled. Hour 2500 contains the daily total, and it will always be the last value of a record. Midnight = 2400. Local Standard Time in use.
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010	35-40	Data-Value	The actual precipitation data value. The data value portion is a five-digit integer with a leading algebraic sign. The sign is blank for positive and "-" represents negative values ("-" never used in this data set). Units and decimal position, if appropriate, are indicated in the ELEMENT-UNITS field described in Tape Field 004. Range = 00000-99999. 00000 will be used only on the first hour of each month unless there is precipitation during
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that hour, in which case the measured value will be provided. On other days during the month without precipitation, no entry will be made. 99999 indicates that the DATA-VALUE is unknown.

Beginning with the July 1996 data month, traces of precipitation are archived for first order stations. A trace is indicated by 00000 recorded in this element (Data-Value) and a "T" in FLAG1.

011 41 FLAG1 The Data Measurement Flag.

FLAG1 Table (Data Measurement Flag for Hourly Data-Values)

- a Begin accumulation. A value of 99999 accompanies this flag. For TD3240, it indicates that the accumulation has begun sometime during the hour.
- A End accumulation (amount is associated with this flag). For DSI-3240/TD3240, it indicates the accumulation has ended sometime during the hour. Accumulated period indicates that the precipitation amount is correct, but only the exact beginning and ending times are known. A data value of 99999 occurring on the last day and hour of a month indicates the accumulation continues into the next month (see Flag 1 A,@)
- , The "," flag is used at the beginning of a data month when an accumulation is in progress from the previous month. A data value of 99999 always accompanies this flag. This flag is used prior to 1984.
- { Begin deleted period during the hour (inclusive). The original data were received, but were unreadable or clearly recognized as noise. A value of 99999 accompanies this flag. Primarily used since 1984. Also used in Alaska for 1976-1978.
- } End deleted period during the hour (inclusive). The original data were received, but were unreadable or clearly recognized as noise. A value of 99999 accompanies this flag. Primarily used since 1984. Also used in Alaska for 1976-1978.
- [Begin missing period during the hour (inclusive). A value of 99999 accompanies this flag
-] End missing period during the hour (inclusive) A value of 99999 accompanies this flag. Prior to 1984 if precipitation occurred during the last hour of the missing period, the ending missing value appears with a non-zero value (example A00021]@). Beginning in 1984 the beginning and ending hours of the missing period are recorded as A99999[@ and A99999]@, respectively. A missing flag indicates that the data were not received. This flag appears on the first and last day of each month for which data were not

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received or not processed by NCDC.

E Evaporation may have occurred. Data may or may not be reliable. This flag was used during the period 1984-1993.

g Only used for day 1, hour 0100 when precipitation is zero.

T Indicates a "trace" amount. Data value will be zero. "T" flags appear on NWS First Order data only since July 1996.

b (blank) no Flag needed.

FLAG1 Table (Data Measurement Flag for Daily Total Data Values)

I Incomplete or Inexact daily total occurring only with hour 2500. Value is not a true 24-hour amount. One or more periods are missing and/or an accumulated amount has begun but not ended during the daily period.

P A daily total excludes erroneous values (those flagged q, Q, {, or }). A "P" flag will also be present when an accumulation has ended (but not begun) during the daily period.

T TRACE, Flag1 will contain a AT@ flag in the daily total if no values other than a TRACE occurred during the 24 hour period.

b (blank) no Flag needed.

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FLAG2

The Data Quality Flag.

FLAG2 Table (Data Quality Flag)

Z Used since January 1996. Indicates probable amounts as a result of melting frozen precipitation. When assigned to a daily total, it indicates some or all of the total contains values assigned a flag of Z. This flag may be used to identify those sites that are deficient in which the manner the snow shields are employed.

R Used since January 1996. Indicates data values are suspect with regard to the times or period of occurrence. When assigned to a daily total, it indicates data with suspect "times" are included in the daily amount.

Q Prior to 1996. Indicates value failed an extreme value test (value will be present); data are to be used with caution. Extremes tests were:

1) If the value was not an accumulated precipitation total, the value failed the one-hour statewide 100-year return period precipitation.

2) If the value was an accumulated precipitation total, the value failed the 24-hour statewide extreme precipitation total. This flag was assigned during a 1997 NCDC rehabilitation of the 1900-1995 DSI-3240 archive.

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Since January 1996. A single erroneous datum (value will be present). Lowest data resolution is hourly. This data value is excluded from the daily total. This flag is rarely used in TD3240 since 1996.

q Used since January 1996. An hourly value excludes one or more 15 minute periods. Lowest data resolution is 15 minutes.

EXAMPLES OF HOW FLAGS ARE USED. NOTE: blank = b

Example 1: precipitation accumulation from Month 1, day 2 to Month 2, day 4.

Month	Day	Hour	Data	Value
01	0002	0500	00030bb	Precip. 0.3 inches
		1000	99999ab	Accumulation begins
		2500	00030Ib	Incomplete daily total
01	0031	2400	99999Ab	Accumulation continues
		2500	00000Ib	Incomplete daily total
02	0001	0100	99999,b	Accumulation continues
		2500	00000Ib	Incomplete daily total
	0004	1400	00390Ab	Accumulation ends
		2500	00390Pb	Incomplete daily total

Example 2: Accumulated precipitation for 1 monthly only.

01	0002	1000	99999ab	Accumulation begins
		2500	00000Ib	Incomplete daily total
		0031	2400	00320Ab
		2500	00320Pb	Incomplete daily total

Example 3: Accumulated, deleted, and missing precipitation data through months 01 and 02.

01	0001	0100	00000gb	First record of the month
		1100	99999ab	Accumulation begins
			00000Ib	Incomplete daily total
01	0031	2400	99999Ab	Accumulation continues
		2500	00000Ib	Incomplete daily total
02	0001	0100	99999,b	Accumulation continues
		1400	00630Ab	Accumulation ends
		1500	99999{b	Deleted data begins
		2500	00630Pb	Incomplete daily total
02	0028	1300	99999}b	Deleted data ends
		1400	99999[b	Missing data
		2400	99999]b	Missing data
		2500	00000Pb	Incomplete daily total

Example 4: Precipitation charts or forms were never received at NCDC for months 1 and 2.

01	0001	0100	99999[b	Missing data
		2500	00000Ib	
	0031	0100	99999]b	

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		2500	00000Ib
02	0001	0100	99999[b
		2500	00000Ib
	0028	0100	99999]b
		2500	00000Ib

Example 5: Missing precipitation data through months 11 and 12 that ends on hour 1 day 1 of month 12 (rare occurrence of unmatched flag pair in month):

Month	Day	Hour	Data value	
11	0001	0100	99999[b	Missing data begins
		2500	00000Ib	
	0030	2400	99999]b	Missing data ends
		2500	00000Ib	
12	0001	0100	99999]b	
		2500	00000Ib	Missing data ends (unmatched flag pair)

3. **Start Date:** 1900. Most stations begin in 1948.

4. **Stop Date:** Ongoing

5. **Coverage:** Atlantic Ocean, Pacific Ocean, North America, and includes the United States, Puerto Rico, Virgin Islands and U.S. protectorates located in the Pacific.

- a. Southernmost Latitude: 14S
- b. Northernmost Latitude: 66N
- c. Westernmost Longitude: 135E
- d. Easternmost Longitude: 64W

6. **How to Order Data:**

Ask NCDC's Climate Services about the cost of obtaining this data set.
 Phone: 828-271-4800
 FAX: 828-271-4876
 E-mail: NCDC.Orders@noaa.gov

7. **Archiving Data Center:**

National Climatic Data Center
 Federal Building
 151 Patton Avenue
 Asheville, NC 28801-5001

8. **Technical Contact:**

National Climatic Data Center
 Federal Building
 151 Patton Avenue
 Asheville, NC 28801-5001
 Phone: 828-271-4800;

9. **Known Uncorrected Problems:** Hours with zero precipitation occur for times other than the first day and hour of a month.

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10. Quality Statement: Data before 1984 were converted from existing digital files (TD-9657) to the element structure format. These (historical) data were processed through a gross value check only. Beginning January 1984, hourly precipitation data were processed through a completely revised system which produced the element structure database file. This system was further enhanced beginning with the January 1996 data month. The new interactive quality control system introduced many features. Data are subjected to new computer editing procedures reducing the manual handling of the data.

To make the pre-1996 data consistent with the January 1996 processing system, the historical data were re-processed in 1997. The rehabilitated data covered the 1900 through 1995 period and contained more than 53 million observations. Approximately 400,000 inconsistencies were identified and corrected as a result of this effort. These inconsistencies were categorized into 22 error types. In addition to this effort, "last look" quality assurance software was implemented on HPD data (post 1996) operationally sent to the archive each month. The "last look" software uses similar checks as the rehabilitation software and should result in maintaining consistency between the historical data and operationally received data.

11. Essential Companion Datasets: The use of NCDC's Station History file (TD9767/DSI-9767) is required in order to determine metadata on each station (name, location, elevation, etc.). This can be accomplished by comparing the station number in bytes 1 through 6 of this data set with the corresponding station number in the Station History data set.

12. References:

Tollerud, E.I., Govett, M.W., Steurer, P.M., and Moninger, W.R., 1997: New access and display routines for hourly precipitation data and metadata using CD-ROMs and the World Wide Web. Preprints, 105th Conf. on Applied Meteorology, Reno, Nevada, American Meteorological Society.

Steurer, P.M., 1997: Hourly Precipitation Data rehabilitation for the period 1900-1995. NOAA/NCDC TD3240 Documentation Series, Asheville, NC, 5 pp.

Hammer, G.R. and Steurer, P.M., 1997: Data set documentation for Hourly Precipitation Data. NOAA/NCDC TD3240 Documentation Series, Asheville, NC, 18 pp.

Hammer, G.R. and Reek, T., 1997: The Processing of Recording Rain Gage Data at the National Climatic Data Center. Proceedings of the 13th Conference on Hydrology, Long Beach, California, American Meteorological Society, 223-226.

Collander, R.S., Tollerud, E.I., Li, L., and Lazar, A., 1993: Hourly precipitation data and station histories: A research assessment. Proceeding of the 8th Symposium on Meteorological Observations and Instrumentation, Anaheim, California, American Meteorological Society.

National Weather Service Observing Handbook No. 2: Cooperative Station Observations, July 1989, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, Observing Systems Branch, Silver Spring, MD.

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