DSI-3297

CDMP COOP SUMMARY OF THE DAY FORTS

Version 1.1

Prepared by

Karen Andsager
Michael C. Kruk
Michael L. Spinar
Leslie Stoecker

Midwestern Regional Climate Center
2204 South Griffith Avenue
Champaign, Illinois 61820

March 2010

This document was prepared by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Environmental Satellite Data and Information Service, Midwestern Regional Climate Center, Champaign, Illinois, and the National Climatic Data Center, Asheville, North Carolina.

This document is designed to provide general information on the current, origin, format, integrity and the availability of this data file.

Errors found in this document should be brought to the attention of the Data Base Administrator, NCDC. See topic 58 for a summary of this data set.

Table of Contents

1. Data Set ID:

CDMP-Forts

2. Data Set Name:

COOP Summary of the Day – CDMP – 1700s and 1800s Forts and Other Voluntary Observers

3. Data Set Aliases:

Surface Land Daily Cooperative Data
Summary of the Day Data
Co-op Data
Climatological Data
Daily Weather Data
SOD

4. Access Method and Sort for Archived Data:

Data are archived in a variable length element file structure. The element file structure is designed to allow maximum flexibility in requesting data. Only those elements or groups of elements of particular interest need be ordered. Archived data are currently sorted by Station-ID (excluding the Division Number) as the primary key and year, month, and meteorological element-type as secondary keys.

NCDC maintains an extensive digital collection of historical global, climatic archives from surface, oceanic, and satellite sources. Like types of meteorological data are categorized into "Tape Deck (TD) families". For instance: the TD-5600 series contains upper air data; the 1100 series contains marine data, the 9700 series contains model analysis data, etc.

In the early 1980's NCDC instituted the 'element file structure' in an effort to standardize the archival of meteorological data. The 3200 series utilizes the element file structure to assimilate surface weather information.

The record structure as shared by the TD-32XX records (where "XX" denotes any one of a particular TD series) may be generalized as two distinct "portions". These portions are as follows:

The contents of the first portion are essentially 'fixed' as it contains information used to describe the remainder of the record. By its design, the second portion allows for a logical maximum of 100 data values; nonetheless, the actual "maximum" varies with the TD series. For example, in the daily data series the actual maximum is 62; in the monthly data it is 26; in the minute data it is 60, etc. In this respect, this portion is termed as "variable"; consequently, the entire record is also of variable length.

Data may also be received in a fixed length record structure described in topic 5 "Description: Access Method and Sort for Supplied Data".

Provided within this section are information and examples of how to access the Variable Length data records, specifically:

a. COBOL Data Description (1 example)
b. FORTRAN Data Descriptions (2 examples)
c. Control Language Notes
d. List of Variables ("Elements")

e. Schematic Variable Length Record Format Layout

The following COBOL and FORTRAN statements are to be used as guidelines only. NCDC recognizes the fact that many different types of equipment are used in processing these data. It is impossible to cover all the idiosyncrasies of every system.

a. COBOL Data Description

This is a typical ANSI Standard COBOL Variable Length Description.

```
       FD   INDATA
            LABEL RECORDS ARE STANDARD
            RECORDING MODE D
            BLOCK CONTAINS 12000 CHARACTERS
            DATA RECORD IS DATA-RECORD.
       01   DATA-RECORD.
            02 RECORD-TYPE                PIC X(3).
            02 STATION-ID                 PIC X(8).
            02 ELEMENT-TYPE               PIC X(4).
            02 ELEMENT-UNITS-CODE         PIC XX.
            02 YEAR                       PIC 9(4).
            02 MONTH                      PIC 99.
            02 FILLER                     PIC 9(4).
            02 NUMBER-VALUES              PIC 9(3).
            02 DAILY-ENTRY
                 OCCURS 1 TO 100 TIMES DEPENDING ON NUMBER-VALUES.
               04 DAY                     PIC 99.
               04 HOUR                    PIC 99.
               04 DATA-VALUE              PIC S9(5) SIGN LEADING
                                                SEPARATE.
                   04 D-VAL REDEFINES DATA-VALUE.
                      05 SIGN-VAL        PIC X.
                      05 DATA-IN         PIC X(5).
                   04 FLAG-1             PIC X.
                   04 FLAG-2             PIC X.
```

b. FORTRAN Data Description

(1) FORTRAN 77 Example 1

This description is for those systems that can handle variable blocked records normally.

```
          IMPLICIT INTEGER (A-Z)

          OPEN (10,FILE = 'FILENAME',ACCESS = 'SEQUENTIAL', STATUS = 'OLD',
         +    RFORM = 'VB',MRECL = 1230,TYPE = 'ANSI',BLOCK =
         +    12000)
    C          LAST 2 lines of OPEN statement are SPERRY UNIQUE

          DEFINE FILE 10 (ANSI, VB, 1230, 12000)
            CHARACTER*3 RECTYP
            CHARACTER*8 STNID
            CHARACTER*4 ELMTYP
            CHARACTER*2 EUNITS
            CHARACTER*1 FLAG1, FLAG2
```

```
          DIMENSION IDAY(100), IHOUR(100), IVALUE(100), FLAG1(100),
         +     FLAG2(100)

        10  READ (10,20,END=999,ERR=10) RECTYP, STNID, ELMTYP, EUNITS,
IYEAR,
         +     IMON, IFIL, NUMVAL, (IDAY(J), IHOUR(J), IVALUE(J),
         +     FLAG1(J), FLAG2(J), J=1, NUMVAL)
       20  FORMAT (A3, A8, A4, A2, I4, I2, I4, I3, 100(2I2, I6, 2A1))
```

(2) FORTRAN 77 Example 2

This description is for those <u>systems that can't handle variable blocked records normally.</u>

```
            PROGRAM TAPEREAD
            IMPLICIT INTEGER (A-Z)
            .....
            OPEN(1,FILE=TAPE:',ACCESS='SEQUENTIAL',FORM=FORMATTED',
           + STATUS='OLD',READONLY)

            CHARACTER BUFFER*12000      ! YOUR MACHINE MUST SUPPORT
                                        ! CHARACTER VARIABLES THIS LARGE
            CHARACTER*3 RECTYP
            CHARACTER*8 STNID
            CHARACTER*4 ELMTYP
            CHARACTER*2 EUNITS
            CHARACTER*1 FLAG1, FLAG2
            DIMENSION IDAY(100), IHOUR(100), IVALUE(100), FLAG1(100)
           +       FLAG2(100)
            .....
            NBYTES=0
   5        NBEG=1
            READ(1,101,END=99)BUFFER     !READ IN PHYSICAL RECORD (BLOCK)
  10        NBEG=NBEG+NBYTES
            READ(BUFFER(NBEG:NBEG+3,102)NBYTES   !READ THE CONTROL WORD
            IF( NBYTES.EQ.0 )GO TO 5
            READ(BUFFER(NBEG+4:NBEG+NBYTES-1),103) RECTYP, STNID, ELMTYP,
           + EUNITS, 1YEAR, IMON, IFIL, NUMVAL, (DAY(J), IHOUR(J),
           + IVALUE(J), FLAG1(J), FLAG2(J), J=1, NUMVAL)
            .....

            .....
            GO TO 10
    99      CONTINUE
            .....
            .....
            STOP 'FINISHED'
   101      FORMAT(A)
   102      FORMAT(I4)
   103      FORMAT (A3, A8, A4, A2, I4, I2, I4, I3, 100(212, 16, 2A1))
            END
```

<u>c. Control Language Notes</u>

(1) IBM JCL Notes

```
             For ASCII Variable specify:
               LRECL   = 1234
               RECFM   = DB
```

OPTCODE = Q

For EBCDIC Variable specify:
LRECL = 1234
RECFM = VB

(2) VAX DCL Notes

$ MOUNT/FOREIGN/BLOCKSIZE=12000 MT: tapename TAPE:

d. List of Variables

ELEMENT		WIDTH	POSITION	
001	RECORD TYPE (= DLY)	3	001-003	--
002	STATION ID	8	004-011	|
003	METEOROLOGICAL ELEMENT TYPE	4	012-015	|
004	MET. ELEMENT MEASUREMENT UNITS CODE	2	016-017	-- ID
005	YEAR	4	018-021	|
PORTION				
006	MONTH	2	022-023	|
007	AMOUNT OF TIME BETWEEN MEASUREMENTS	2	024-025	|
008	FILLER (= 99)	4	026-027	|
009	NUMBER OF DATA PORTIONS THAT FOLLOW	3	028-030	--
010	DAY OF MONTH	2	031-032	--
011	HOUR OF OBSERVATION	2	033-034	|
012	SIGN OF METEOROLOGICAL ELEMENT VALUE	1	035	-- DATA
	VALUE OF METEOROLOGICAL ELEMENT	5	036-040	|
PORTION				
	QUALITY CONTROL FLAG 1	1	041	|
	QUALITY CONTROL FLAG 2	1	042	--
	DATA GROUPS IN THE SAME FORM AS ELEMENT	12	043-054	DATA
PORTION				
	POSITIONS 31-42 REPEATED AS MANY	12	055-066	DATA
PORTION				
	TIMES AS NEEDED TO CONTAIN ONE MONTH	12	067-078	DATA
PORTION				
	OF RECORDS.	.....	.....	
608		12	1219-1230	DATA
PORTION				

e. Format (Variable Length Record Layout)

1. The first eight elements (positions 001-030) constitute the ID PORTION of the record and describe the characteristics of the entire record. The next six elements, the DATA PORTION of the record contains information about each meteorological element value reported. This portion is repeated for as many values as occur in the monthly record.

2. Each logical record is of variable length with a maximum of 1230 characters. Each logical record contains a station's data for a specific meteorological element over a one-month interval. The form of a record is:

ID PORTION (30 Characters) Fixed length

* REC * TYP	STATION ID	ELEM TYPE	UNT	YEAR	MO	**DUR**	FILL	NUM VAL
******	**********	******	**********	****	**********	******		

```
       * XXX | XXXXXXXX | XXXX | XX  | XXXX | XX | XX  |  XX  | XXX  >
       ************************************************************
ELEMENTS 001     002       003   004    005   006  007    008   009
```

DATA PORTION (12 Characters, repeated "NUM-VAL" times--up to 100)

```
        ************************************************************
       < DY | HR | MET.  ELEM | FL | FL | DY | HR | MET. ELEM  | FL | FL >
       <    |    |            |  1 |  2 |    |    |            |  1 |  2 >
       <    |    |************|    |    |    |    |************|    |    >
       <    |    |    | DATA  |    |    |    |    |     | DATA |    |    >
       <    |    |  S | VALUE |    |    |    |    |  S  | VALUE|    |    >

       <****|****|****|*******|****|****|****|****|*****| *****|****|*** >
       < XX | XX |  X | XXXXX |  X |  X | XX |  XX|  X  | XXXXX|  X |  X >
        ************************************************************
ELEMENTS  010  011   012   013    014  015  016  017  018    019   020  021
```

```
         *********************************
        < DY | HR | MET. ELEM | FL | FL *
        <    |    |           |  1 |  2 *
        <    |    |***********|    |    *
        <    |    |   | DATA  |    |    *
        <    |    | S | VALUE |    |    *
        <****|****|***|*******|****|*****
        < XX | XX | X | XXXXX |  X |  X *
         *********************************
ELEMENTS   604  605  606   607    608  609
```

3. The Number of Data Portions (position 009) for the logical record of type "DLY" ranges from 1 to 62.

5. Access Method and Sort for Supplied Data:

In addition to a variable length record structure, users may also receive data in a fixed length record structure as described below. However, the user must specify whether to extract either the original or edited data values. Supplied data are in the same sort as archived data (see topic 4 "Description: Access Method and Sort for Archived Data").

Provided within this section are information and examples of how to access the fixed length data records, specifically:

a. COBOL Data Description
b. FORTRAN Data Description
c. List of Variables ("Elements")
d. Schematic Fixed Length Record Format Layout

a. COBOL Data Description

This is a typical ANSI Standard COBOL Fixed Record Length Description

```
      FD   INDATA
           LABEL RECORDS ARE STANDARD (FOR STD LABEL TAPES)
           RECORDING MODE F
           BLOCK CONTAINS 15 RECORDS
           DATA IS DATA-RECORD
      01   DATA RECORD
           02  RECORD-TYPE         PIC X(3).
           02  STATION-ID          PIC X(8).
           02  ELEMENT-TYPE        PIC X(4).
           02  ELEMENT-UNITS       PIC XX.
           02  YEAR                PIC 9(4).
           02  MONTH               PIC 99.
           02  FILLER              PIC 9(4).
           02  NUMBER-VALUES       PIC 9(3).
           02  DAILY-ENTRY
               OCCURS 31 TIMES.
               04  DAY             PIC 99.
               04  HOUR            PIC 99.
               04  DATA-VALUE      PIC S9(5) SIGN LEADING SEPARATE.
               04  D-VAL REDEFINES DATA-VALUE.
                   05  SIGN-VAL    PIC X.
                   05  DATA-IN     PIC X(5).
               04  FLAG-1          PIC X.
               04  FLAG-2          PIC X.
```

b. FORTRAN Data Description

FORTRAN 77 Example

```
      DEFINE FILE 10 (ANSI, FB, 402, 6030)
      CHARACTER*3 RECTYP
      CHARACTER*8 STNID
      CHARACTER*4 ELMTYP
      CHARACTER*2 EUNITS
      CHARACTER*1 FLAGI, FLAG2
      DIMENSION IDAY(31), IHOUR(31),
     +  IVALUE(31), FLAG1(31), FLAG2(31)

 10   READ (10,20,END=999,ERR=10)RECTYP, STNID, ELMTYP, EUNITS, IYEAR,
     +      IMON, IFIL, NUMVAL, (IDAY(J), IHOUR(J), IVALUE(J),
     +      FLAG1(J), FLAG2(J), J=1, 31)

 20   FORMAT (A3, A8, A4, A2, I4,I2, I4, 13, 31(212, I6, 2A1))
```

c. List of Variables

	ELEMENT	WIDTH	POSITION	
001	RECORD TYPE (= DLY)	3	001-003	--
002	STATION ID	8	004-011	|
003	METEOROLOGICAL ELEMENT TYPE	4	012-015	|
004	MET. ELEMENT MEASUREMENT UNITS CODE	2	016-017	|--ID
005	YEAR	4	018-021	| PORTION
006	MONTH	2	O22-023	|
007	AMOUNT OF TIME BETWEEN MEASUREMENTS	2	024-025	|
008	FILLER (= 99)	2	026-027	|
009	NO. OF DATA PORTIONS THAT FOLLOW (= 031)	3	028-030	--
010	DAY OF MONTH	2	031-032	--

011	HOUR OF OBSERVATION	2	033-034	| DATA
012	SIGN OF METEOROLOGICAL ELEMENT VALUE	1	035	|--PORTION
	VALUE OF METEOROLOGICAL ELEMENT	5	036-040	|
	QUALITY CONTROL FLAG 1	1	041	|
	QUALITY CONTROL FLAG 2	1	042	--
	DATA GROUPS IN THE SAME FORM AS ELEMENT	12	043-054	DATA PORTION
	POSITIONS 31-42 ARE REPEATED	12	055-066	DATA PORTION
	31 TIMES.	.....	.....	
194		12	391-402	DATA PORTION

d. Format (Fixed Length Record Layout)

1. The first eight elements (positions 001-030) constitute the ID PORTION of the record and describe the characteristics of the entire record. The next six elements, the DATA PORTION of the record, contain information about each meteorological element value, reported. This portion is repeated 31 times.

2. Each logical record is fixed with 402 characters. Each logical record contains a station's data for a specific meteorological element over a one month interval. The form of a record is:

ID PORTION (30 characters) Fixed Length

* REC * TYP	STATION ID	ELEM TYPE	UNT	YEAR	MO	**DUR**	FILL	NUM VAL
* XXX	XXXXXXXX	XXXX	XX	XXXX	XX	XX	XX	XXX >

ELEMENTS 001 002 003 004 005 006 007 008 009

DATA PORTION (12 Characters, repeated 31 Times)

< DY	HR	MET. ELEM DATA S VALUE	FL	FL	DY	HR	MET. ELEM DATA S VALUE >
< XX	XX	X XXXXX	X	X	XX	XX	X XXXXX >

ELEMENTS 010 011 012 013 014 015 016 017 018 019

< DY	HR	MET. ELEM DATA S VALUE	FL 1	FL 2 *
< XX	XX	X XXXXX	X	X *

ELEMENTS 190 191 192 193 194 195

6. Element Names and Definitions:

RECORD TYPE
The type of data stored in this record. (Value is "DLY"). Each record contains one month of daily values.

STATION-ID
This 8-character alphanumeric station identifier is assigned by the National Climatic Data Center. The first two digits refer to a state code (value range is 01-91; reference Table "A"). The next four digits refer to the Cooperative Network Index number (value range is 0001-9999). The last two digits are the Cooperative Network Division Number (value range is 01-10; 99 = Missing Division Number; reference Table "B").

METEOROLOGICAL ELEMENT-TYPE
The type of meteorological elements stored in this record. Range of values is listed below.

BARP

Barometric pressure, unadjusted instrument reading. Unit Measurement, Thousandths of Inches of Mercury.

BPTI

Barometric pressure, instrument reading adjusted for temperature and instrument correction. Unit Measurement, Thousandths of Inches of Mercury.

BPSL

Barometric pressure, instrument reading adjusted for temperature and instrument correction and reduced to sea level. Unit Measurement, Thousandths of Inches of Mercury.

CLSK

Clearness of sky, on a scale of 0-10, with clear sky being 10, and cloudy being 0.

CLDL, CLDU

Cloud direction of motion. CLDL for lower clouds; CLDU for upper clouds. Unit Measurement, Whole Degrees.

CLTL, CLTU

Cloud type (reference Table "C"). CLTL for lower clouds; CLTU for upper clouds.

CLVL, CLVU

Cloud velocity – speed component. CLVL for lower clouds; CLVU for upper clouds. Unit Measurement, Whole Miles per Hour.

DPTP

Dew point temperature. Unit Measurement, Hundredths of Degrees Fahrenheit.

DPTD

Dew point temperature depression. Unit Measurement, Hundredths of Degrees Fahrenheit.

DYSW

Daily occurrence of weather, including all different types of weather occurring that day (reference Table "D").

MNTP

Mean daily temperature, for 24-hour period ending at observation time. Generally, this mean is calculated from the average of the maximum and minimum daily temperatures, when available. See Section 33 – Station Data Time Averaging. Unit Measurement, Hundredths of Degrees Fahrenheit.

MNTO

Mean daily temperature, for 24-hour period ending at observation time. Generally, this mean is calculated from the average of three point measurements of the temperature observed over the course of the 24-hour period. See Section 33 – Station Data Time Averaging. Unit Measurement, Hundredths of Degrees Fahrenheit.

PTYP

Precipitation type (reference Table "E").

PRCP

Daily precipitation. Trace is less than 0.005 inch. Unit Measurement, Hundredths of Inches.

RGHT

River gauge height, or height of other body of water. Point measurement at time of observation. Unit Measurement, Tenths of Feet.

RGHC

Daily change in river gauge height, or height of other body of water. Change ending at time of observation. Unit Measurement, Tenths of Feet.

RHUM

Relative Humidity. Point measurement at the time of observation. Unit Measurement, Whole Percent.

SKYL, SKYU

Daily cloudiness. SKYL for measurement of lower clouds; SKYU for measurement of upper clouds. Clear is zero coverage of the sky by clouds; “10” is completely cloudy. Unit Measurement, Scale of 0-10. This element was sometimes recorded on a scale of 0-4; when this is occurred is not indicated in the daily data at this time.

SMEL

Water equivalent of melted snowfall. Trace is less than 0.05 inch. Unit Measurement, Hundredths of Inches.

SNOW

Daily snowfall. Sleet and hail may or may not be included in the snowfall measurement, depending on the general and specific observer practices of the time. Trace is less than 0.05 inch. Unit Measurement, Hundredths of Inches.

SNWD

Snow depth at observation time. Snow depth is depth of snow on the ground at time of observation. Trace is depth less than 0.5 inch. Unit Measurement, Tenths of Inches.

STWX

State of the weather at time of observation (reference Table "D").

TAHR

Temperature measurement. Point measurement at time of observation. Unit Measurement, Hundredths of Degrees Fahrenheit.

TBAR

Temperature measurement using thermometer attached to barometer. Used to adjust barometer reading for temperature. Unit Measurement, Hundredths of Degrees Fahrenheit.

TMAX

Daily maximum temperature. Maximum temperature reading for 24 hours ending at time of observation. Unit Measurement, Hundredths of Degrees Fahrenheit.

TMIN

Daily minimum temperature. Minimum temperature reading for 24 hours ending at time of observation. Unit Measurement, Hundredths of Degrees Fahrenheit.

TMPD

Dry bulb temperature. Point measurement at time of observation. Unit Measurement, Hundredths of Degrees Fahrenheit.

TMDW

Wet bulb temperature. Point measurement at time of observation. Unit Measurement, Hundreths of Degrees Fahrenheit.

TPBG, TPEN

Time of beginning and ending of precipitation. TPBG and TPEN for time of beginning and ending for 24-hour observation of precipitation events (one time of beginning and ending within each 24-hour period). Unit Measurement, Hour and Minutes, AM/PM indicator (reference Table "F").

TRNG

Daily temperature range. Maximum temperature minus minimum temperature. Unit Measurement, Whole Degrees Fahrenheit.

TWAR

Surface air temperature observed at location of water temperature observation. Unit Measurement, Hundredths of Degrees Fahrenheit.

TWBT

Bottom water temperature. Unit Measurement, Hundredths of Degrees Fahrenheit.

TWDP

Depth of water for TWBT – bottom water temperature observation. Unit Measurement, Tenths of Feet.

TWSR

Surface water temperature. Unit Measurement, Hundredths of Degrees Fahrenheit.

WD16

Prevailing wind direction. Unit Measurement, 8-Point or 16-Point Compass Directions, Expressed as Whole Degrees (Calm is “0”, North is “360”, Changing or Variable is “991”).

WDDM

Maximum wind direction. Unit Measurement, 8-Point or 16-Point Compass Directions, Expressed as Whole Degrees (Calm is “0”, North is “360”, Changing or Variable is “991”).

WDFC

Prevailing wind force. Unit Measurement, Scale of 0-10 or Scale of 0-12; which scale was used is not indicated in the daily data at this time.

WDMV

Total wind movement. Unit Measurement, Whole Miles.

WDVL

Prevailing wind velocity, speed component. Unit Measurement, Whole Miles.

WDVM

Maximum wind velocity, speed component. Unit Measurement, Miles per Hour.

METEOROLOGICAL ELEMENT MEASUREMENT UNITS CODE

The units and decimal position (precision) of the data value for this record (reference Table "G").

YEAR

This is the year of the record. Range of values is 1800-current year processed.

MONTH

This is the month of the record. Range of values is 01-12 LST.

DURATION

This is the number of hours over which the observation was collected. Range of values is 00-24, and 99 for missing. A duration of 00 indicates a point measurement in time, while 24 indicates a true daily observation.

FILLER

Filler value is 99.

NUMBER OF DATA PORTIONS THAT FOLLOW
This notes the actual number of values reported. Range of values is 01-62.

NOTE: A record may contain fewer or more data values than you might expect. A monthly record of daily values may contain as few as one data value or as many as 62 data values.

A maximum of two DATA PORTIONS are used for each day of the month so as to allow one original meteorological data value and one edited data value. The only exception at this time, is that the "days with weather" element-types (DYSW) of original data values can be reported in multiple logical records (e.g. only one original DYSW Data Portion for each day is given within a single DLY logical record). When more than two types of weather on any given day, a new DLY logical record for the same month will exists until DYSW is exhausted. At most, 62 data values may be contained in any given logical record (e.g., 30 + (62 x 12) = 774 characters). Thus, while a maximum of 1,230 characters has been assigned, no more than 774 characters will be used for the daily data record types.

If a particular data value was not taken or is unavailable, there is no entry for it. (For meteorological elements observed once a day, if all the daily observations of a given month are received and pass QC checks, there will be one DATA PORTION for each day. If every value were to fail the QC, there may be two DATA PORTIONS for every day of that month. When two DATA PORTIONS for

a daily record are encountered (with the exception of DYSW), the original data values are flagged and the second DATA PORTION is the best possible replacement. (See code definitions for the Flag 2 element).

DAY OF MONTH

Contains the day of the month on which the data element was observed. Range of values is 01-33. Day 32 is the monthly sum; Day 33 is the monthly average.

HOUR OF OBSERVATION

Contains the hour of the daily observation. Hour is reported using the 24-hour clock 00-23 LST. Other codes for non-specific hours are listed in the table below.

Sunrise	91
Sunset	92
Morning	93
Afternoon	94
Evening, night	95
Missing hour	99
Midnight	0
Noon	12

SIGN OF METEOROLOGICAL VALUE

The algebraic sign of the meteorological data value is given as either a blank or a minus sign (-). Blank indicates a positive value and a minus sign represents a negative value (see topic 45 "Data Quality: Known Uncorrected Problems").

VALUE OF METEOROLOGICAL ELEMENT

The actual data value is given as a five-digit integer, except for cloud type, precipitation type, precipitation time of beginning and ending, and days with weather/state of the weather. (Tables “C” through “F”).

For fixed length records only when a data value is missing, the sign of the data value is set to "-", the data value is set to "99999", flag position 1 is set to "M" and flag position 2 is blank.

When no daily precipitation reading was taken but the amount from that day (if any) is included in a subsequent value, the data value of precipitation is set equal to "99999" and flagged with an "S" in flag position 1. In turn, the successive accumulated amount will be flagged with an "A" in flag position 1.

FLAG1

The Data Measurement FLAG (reference Table "H").

FLAG2
The Data Quality FLAG (reference Table "I").

TABLES

TABLE “A”

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

TABLE "B"

Cooperative Network Division Table

NOTE: The division number for a station may change over time.

HAWAII (STATE 51)*

ISLAND NAME	DIVISION
Kauai	01
Oahu	02
Molokai	03
Lanai	04
Maui	05
Hawaii	06

*NOTE: Hawaii (State 51) division numbers were changed during the initial conversion of this file. Divisions within islands no longer exist. Division numbers now represent each island.

PACIFIC ISLANDS (STATE 91)

Division

02 - East of 180th Meridian - Phoenix Islands, Line Islands, and American Samoa

03 - Western Pacific Islands, North of 12N

04 - Caroline and Marshall Islands

TABLE "C"

CLTL, CLTU – Cloud Type Table

C	Cirrus
K	Cumulus
ST	Stratus
CC	Cirro-cumulus
CS	Cirro-stratus
KS	Cumulo-stratus
KN	Cumulo-nimbus
N	Nimbus
NS	Nimbo-stratus
3	clouds
1	clear
HZ	haze
F	fog
HF	high fog
SM	smoky
SD	scudd

These two-character CLTL/CLTU cloud type codes are stored into the rightmost two characters of the data value portion of the meteorological element. Within the two characters used, the weather codes are entered left justified and zero filled. Thus, if cloud type is reported, the data values would appear as 000XX, where XX is the appropriate cloud type code. Cloud types may include codes for Daily Occurrence of Weather (Table D), or Precipitation Type (Table E).

TABLE "D"

DYSW/STWX - Daily Occurrence of Weather/State of the Weather Table

1	Clear	
2	Partly cloudy	Clearing, variable
3	Cloudy	Threatening
4	Rain	Showers/sprinkles
5	Snow	
6	Smoke/haze	
7	Fog	
8	Drizzle (mist)	Misty clouds
9	Sleet	
10	Glaze	

11	Thunder	
12	Hail	
13	Dust storm	
14	Blowing snow	
15	High wind	
16	Tornado	
17	Fair	
18	Squalls	
19	Frost	Hoar Frost
20	Mixed rain and snow	
21	Dew	
99	Illegible	

These two-character DYSW/STWX element-type codes are stored into the rightmost four characters of the data value portion of the meteorological element. Within the four characters used, the weather codes are entered left justified and zero filled. Thus, if one type of weather occurs during a day, the data values would appear as OXXOO, where XX is the appropriate weather code. If two types of weather occur, the data value will contain OXXYY, where XX is value 1 and YY is value 2. If more than two types of weather occur on the same day, they will be stored into additional "DLY" records of the element-type code "DYSW" as needed. For STWX, only one element-type code is allowed for each observation time over the course of the day. The codes for cloud type (TABLE “C”) may also appear in the DYSW/STWX data, if recorded as such by the observer. Each element-type code is reported only once for a given day, even if, for example, there were more than one case of thunder reported for the day.

TABLE "E"

PTYP – Precipitation Type Table

R	Rain
T	thunderstorm
S	Snow
D	drizzle/mist
E	Sleet
G	Glaze
H	Hail
I	Ice
M	mixed - rain and snow
W	squalls/showers/sprinkles
F	Fog
X	Dew
Z	Frost

These one-character PTYP element-type codes are stored into the rightmost character of the data value portion of the meteorological element. Thus, if precipitation occurs during a day, and the precipitation type is available, the data value would appear as 0000X, where X is the appropriate precipitation type code. Only one code is recorded for each day for PTYP.

TABLE "F"

TPBG, TPEN - Time Table

Sunrise	1300A
Sunset	1400P
Morning	____A
Afternoon, evening	____P
Missing hour	
Midnight	1200A
Noon	1200P
DN - during night - means after midnight	____A
Continuing or unknown	_____D

Times are given in hours and minutes using a 12-hour clock and an AM/PM indicator. For TPBG/TPEN, if the observer wrote more than one time of beginning/ending into the slot for the day, the keyer digitized the first beginning time, and the last ending time, for each day.

TABLE "G"

Units of Measurement Table

Range of values where b = Blank:

HF	Hundredths of degrees Fahrenheit
bI	Inches
TI	Tenths of an inch
HI	Hundredths of inches
IT	Thousandths of inches of mercury
MH	Miles per hour
bM	Whole miles (right justified)
NA	No units applicable (nondimensional)
DG	whole degrees
TN	Scale of 0 to 10
WN	Scale of 0 to 12
PC	Whole percent
TP	Tenths of a percent
TG	Tenths of feet
HG	Hundredths of feet

TABLE "H"

Data Measurement Flag 1

A - Accumulated amount since last measurement.
M - For fixed length records only.
Flag1 is "M" if the data value is missing. In this case, the sign of the meteorological value is assigned "-" and the value of the meteorological element is assigned "99999".
S - Included in a subsequent value. (data value = "00000" OR "99999").
T - Trace (data value = 00000 for a trace).
Blank - Flag not needed.

Flag 1 values of "S" and "A" usually occur in pairs (ie. a daily value will have Flag 1 assigned as "S" and the next daily value will have Flag 1 assigned as "A"). For some daily values these flags do not occur in pairs.

TABLE "I"

Data Quality Flag 2

2 - Invalid data element (subsequent value replaces original value).
3 - Invalid data element (no replacement value follows).
4 - Validity unknown (not checked).
T - Failed internal consistency check

7. Start Date:

Data prior to 1896 comprise the bulk of the data set with most of the earliest records dating back to 1820.

8. Stop Date:

For the bulk of the data, the stop date is 1892 or 1896, but some data stop after 1900.

9. Parameter:

Atmospheric Dynamics>Atmospheric Temperature>Daily Maximum Temperature
Atmospheric Dynamics>Atmospheric Temperature>Daily Minimum Temperature
Atmospheric Dynamics>Atmospheric Temperature>Daily Average Temperature
Atmospheric Dynamics>Atmospheric Temperature>Daily Temperature Range
Atmospheric Dynamics>Atmospheric Temperature>Observation Time Temperature
Atmospheric Dynamics>Precipitation>Daily Precipitation
Atmospheric Dynamics>Precipitation>Daily Snowfall
Atmospheric Dynamics>Precipitation>Daily Snow Depth
Atmospheric Dynamics>Wind>Wind Movement
Atmospheric Dynamics>Wind>Daily Prevailing Wind Direction
Atmospheric Dynamics>Cloud>Daily Cloud Amount

10. Discipline:

Earth Science>Atmospheric>Meteorology/Climatology
Daily Precipitation, Daily Snowfall, Daily Snow Depth, Daily Maximum Temperature, Daily Minimum Temperature, Observation Time Temperature, Wind Movement, Weather

Earth Science>Land>Hydrology
Evaporation, Daily Snowfall, Daily Snow Depth, Daily Precipitation

Earth Science>Land>Agriculture
Daily Precipitation, Evaporation

11. Coverage:

Southernmost Latitude	22N
Northernmost Latitude	65N
Westernmost Longitude	178W
Easternmost Longitude	68W

12. Location:

Areal Coverage
North America>Continental USA

13. Keywords:

Temperature
Maximum Temperature (24 HR)
Minimum Temperature (24 HR)
Mean Temperature (24 HR)
Temperature at Observation Time
Precipitation
Snow
Snow on Ground
Evaporation
Sky Condition
Weather
Drizzle
Ice Pellets
Glaze
Thunder
Hail
Dust
Sand Storm
Blowing Snow
Winds
Tornado
Rain
Smoke
Fog
TD-3206
3206

14. Storage Medium:

HDSS

15. File Mode:

ASCII

16. How to Order Data:

These data are available for purchase from the National Climatic Data Center, Climate Services Branch, Federal Building, 151 Patton Avenue, Room 120, Asheville, NC., 28801-5001, phone number (828)-271-4800, e-mail ncdc.orders@noaa.gov

17. Historical and Current Data Sources:

Cooperative Observations
Principal Climatological Stations
Summary of the Day Observations
Punched Card Deck 345
Punched Card Deck 486
State Universities
Evaporation Observations
Digital Files
Daily Observations (manuscripts and publications)
Tape Deck 9639
Tape Deck 9727
Historical Files
MAPSO Diskettes

18. Algorithms:

No information available at this time.

19. Responsibility for Algorithms:

No information available at this time.

20. Project:

National Weather Service (NWS) Cooperative Program

21. Archiving Data Center:

National Climatic Data Center,
NOAA/NESDIS/NCDC
151 Patton Avenue
Asheville, NC 28801-5001
Phone (828) 271-4800

22. Originating Data Center:

National Climatic Data Center
NOAA/NESDIS/NCDC
151 Patton Avenue
Asheville, NC 28801-5001
Phone (828) 271-4800

23. Technical Contact:

National Climatic Data Center
NOAA/NESDIS/NCDC
151 Patton Avenue
Asheville, NC 28801-5001
Phone (828) 271-4800

25. Sensor Name and Operating Principles:

No information available at this time.

26. Sensor Siting:

No information available at this time.

27. Sensor Accuracy and Calibration:

No information available at this time.

28. Sensor Sampling Characteristics:

No information available at this time.

29. Data Capture Method:

No information available at this time.

30. Station Location Accuracy:

Station History Locations are digitized as recorded on the original forms. In most cases, the latitude and longitude were recorded to the nearest minute; in some cases, to the nearest second. The accuracy of the instrumentation and process of measuring the locations is unknown.

31. Station Observation Schedule:

Since the observations preserved in this digital data set are from the beginnings of instrumented weather observations and observing networks, the station observation schedule is non-standard, especially for the records for the early 1800's. Observations in this data set include daily observations recorded in either the morning, evening, or at midnight, as well as observations at one or more points in time throughout the day.

32. Station Data Time Averaging:

The daily mean temperatures keyed for this data set are those as recorded on the original forms by the observers. In general, when daily maximum and minimum temperatures were available, the daily mean was calculated by the observer or other editor as the simple average of the two. When three point measurements of the temperature (TAHR) were recorded over the course of the 24-hour period, the mean was generally calculated in one of two ways. One was to take the simple average of the three measurements; the other, to add in the evening temperature twice and divide by four. Which calculation method was used by the observer or other editor to calculate the daily mean is generally not available. Some information may be available in the accompanying metadata.

33. Spatial Sampling Using Station Grouping:

Not Applicable.

34. Network Participation:

This data set is comprised of stations from the 1800's from a variety of networks, as well as private journals and other documents. The networks include military and civil; some observers were paid, while others were volunteers. The funding and responsibility for maintenance of the instruments varied by network.

35. Geographic Criteria for Selecting Stations:

Not Applicable.

36. Geographical Distribution:

The distribution of stations varies over time and space as a result of the expansion of observers across the country and the evolution of observer networks. There are approximately 5,000 stations, as defined by location name, in the entire historical archive for the 1800's. A subset of these were selected for digitization based on length and continuity of record, location, and other factors.

37. Elevation Distribution:

Elevations for fixed surface locations for the data set are mostly below 1,000 meters above sea level.

38. Instrument Problems:

No information available at this time.

39. Missing Data Periods:

No information available at this time.

40. Sampling Biases:

No information available at this time.

41. Error Detection and Correction:

The historical data were keyed from microfilm copies of original observation forms. A quality control process developed specifically for this data set performs internal consistency, climatological limit, and serial checks on both daily values and monthly values derived from the daily values. This process includes manual verification of flagged data. In general, quality control flags are not included in the digitized data set. The general purpose of the quality control process is to assure that the digitized data accurately reflect the observations as recorded on the form. In some cases, the assignment of element code to the data is adjusted to match the data rather than the column headings on the forms. For more information about the quality control process, please refer to Appendix A, "Digitization of Historical Daily Data from the 1800's". The user should investigate the accuracy and homogeneity of the data for each specific application.

42. Missing Value Estimates:

No information available at this time.

43. Quality Control Responsibility:

Responsibility for data quality rested with the individual observer, as well as the historical network managers.

44. Known Uncorrected Problems:

For some stations for some time periods, the date of the maximum temperature may be wrong by one day. The problem arises because the observer or network manager may have recorded the maximum temperature on a calendar date rather than on the date of the end of the 24-hour observation. This problem sometimes causes the maximum temperature for a day to be less than the minimum temperature. For more information about uncorrected problems, please refer to Appendix A.

45. Confidence Factors:

Because the data were keyed from microfilm, because the operational observation and quality assurance procedures changed markedly over the historical period of the data set, and because no quality assurance of the data was performed for this project other than those noted in Appendix A, the user should be wary of all the data in this data set.

46. History of Data Usage:

This digital data set is new and does not yet have a history of use.

47. Quality Statement:

The historical nature of the data set, as well as limited resources (monetary and personnel) for applying quality control and assurance, contribute toward less than optimum conditions in ensuring the integrity of the data.

48. Revision Date:

None.

49. Science Review Date:

None.

50. Future Review Date:

Not applicable at this time.

51. Source Data Sets:

This data set is currently compiled from microfilm copies of manuscript forms from the National Archives.

52. Essential Companion Data Sets:

TD-3200.

53. Derived Data Sets:

None.

54. Larger Collections:

No information available at this time.

55. Similar Data Sets:
DS-3200 Coop Summary of the Day
DS-3210 Summary of Day-First Order
DS-3220 Coop Summary of Month
DS-3240 Hourly Precipitation
DS-3260 15-Minute Precipitation
DS-3280 US Global Surface Airways Hourly Observations

56. References:

See Appendix A.

57. Summary:

This data set is a compilation of digitized daily observations for the 1800's. The period of record and number of stations varies among the states. The records generally date back to the late 1820's. These data have been subjected to internal consistency checks, compared against climatological limits, and checked serially.

Glossary

Access Method for Archived Data -- How a digital data set can be accessed in its archived condition.

Access Method for Supplied Data -- How the user can access data in its most commonly supplied form.

Archiver -- The one person or institution responsible for archival and maintenance of the data, and how to contact.

Archiving Data Center -- Name, organizational acronym and address of institution that archive and distribute the data.

Confidence Factors -- The expected numerical accuracy of the data.

Cost of Acquiring Data -- Describes how to find the approximate costs that are associated with obtaining the data set, or quotes the cost.

Coverage -- The smallest latitude-longitude "box" on the earth's surface that all data measurements occurred within.

Data Capture Method at Sensor -- The method used to collect data initially at the sensor. Aspects that should be mentioned here include such concepts as manual, automatic, forms, charts, telemetered, etc.

Data Derivation Algorithms -- The methods, if any, used to calculate values in the data set.

Data Derivation Algorithms, Responsibility for -- A list of programs or agencies that provide data derivation algorithms or which carry out the data derivations using the algorithms.

Data Set Aliases -- Other names associated with the data set, now or in the past.

Data Set ID -- A unique code number or acronym identifying the data set. Normally, it is the code number used by the data center as the data set is archived.

Data Set Name -- A descriptive name for the data set that provides a Thumbnail description.

Derived Data Sets -- Other data sets that are partly or entirely derived of this data set.

Discipline -- A collection of standard phrases that name the scientific disciplines, or fields, in which the data are normally used. Most of each phrase comes from the "Directory Interchange Format Manual".

Elements -- The basic units of data that need to be described. Often, elements are simply data variables such as station id, precipitation or ocean depth. However, when FORTRAN, C, etc. issued to access a digital data set, elements are the same as the "fields" used in the access software, such as in a FORTRAN "READ" format. (This definition simplifies the preparation and maintenance of the documentation.

Element Names and Definitions -- The names and brief definitions of the basic units of data that need to be described.

Elevation Distribution -- Variation of the elevations of the fixed observing locations.

Error Detection and Correction -- Any procedures used now or in the past to identify, and avoid or correct, data errors.

Essential Companion Data Sets -- Other data sets, if any, that must be obtained in order to use this data set.

File Mode -- The mode, or code standard, of a digital file in which a digital data set is stored. Commonly seen modes include ASCII, EBCDIC, Fielddata (unisys only), and binary.

Future Review Data -- The date, if any, recommended by the archiver for the next science review.

Geographic Criteria for Selecting Stations -- Fixed surface locations may be selected with a specific type of geographic environment in mind. Geographic selection criteria describes this.

Geographic Distribution -- The spatial sampling, i.e. the number and closeness of fixed observing locations within a geographical area.

History of Data Usage -- The extent to which this data set, or parts of it, has been used by researchers, and how they rated its quality.

Instrument Problems -- Difficulties that occur as a natural result of sensor operation.

Investigator -- Data set experts other than the archiver or technical contact, who can provide information that they cannot.

Keyword -- Words or short phrases that suggest the data set, or suggest aspects of it. Actual variable names should not be used as keywords.

Known Uncorrected Problems -- Known data difficulties, if any, for which no corrections have been made.

Larger Collections -- Supersets of data sets, if any, that include this data set.

Location -- A collection of standard phrases that name the major geographic area(s), and the atmospheric layer(s), that the data refer to. Most of each phrase comes from the "Directory Interchange Format Manual".

Missing Data Periods -- Times when major parts of the data are missing.

Missing Value Estimates -- Procedures used to produce estimated values for missing data.

Network Participation -- Describes the named collections of fixed surface locations, if any, whose data contribute to this data set.

Originating Data Center -- Name, organizational acronym, and address of the

data center(s) that generated the data documentation.

Parameter -- A collection of standard phrases that briefly name and describe the measured parameters of the data set. Most of each phrase comes from the "Directory Interchange Format Manual".

Project -- Specific campaign or effort, if any, with which the data set is associated.

Quality Control Responsibility -- Agencies or programs, if any, that provide major quality control processing.

Quality Statement -- A brief generalization of how good the data are. Includes a "quality value" number.

Reference -- Any important bibliographic reference pertaining to the data set or any part of it.

Revision Date -- The date that this documentation is created, or the date of its latest revision.

Sampling Biases -- Data biases caused by inadequacies in spatial or temporal sampling.

Science Review Date -- The date, if any, of the latest review of this documentation for accuracy of technical content.

Sensor Accuracy and Calibration -- The precision to which the measured variables are known. It refers both to the accuracy of the sensor and to the significant digits in the data values captured by the sensor.

Sensor Name and Operating Principles -- The sensors used to obtain the data in the data set.

Sensor Sampling Characteristics -- Spatial averaging, temporal accumulation, and sampling frequency that occur at the sensor.

Sensor Siting -- The local environment into which sensors are placed.

Source Data Sets -- Other data sets, if any, used to assemble this data set.

Similar Data Sets -- Other data sets, if any, used to assemble this data set.

Sources -- Origins of the data set.

Spatial Sampling Using Station Groupings -- How data from specific locations are collected, aggregated, or arranged to represent a geographical area.

Start Date -- The date of an earliest appearance.

Station -- A fixed surface location that reports data.

Station Data Time Averaging -- Aggregation or averaging of data over time to obtain values representative of a time period.

Station Location Accuracy -- How accurately the positions of the fixed surface location are known.

Station Observation Schedule -- When fixed surface locations make data measurements.
Stop Date -- The date of latest appearance.

Storage Medium -- The quantities, capacities, and types of media on which the data are now stored.

Summary -- A concise abstract that is used to capture a few of the most important facts about the data set, all of which should have appeared in more detail under individual topic discussions.

Technical Contact -- The person who can be contacted to obtain and provide information about the data.

Appendix A

Quality Control of Daily Data from the 1800's

The quality control tests developed for this data set are listed in the following table. The quality control tests are applied in order, with the outliers from each test verified before continuing to the next test. The outliers generated by each test are appended to the outlier file for each station. The verification process produces two files, one listing the verification with explanation for each outlier, the other listing necessary corrections to be applied to the data. After the outliers for one test are verified, the corrections are all applied in order to the data for the station, and then the next test is run.

Quality Control

Name	Flag Type	Sub-Flag Type	Description
Duplication Test	01	00	This test checks for elements on an image with the same month/year/hour/duration. Outlier are produced for the second occurrence of the same month/year/hour/duration with a 30 in the hour postions so no data is overwritten. This test produces outliers that must be manually checked.
Gross Errors Check	01	01	This test is applied during translation of the data from SourceCorp format to TD-3200 format. This test flags individual daily values, with cutoffs set to the extreme range of each element type. This test produces outliers that must be manually checked
Apply Durations	01	02	This test is applied after each run time the corrections is applied. It pulls the duration of each element from the metadata and inserts it into the TD-3200 format data in columns 24 & 25. No corrections are added to the Corrections file for this test
Date Check	01	03	This test compres the date for each image in the 3200 output file, with the dates keyed for that image in the metadata. The entire month is flagged during this test. This test produces outliers that must be manually checked.
Station Number Check	01	04	This test compares the station number as entered in the metadata through the PICS tool, with the station number keyed by the daily data keyers. This is an automatic test which produces only corrections which are applied by the test.
Monthly Mean Check	01	05	This test compares the monthly mean temperatures entered in the 3200 output file with that in the metadata. If MNTP is keyed when MNTO is asked for, the data is switched to MNTO. Corrections are automatically created and applied by the test

Wet Bulb Check	01	06	If dry-bulb temperature for a day is less than or equal to 32(F) and the wet-bulb temperature is greater than the dry-bulb, a correction is added to the file flagging the wet-bulb temperature as an observer error.
Wind Movement Check	01	07	The tests verifies that the number of digits in the monthly total wind movement as keyed is consistent with the sum of the daily data values. If any inconsistency exists, the program will write a correction to the Corrections file.
Sky Cover Check	01	09	This test converts any 3200-format SKYC elements to SKYL. Corrections are automatically added to the Corrections file
Precipitation Check	01	10	This test checks the 3200-format precipitation data to see if any values can be automatically corrected. One is to correct daily sums from hourly observations if they work with the monthly sums. Another is to correct the monthly mean if the daily sum and the keyed sum are equal.
Metadata Test	**	**	This test checks that all elements for an image in the metadata matches all the elements for an image in the 3200-format data. There are 3 subcategories of outliers
	02	01	This subcategory always has a +3200 in the outlier. It indicates that an element is in the 3200-format but not in the metadata
	02	02	This subcategory always has a -3200 in the outlier. It indicates that an element is in the metadata but was not keyed in the 3200-format data.
	02	03	This subcategory offers a suggestion about what is possibly wrong between the metadata and the keyed 3200 data
Monthly Means	05	**	This test checks the keyed monthly values against the calculated monthly values from the daily data. This is only done for TMAX, TMIN, TAHR, PRCP and SNOW

	05	01	When a monthly mean (day 33) is keyed for a temperature element, this mean is compared to the mean calculated for all of the daily values. If the difference between the two is greater than 5(F), the day 33 value is flagged
	05	02	When a monthly sum (day 32) is keyed for a snow element, this sum is compared to the sum calculated for all of the daily values. If the two are not equal the day 32 value is flagged.
	05	05	When the monthly sum (day 32) for PRCP is missing or not equal to the sum of the daily values, the day 32 value is flagged.
Monthly Temperature Consistency	06	**	This test checks for internal consistency of the monthly means and totals from the daily values for all element types within each station. This test flags the day 33 means.
	06	01	monthly mean max < monthly mean min
	06	02	monthly mean max < mean of all at-hour temperatures
	06	03	monthly mean min > mean of all at-hour temperatures
	06	04	11AM-4PM temperatures < sunrise-1AM-10AM tempreatures (afternoon < morning temperatures)
	06	05	11AM-4PM tempreatures < 5PM-sunset-midnight temperatures (afternoon < evening temperatures)
	06	06	mean dry-bulb < mean wet-bulb (for each hour)
	06	07	at-hour temperature < wet-bulb temperature (for each hour)
	06	08	dry-bulb < dewpoint (for each hour)
	06	09	at-hour < dewpoint (for each hour)
	06	10	lowest at-hour minimum temperature > mean temperature > highest at-hour max temperature
	06	11	mean monthly max temperature > mean monthly min temperature + 60(F)
	06	12	mean average temperature range > 50(F)
	06	13	mean average temperature range does not equal (mean max - mean min) +/- 1(F)

	06	14	all at-hour pressure-attached temperatures < morning temperatures (or minimum temperature, whichever lower)
Monthly Precipitation Tests	07	**	This test checks for internal consistency of the monthly means and totals from the daily values for all element types within each station. This test flags the day 32 sums.
	07	01	snowfall > 0 and the lowest monthly minimum temperature is > 39
	07	02	snowfall > 0 and there was no precipitation during the month
	07	03	snowfall > 1 inch and was also greater than 50 times the precipitation amount
	07	04	snowfall was zero and precipitation > 0.05 and the highest monthly max temperature was < 30
	07	05	snowfall > 1 inch and snowdepth was zero and the highest monthly max temperature was > 30
	07	06	snow depth > 0 and the lowest monthly minimum temperature was > 39
	07	07	If there was precipitation data on all days in the month, and only one day is missing (I.e. n-1 days), who summed together total zero. That is, the number of days with precip, including traces, is greather than or equal to n-1.
	07	08	The number of days with precipitation is less than the number of days with snowfall, and no snow depth.
	07	71	Precipitation amount is the highest monthly total in the record.
	07	72	Precipitation amount is the second highest monthly total in the record.
	07	73	Precipitation amount is the third highest monthly total in the record.
	07	74	Precipitation amount is the fourth highest monthly total in the record.
	07	75	Precipitation amount is the fifth highest monthly total in the record.
	07	81	Snowfall amount is the highest monthly total in the record.
	07	82	Snowfall amount is the second highest monthly total in the record.
	07	83	Snowfall is the third highest monthly total in the record.

	07	84	Snowfall is the fourth highest monthly total in the record.
	07	85	Snowfall is the fifth highest monthly total in the record.
	07	91	Snowdepth is the highest monthly snowdepth in the record.
	07	92	Snowdepth is the second highest monthly total in the record.
	07	93	Snowdepth is the third highest monthly total in the record.
	07	94	Snowdepth is the fourth highest monthly total in the record.
	07	95	Snowdepth is the fifth highest monthly total in the record.
Daily Extremes and Climatological Consistency	08	**	This checks for extremes and internal consistency of the daily values within each station. The extreme limits are set on a daily basis using the climatology of the station within the CDMP Forts data set. This test flags individual daily values.
	08	01	Extremes test of maximum and minimum temperature
	08	02	Max/min inconsistency checks
	08	03	Flatliner check for TMAX and TMIN
	08	04	Excessive diurnal range for TMAX and TMIN.
	08	51	Spike Check
	08	52	Spike Check
	08	06	Step Check
	08	07	Extreme test of precipitation
	08	08	Precipitation cloud test: If a station reports precipitation, there must be at least one observation on that day of some sort of cloud cover.
	08	09	TMAX must be greater than or equal to largest at hour temperature (or drybulb), and TMIN must be less than or equal to lowest at hour temperaure (or drybulb).
Daily Calculated Consistency	09	**	This test checks for consistency of the daily values that can be calculated from other keyed daily values within each station. This test flags individual daily values.
	09	01	Daily mean temperature consistency with at-hour/max-min temperatures check. Includes a check that doubles the 9pm temperature as another method for determining the daily mean.

09	02	Daily range in temperature with at-hour/max-min temperatures check
09	03	Daily consistency of dew point/dew point depression/relative humidity with exposed/dry bulb/wet bulb temperatures
09	04	Daily total preciptation/snowfall measurements (24-hr duration) with partial-day duration (not 24-hrs) precipitation/snowfall consistency check
09	05	Daily mean wind direction, velocity, force, movement, max direction, and max velocity with at-hour/duration observations consistency check
09	06	Daily mean clearness and cloud amount with at-hour clearness and cloud amount consistency check
09	07	River gauge height and gauge height change consistency check

Appendix B

Documentation of Problems with and Changes Made to Keyed Data

The quality control suite finds many issues within the data. Most are able to be corrected; some are not. An overwhelming number of errors are due to unclearly scanned images of the original forms, smeared or illegible script, or messy and faded forms. The following sections document the recurring problems that have been found and how they are being fixed.

Non-Standard Units
While specific units are used to record meteorological conditions today, the observers of the 1800s recorded data in several different units. The table below lists the ones found to date.

Element	Non-Standard Unit	Conversion
Temperature	Degrees Celsius	Converted to Degrees Fahrenheit
Sky Cover	0-4, 0-1, 0-12	Converted to 0-10
Precipitation	Cubic Centimeters	Converted to Inches
Relative Humidity	0-1	Converted to 0-100
Barometric Pressure	Centimeters of Mercury Millimeters of Mercury	Converted to Inches of Mercury
Wind Force	Many different scales	These cannot be fixed because most observers did not note what scale they were using. These are marked with a flag 2 in the data

Keying Error
These occur through simple human error. It could be typing in the incorrect value to confusing columns on the form. Some of the more common are listed below:

1. Keying the TMAX column as TMIN and TMIN column as TMAX.

2. Keying one element as another element.

3. Keying one hour as another hour.

4. Keying the date of the form.

5. Shifting the day of the data up or down to the incorrect day

Observer Error
This category occurs when what is on the form matches what is in the digitized daily data, but there is something obviously wrong with the data because meteorological it makes no sense. Some of the common types of these are listed below:

1. Observers recorded TMAX values less than/TMIN values greater than at-hour temperatures

2. Adding and division errors when calculating sums and means of the daily values.

3. Including snowfall amounts in precipitation totals.

4. Recording wet-bulb temperatures higher than dry-bulb temperatures