

National Climatic Data Center

DATA DOCUMENTATION

FOR

DATA SET: 3850 (DSI-3850)

Surface Weather Observation Forms 1001

January 31, 2006

National Climatic Data Center
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1. **Abstract:** In order to fill in the observation gap prior to the time when commercial aviation began in the U.S., NCDC's Climate Data Modernization Project (CDMP) retrieved surface observations taken two to four times daily beginning as early as 1893 at the City Weather Bureau Offices. Through 1936 observations were taken twice daily; then in 1937 the general practice was to record four observations per day. Since this data overlaps with the pre-1948 hourly dataset DSI-3851 (surface airways observations), data for each station were not keyed once their observations overlapped with the DSI-3851 data which generally contains more observations per day.

The data elements are as follows: station pressure, sea level pressure, dry and wet bulb temperature, dew point, maximum and minimum temperature, wind direction and speed, precipitation, cloud amount and type, ceiling, state of weather and visibility. It should be noted that not all elements are present for all stations in this dataset, and that ceiling and visibility observations did not begin at the city office's until the 1930's.

Official surface weather observation standards can be found in the Circular N manuals. The images are available on a web based system, Web Search Store Retrieve Display (WSSRD), and will eventually be accessible through NCDC's On-Line store.

2. **Output Keying Format Names and Definitions:**

The keying format listed below was developed and used to key the various elements from the 1001 Forms for 1893-1948.

1001 BOR - 1930's Output Keying Format
(Revision Jun 28, 2005)

Data Records	Contents	Instructions
1-5	WBAN Number	Auto filled from NCDC WBAN list
6	,	Comma delimited
7-10	Year	e.g. 1900
11	,	Comma delimited
12-13	Month	e.g. 01 = January 02 = February . . 12 = December
14	,	Comma delimited

15-16	Day	right justify, zero fill e.g. 01, 02, ...31
17	,	Comma delimited
18-22	Time of Local Observation that corresponds to the printed 75 th Meridian time on the form (e.g. 8 a.m. or 8 p.m.)	<p>Positions 18-19 are reserved for the hour. Positions 20-21 are reserved for minutes. Position 22 is reserved for AM or PM. Code is as follows: A = A.M. P = P.M. e.g. if entry is 5:00 a.m.: Position 18 = 0 Position 19 = 5 Position 20 = 0 Position 21 = 0 Position 22 = A</p> <p>If 24 hour clock, key time in positions 18-21 and leave position 22 blank. Entries may range from 0000-2400. e.g. if entry = 1830, then Position 18 = 1 Position 19 = 8 Position 20 = 3 Position 21 = 0 Position 22 = blank</p> <p>Time can be selected from the following sentence located below the number of station barometer and above the element title columns: e.g. "Observations at 8 a.m. 75th Meridian Time, which corresponds to e.g. 5:00 a.m. 120 Meridian Time, the standard of time in local use; 4:51 a.m. local mean time." Key 5:00 a.m. since Seattle is located in the Pacific Time Zone and corresponds to 8 a.m. 75th Meridian time (120th meridian). Always select the time which is filled in after the statement which corresponds to ___ a.m. On some forms the sentence reads: a.m. 75th Meridian Time; ___ a.m. Local Time. The local time not</p>

			the local mean time is what is to be entered.
23	,		Comma delimited
24-28	Barometer		The Station Pressure is recorded to thousandths of an inch, decimal implied. Listed on 1001 form as “actual” or “station” (observed reading plus total correction). e.g. if entry is 28.587 Positions 24-28 = 28587
29	,		Comma delimited
30-34	Barometer Sea Level Pressure (Inches)		The Sea Level Pressure is recorded to thousandths of an inch, decimal implied. Listed on 1001 form as “reduced” or “reduced to sea-level”. e.g. if entry is 29.371 Positions 30-34 = 29371
35	,		Comma delimited
36-40	Barometer Sea Level Pressure (Millibars)		The Sea Level Pressure is recorded to tenths of millibar, decimal implied. Listed on 1001 form as “reduced to sea-level”. e.g. if entry is 1012.7 Positions 36-40 = 10127
41	,		Comma delimited
42-46	Dry Bulb Temperature		Temperature is recorded in Fahrenheit to tenths of a degree, decimal implied. Position 42 is reserved for the sign field. If positive leave blank. If negative key (-). Positions 43-45 = whole degrees. Position 46 = tenths of a degree. e.g. if entry is 100.8 Position 42 = blank Position 43 = 1 Position 44 = 0 Position 45 = 0 Position 46 = 8 e.g. if entry is -12.2

		Position 42 = - Position 43 = blank Position 44 = 1 Position 45 = 2 Position 46 = 2
47	,	Comma delimited
48-51	Wet Bulb Temperature	The Wet Bulb Temperature value always lies between the dry bulb temperature and dew point temperature. Follow the same rules as for the dry bulb temperature entry above except that a wet bulb temperature of 100 F is unrealistic; therefore, one less position is provided. Position 48 is reserved for the sign field. If positive leave blank. If negative key (-). Positions 49-50 = whole degrees Position 51 = tenths of a degree e.g. if entry is 0.6 Position 48 = blank Position 49 = blank Position 50 = 0 Position 51 = 6
52	,	Comma delimited
53-55	Dew Point Temperature	The Dew Point Temperature value in Fahrenheit is reported to whole degrees. Position 53 is reserved for the sign field. If positive leave blank. If negative key (-). e.g. if entry is -2 Position 53 = - Position 54 = blank Position 55 = 2
56	,	Comma delimited
57-61	Maximum Temperature	Maximum temperature is recorded in Fahrenheit to tenths of a degree, decimal implied. Position 57 is reserved for the sign field. If positive leave blank. If negative key (-).

		Positions 58-60 = whole degrees Position 61 = tenths of a degree e.g. if entry is 54.7 Position 57 = blank Position 58 = blank Positions 59-61 = 547
62	,	Comma delimited
63-66	Minimum Temperature	Minimum temperature is recorded in Fahrenheit to tenths of a degree, decimal implied. Position 63 is reserved for the sign field. If positive leave blank. If negative key (-). Positions 64-65 = whole degrees Position 66 = tenths of a degree e.g. if entry is -1.0 Position 63 = - Position 64 = blank Position 65 = 1 Position 66 = 0
67	,	Comma delimited
68-70	Wind Direction	left justify, blank fill If direction is Calm then key direction as C Wind direction codes as follows: Calm or C N NNE NNW NE ENE E ESE SE SSE S SSW SW WSW W WNW NW e.g. if entry is Calm

		Position 68 = C Position 69 = blank Position 70 = blank e.g. if entry is SW Position 68 = S Position 69 = W Position 70 = blank e.g. if entry is ESE Position 68 = E Position 69 = S Position 70 = E
71	,	Comma delimited
72-74	Wind Velocity	right justify, blank fill. Wind velocity is recorded in m.p.h. e.g. if entry is 0 Position 72 = blank Position 73 = blank Position 74 = 0 If wind is entered as non-numerical character (light, fresh, gale, etc...) use the following table to convert from alpha to numerical characters: Calm = 0 Air = 2 Light = 4 Gentle = 10 Moderate = 15 Fresh = 21 Strong = 32 Gale = 47 Whole Gale = 65 Hurricane = 78
75	,	Comma delimited
76-79	Precipitation	right justify, blank fill. If no entry leave blank. Keyed to inches and hundredths, decimal implied. e.g. if entry is 0.42 Positions 76-77 = blank Positions 78-79 = 42 e.g. if entry is T (Trace)

Positions 76-78 = blank
 Position 79 = T
 e.g. if entry is 0
 Position 76-78 = blank
 Position 79 = 0

80

,

Comma delimited

81

First Cloud Amount

Cloud amounts are reported in tenths generally ranging from 0 to 10. Occasionally “few” will be entered as an amount. The keyers will enter the letter “f” when encountering few in the cloud amount field. The keyers will enter an asterisk “*” when encountering a 10 in the cloud amount field. The field may contain multiple entries, with the highest cloud amount appearing on top and the lowest cloud amount as the bottom number.
 e.g. if entry is 10
 Position 81 = *
 e.g. if entry is few
 Position 81 = f

82

,

Comma delimited

83-84

First Layer Cloud Type (Kind)

left justify, blank fill.
 See breakout below.

Cirrus

1 = C or Ci

Cirrocumulus

2 = KC, CK, CC, Ci, Cu, Ci-Cu

Cirrostratus

3 = CS, Ci, St., CI-S

Cumulus

4 = Cu, K

Alto cumulus

5 = A.Cu, A-Cu, AC

Stratocumulus

6 = S-Cu, KS, St.Cu., SC

Stratus

7 = S, Strat, St, Str

	Altostratus	8 = A.St., A-S, Ast.
	Nimbostratus	9 = Nim, Nimbus, NB, N, NS, Ni
	Cumulus Fractus	97 = FR CU
	Stratus Fractus	98 = FR ST
	Cumulonimbus	99 = Cb
	Clear/No Clouds	0 = 0
		e.g. if entry is cumulonimbus Position 82 = 9 Position 83 = 9
		e.g. if entry is dense haze Position 82 = 1 Position 83 = 6
		e.g. if entry is CU Position 82 = 4 Position 83 = blank
85	,	Comma delimited
86	Second Layer Cloud Amount	Same as for first cloud layer amount
87	,	Comma delimited
88-89	Second Layer Cloud Type (Kind)	Same as for first layer cloud type (Kind)
90	,	Comma delimited
91	Third Layer Cloud Amount	Same as for first cloud layer amount
92	,	Comma delimited
93-94	Third Layer Cloud Type (Kind)	Same as for first layer cloud type (Kind)
95	,	Comma delimited
96	Fourth Layer Cloud Amount	Same as for first cloud layer amount

97	,	Comma delimited
98-99	Fourth Layer Cloud Type (Kind)	Same as for first layer cloud type (Kind)
100 101-105	, Ceiling	Comma delimited See breakout below
101	Ceiling Classification	U = UNL = Unlimited (>9750 ft) A = Aircraft B = Balloon E = Estimated M = Measured P = Precipitation ceiling V = Variable ceiling W = Indefinite ceiling + = Last observed height of ceiling balloon before it disappeared without reaching the clouds. Ceiling classification column may also be blank.
102-105	Ceiling height in feet	right justify, blank fill e.g. if entry is 300 Position 102 = blank Position 103 = 3 Position 104 = 0 Position 105 = 0 Ceiling height column may also be blank.
106	,	Comma delimited
107-109	State Of Weather	See breakout below
107	State of Weather Flag	Set to zero (0) if alpha characters and use the codes below in Positions 108-109. Set to one (1) if all symbols and use attachment #1 codes in Positions 108-109. Set to two (2) if numerical and/or symbol codes and use attachment #2 codes (Present weather codes 00-99) in Positions 108-109.

108

Clear/Partly Cloudy/
Cloudy/Clearing/
Foggy/Misting/
Threatening (U)/
Smoky/Hailing/
Sleet

0 = Clear
1 = Partly Cloudy
2 = Cloudy
3 = Clearing
4 = Foggy
5 = Misting
6 = Threatening (U)
7 = Smoky
8 = Hailing
9 = Hazy
A = Light Fog (Lt. Fog)
B = Moderate Fog (Fog)
C = Dense Fog
D = Light Haze (Lt. Haze)
E = Moderate Haze (Haze)
F = Dense Haze
G = Light Smoke (Lt. Smoke)
H = Smoke
I = Dense Smoke
J = Light Dust (Lt. Dust)
K = Dust
L = severe/Heavy Dust
blank = no entry

109

Rain/Snow/Sprinkling/
Thunderstorm

1 = Light Rain (Lt. Rain)
2 = Moderate Rain (Rain)
3 = Heavy Rain (Hvy. Rain)
4 = Light Snow (Lt. Snow)
5 = Moderate Snow (Snow)
6 = Heavy Snow (Hvy. Snow)
7 = Sprinkling
8 = Sleet
9 = Thunderstorm or Thunder shower
Generally represented by the
symbol:



A = Lightning

blank = no entry

Note: Symbol and numerical codes were used by the observers after Jan 1939. These codes will only be used when there are no 1130s available and 1001s are used to fill in the data gaps. If symbols or numerical characters are present see attachments 1, 2 for definition.
 Attachment 1 = Symbols Definition
 Attachment 2 = Numerical and Symbols Definition

110	Symbol Sign	+ = Heavy - = Light Note: These symbols will only be used in conjunction with attachment 1 above.
111	,	Comma delimited
112-117	Visibility	See breakout below
112	Visibility Flag	Set to one (1) if observations are taken twice per day or observations taken at 8 a.m. 75 th Meridian time. Set to two (2) if 4 observations are taken per day.
113-117	Visibility	Visibilities at 8 a.m. 75 th Meridian time or Time of observation (Positions 18-22), when observations appear four times per day, rather than twice daily. Positions 113-115 = whole miles Positions 116-117 = fractions of miles e.g. if entry is 1 3/8, then Position 113 = blank Position 114 = blank Position 115 = 1 Position 116 = 3 Position 117 = 8 e.g. if entry is U or UNK, then Position 113 = U Position 114-117 = blank

Coding instructions for fractions of a mile: (Positions 116-117) If no fractions reported blank fill.

Entry	Key
1/16	16
1/8	18
1/4	14
5/16	56
3/8	38
-	12
5/8	58
3/4	34
7/8	78

118	,	Comma delimited
119-123	Visibility Local Noon	Flag #1 in Position 112 indicates Visibility should be available. When flag #2 is used in Position 112 this field will be left blank.
124	,	Comma delimited
125-129	Visibility at 8 p.m. 75 th Meridian Time	Flag #1 in Position 112 indicates Visibility should be available. When Flag #2 is used in Position 112 this field will be left blank.

Notes:

1) Keith & Dan: When converting the visibility to TD-3280 format, the 8:00 p.m. visibility is located on the page which contains the observations at 8:00 a.m.75th Meridian Time.

2) Whenever an element field has a value to be keyed, but the value cannot be determined because of illegibility or non-recognizable characters by the keyer then place a tilde (~) in the last position of that element field. This will provide the data user with information that an entry was made by the observer but could not be keyed. If sufficiently interested the user can view the image.

3. Start Date: 1893

4. Stop Date: 1948

5. **Coverage:** U.S. Weather Stations in all 50 states.

6. **How to Order Data:**

Ask NCDC's Climate Services about costs to obtain 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:**

Name: Mark Seiderman

Address: National Climatic Data Center

NOAA/NESDIS

Veach-Baley Federal Building

151 Patton Avenue

Asheville, NC 28801-5001

Voice Telephone: 828-271-4798

Fax: 828-271-4126

E-mail: Mark.Seiderman@noaa.gov

9. **Known Uncorrected Problems:** No known problems. During the keying process if a value was entered on the form, but the keyer could not read the handwriting then a tilde (~) was placed in the element field. Where possible these entries should be corrected.

10. **Quality Statement:** These are "raw" keyed data, and have undergone limited quality control or quality assurance checks. A pre-keying check of the original data forms was performed to correct obvious errors, and some internal bounds checking was performed on the data at keying. The data will undergo extensive automated quality control using limits, internal and temporal consistency checks provided by the Northeast Regional Climate Center (NRCC), and additional manual quality control at NCDC, before conversion to the ISH format.

11. **Essential Companion Datasets:** The NCDC in-house station history files (DSI-9767) would be essential in correcting location (WBAN number) errors.

12. **References:** Graybeal, D. Y., A. T. DeGaetano, and K. L. Eggleston, 2004: Complex quality assurance of historical hourly surface airways meteorological data. *J. Atmos. Oceanic Technol.*, 21, 1156-1169.

Graybeal, D. Y., A. T. DeGaetano, and K. L. Eggleston, 2004: Improved quality assurance for historical hourly temperature and humidity: Development and application to environmental analysis. *J. Appl. Meteor.*, 43, 1722-1735.

Attachment 1

HYDROMETEOR SYMBOLS			
10		Dew	Condensed water on grass, stones, etc.
50		Drizzle	Precipitation of small water droplets
07		Dust	Presence of dust in the air
31		Duststorm	Heavy blowing dust
45		Fog, light	Fog with visibility 5/8 mile or more
45		Fog, moderate	Fog with visibility less than 5/8 mile
45		Fog, heavy	
05		Haze, dry	Very fine dust in the air; air seems smoky or opalescent
90		Hail	Iceballs, usually fall in thunderstorms
89		Hail, small	Small iceballs, usually appear glazed
76		Ice crystals	Fine needles of ice floating in the air
13		Lightning, distant	Lightning in the distance, without audible thunder
<hr/>			
60		Rain	Precipitation of fairly large water drops
68		Rain / snow, mixed	Precipitation of rain and snow together
31		Sandstorm	Heavy blowing sand
80		Showers	Irregular falls of hydrometers, rain, hail, etc.
79		Sleet	Precipitation of ice pellets or frozen raindrops
04		Smoke	Particles of foreign matter in the air from combustion
70		Snow	Precipitation of hexagonal crystals or flakes
38		Snow, blowing	Snow driven up into the air by the wind
36		Snow, drifting	Snow driven along the ground by the wind
77		Snow grains	Flattened or oblong grains of snow
79		Snow pellets	Small, round, crisp pellets of snow
95		Thunderstorm	Thunder and lightning in the vicinity

Attachment 2 (Part 1)

WW PRESENT WEATHER (Descriptions abridged from International Code)				
0	1	2	3	4
00  Cloud development NOT observed or NOT observable during past hour	 Clouds generally dissolving or becoming less developed during past hour	 State of sky on the whole unchanged during past hour	 Clouds generally forming or developing during past hour	 Visibility reduced by smoke
10  Light fog (mist)	 Patches of shallow fog at station, NOT deeper than 6 feet on land	 More or less continuous shallow fog at station, NOT deeper than 6 feet on land	 Lightning visible, no thunder heard	 Precipitation within sight, but NOT reaching the ground
20  Drizzle (NOT freezing) or snow grains (NOT falling as showers) during past hour, but NOT at time of observation	 Rain (NOT freezing and NOT falling as showers) during past hour, but NOT at time of observation	 Snow (NOT falling as showers) during past hour, but NOT at time of observation	 Rain and snow or ice pellets (NOT falling as showers) during past hour, but NOT at time of observation	 Freezing drizzle or freezing rain (NOT falling as showers) during past hour, but NOT at time of observation
30  Slight or moderate dust storm or sandstorm, has decreased during past hour	 Slight or moderate dust storm or sandstorm, no appreciable change during past hour	 Slight or moderate dust storm or sandstorm has begun or increased during past hour	 Severe dust storm or sandstorm, has decreased during past hour	 Severe dust storm or sandstorm, no appreciable change during past hour
40  Fog or ice fog at distance at time of observation, but NOT at station during past hour	 Fog or ice fog in patches	 Fog or ice fog, sky discernible, has become thinner during past hour	 Fog or ice fog, sky NOT discernible, has become thinner during past hour	 Fog or ice fog, sky discernible, no appreciable change during past hour
50  Intermittent drizzle (NOT freezing), slight at time of observation	 Continuous drizzle (NOT freezing), slight at time of observation	 Intermittent drizzle (NOT freezing), moderate at time of observation	 Continuous drizzle (NOT freezing), moderate at time of observation	 Intermittent drizzle (NOT freezing), heavy at time of observation
60  Intermittent rain (NOT freezing), slight at time of observation	 Continuous rain (NOT freezing), slight at time of observation	 Intermittent rain (NOT freezing), moderate at time of observation	 Continuous rain (NOT freezing), moderate at time of observation	 Intermittent rain (NOT freezing), heavy at time of observation
70  Intermittent fall of snowflakes, slight at time of observation	 Continuous fall of snowflakes, slight at time of observation	 Intermittent fall of snowflakes, moderate at time of observation	 Continuous fall of snowflakes, moderate at time of observation	 Intermittent fall of snowflakes, heavy at time of observation
80  Slight rain shower(s)	 Moderate or heavy rain shower(s)	 Violent rain shower(s)	 Slight shower(s) of rain and snow mixed	 Moderate or heavy shower(s) of rain and snow mixed
90  Moderate or heavy shower(s) of hail, with or without rain, or rain and snow mixed, not associated with thunder	 Slight rain at time of observation; thunderstorm during past hour, but NOT at time of observation	 Moderate or heavy rain at time of observation; thunderstorm during past hour, but NOT at time of observation	 Slight snow, or rain and snow mixed, or hail at time of observation; thunderstorm during past hour, but NOT at time of observation	 Moderate or heavy snow, or rain and snow mixed, or hail at time of observation; thunderstorm during past hour, but NOT at time of observation

Attachment 2 (Part 2)

5	6	7	8	9
Haze	Widespread dust in suspension in the air, NOT raised by wind, at time of observation	Dust or sand raised by wind at time of observation	Well-developed dust whirl(s) within past hour	Dust storm or sandstorm within sight of or at station at time of observation
Precipitation within sight, reaching the ground but distant from station	Precipitation within sight, reaching the ground, near to but NOT at station	Thunder storm, but no precipitation at the station	Squall(s) within sight during past hour or at time of observation	Funnel cloud(s) within sight of station at time of observation
Showers of rain during past hour, but NOT at time of observation	Showers of snow, or of rain and snow, during past hour, but NOT at time of observation	Showers of hail, or of hail and rain, during past hour, but NOT at time of observation	Fog during past hour, but NOT at time of observation	Thunderstorm (with or without precipitation) during past hour, but NOT at time of observation
Severe dust storm or sandstorm has begun or increased during past hour	Slight or moderate drifting snow, generally low (less than 6 ft)	Heavy drifting snow, generally low	Slight or moderate blowing snow, generally high (more than 6 ft)	Heavy blowing snow, generally high
Fog or ice fog, sky NOT discernible, no appreciable change during past hour	Fog or ice fog, sky discernible, has begun or become thicker during past hour	Fog or ice fog, sky NOT discernible, has begun or become thicker during past hour	Fog depositing rime, sky discernible	Fog depositing rime, sky NOT discernible
Continuous drizzle (NOT freezing), heavy at time of observation	Slight freezing drizzle	Moderate or heavy freezing drizzle	Drizzle and rain, slight	Drizzle and rain, moderate or heavy
Continuous rain (NOT freezing), heavy at time of observation	Slight freezing rain	Moderate or heavy freezing rain	Rain or drizzle and snow, slight	Rain or drizzle and snow, moderate or heavy
Continuous fall of snowflakes, heavy at time of observation	Ice prisms (with or without fog)	Snow grains (with or without fog)	Isolated starlike snow crystals (with or without fog)	Ice pellets or snow pellets
Slight snow shower(s)	Moderate or heavy snow shower(s)	Slight shower(s) of snow pellets, or ice pellets with or without rain, or rain and snow mixed	Moderate or heavy shower(s) of snow pellets, or ice pellets with or without rain or rain and snow mixed	Slight shower(s) of hail, with or without rain or rain and snow mixed, not associated with thunder
Slight or moderate thunderstorm without hail, but with rain and/or snow at time of observation	Slight or moderate thunderstorm, with hail at time of observation	Heavy thunderstorm, without hail, but with rain and/or snow at time of observation	Thunderstorm combined with dust storm or sandstorm at time of observation	Heavy thunderstorm with hail at time of observation