National Climatic Data Center

DATA DOCUMENTATION

FOR

DATA SET 3283 (DSI-3283)

ASOS Surface Airways Hourly Observations

May 4, 2005

National Climatic Data Center
151 Patton Ave.
Asheville, NC 28801-5001 USA

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Table of Contents

1. Abstract: This data set contains Automated Surface Observation System (ASOS) observations that are measured primarily at major airports. ASOS was designed specifically to support aviation operations and forecast activities. The automated system provides continuous minute-by-minute observations which are then averaged into an hourly observation. The capability does exist for a human observer to augment parts of an ASOS observation. The stations are usually fully instrumented and therefore record a complete range of meteorological parameters. The observations are generally recorded for the 24-hour period midnight to midnight. NCDC began collecting these data in 2001. In 2005 there were approximately 880 stations included in the data set.

The major data variables and parameters are as follows: Record Type (HLY), WBAN Identification Station number, Units of measurement indicators, source codes, data quality flags, and element types: cloud data, visibility data, wind data, temperature data, sky cover data, relative humidity data, pressure data, solar radiation data, and present weather data.

The stations are located worldwide and are operated by the National Weather Service (NWS) and the Federal Aviation Administration (FAA). The NWS and FAA sites are located in the contiguous U.S., Alaska, Puerto Rico, Hawaii and other Pacific Islands. 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.

Station Data Time Averaging: ASOS is designed to collect data continuously. Hourly observations are computed from data accumulations and averages over the following time periods prior to the report:

Cloud Height	30 minutes
Cloud Amount	60 minutes
Visibility	10 minutes
Present Weather	10 minutes
Freezing Rain	15 minutes
Temperature/Dew Point	5 minutes
Wind	2 minutes
Pressure	1 minute
Precipitation Accumulation	60 minutes

Station Observation Schedule: Historically, the time of observation (hour) archived is that of the record observation, taken within 10 minutes prior to the hour (e.g., 1355 keyed 1400).

Users must be aware that DS-3280 and DS-3283 are similar. The only difference is that DS-3280 contains quality controlled data that has been hand checked by personnel at the National Climatic Data Center. DS-3283 only contains data that is automatically quality controlled, therefore, it is considered to be “raw” data.

2. Element Names and Definitions:

RECORD TYPE
The type of data stored in this record. (Value is "HLY"). Each record contains one day of hourly values.

STATION-ID
:
:

Contains the WBAN Station Number. (Assigned by NCDC.) ID Range of values = 00000000-00099999. Five digit station numbers are always right justified and zero filled.

METEOROLOGICAL ELEMENT-TYPE

The type of meteorological element stored in this record consisting of a four character alpha. Range of values is listed below.

ALC"x"

DESCRIPTION: Sky condition in tenths and height per layer.
VALID TIMES: thru current
COMMENTS: The ASOS ceilometer provides data for a maximum of three layers at or below 12,000 feet and does not distinguish between thin and opaque cloud layers. ASOS sites augmented by a human observer can report up to six layers of clouds and are not limited to 12,000 feet. The element ALC@x@ (tenths) is derived from the element ALM@x@ (eights).

The "x" indicates the layer where:

1 = The lowest layer
2 = The second layer
3 = The third layer
4 = The fourth layer (ASOS Augmented stations only)
5 = The fifth layer (ASOS Augmented stations only)
6 = The sixth layer (ASOS Augmented station only)

The DATA-VALUE portion of the record will appear as XXYYY where:

XX = The code for sky condition
YYY = The layer height in hundreds of feet.

XX Code - Sky Condition (tenths)

00 = clear or less than .1 coverage
02 = scattered .1 to .5 coverage
04 = broken .6 to .9 coverage
06 = overcast 1.0 coverage
07 = obstruction 1.0 coverage
09 = unknown

YYY Code - Layer Height (hundreds of feet)

000 = Clear conditions (with >00' code for XX)
999 = Unknown value (with >09' code for XX)

Sky and ceiling information are automatically derived from ceilometer data in the ASOS. Except in the case of augmentation, sky and ceiling are no longer an estimate of conditions from a human observer. The ASOS cloud height is an estimate based on the heights of clouds detected every 30 seconds during the previous 30 minutes (with the last 10 minutes of data double weighted). The cloud amount (CLR, SCT, BKN, OVC) is derived from the ratio of the number of possible hits. The ceilometer measures clouds at or below 12,000 feet.

ALM"x"

DESCRIPTION: Sky condition in eights and height per layer.

VALID TIMES: thru current
COMMENTS: The ASOS ceilometer provides data for a maximum of three layers at or below 12,000 feet and does not distinguish between thin and opaque cloud layers. ASOS sites augmented by a human observer can report up to six layers of clouds and are not limited to 12,000 feet. The element ALC@x@ (tenths) is derived from the element ALM@x@ (eights).

The "x" indicates the layer where:

1 = The lowest layer
2 = The second layer
3 = The third layer
4 = The fourth layer (ASOS Augmented stations only)
5 = The fifth layer (ASOS Augmented stations only)
6 = The sixth layer (ASOS Augmented station only)

The DATA-VALUE portion of the record will appear as XXYYY where:

XX = The code for sky condition
YYY = The layer height in hundreds of feet.

XX Code - Sky Condition (eights)

00 = Clear
01 = few scattered 1/8 to 2/8 coverage
02 = scattered 3/8 to 4/8 coverage
04 = broken 5/8 to 7/8 coverage
06 = overcast 8/8 coverage
07 = obscuration 8/8 coverage
09 = unknown

YYY Code - Layer Height (hundreds of feet)

000 = Clear conditions (with >00' code for XX)
999 = Unknown value (with >09' code for XX)

Sky and ceiling information are automatically derived from ceilometer data in the ASOS. Except in the case of augmentation, sky and ceiling are no longer an estimate of conditions from a human observer. The ASOS cloud height is an estimate based on the heights of clouds detected every 30 seconds during the previous 30 minutes (with the last 10 minutes of data double weighted). The cloud amount (CLR, SCT, BKN, OVC) is derived from the ratio of the number of possible hits. The ceilometer measures clouds at or below 12,000 feet.

ALTP

DESCRIPTION: Altimeter setting.
VALID TIMES: thru current
Range of values: 02700 to 03200

CLHT

DESCRIPTION: Ceiling height
VALID TIMES: through current
COMMENTS: All clouds are considered opaque.

Sky and ceiling information are automatically derived from ceilometer data in the ASOS. The ASOS cloud height is an estimate based on the heights of clouds detected every 30 seconds during the previous 30 minutes (with the last 10 minutes of data double weighted). The ASOS ceilometer measures clouds at or below 12,000 feet. ASOS Augmented sites and human observer sites can also report ceiling heights greater than 12,000 feet.

CLT"x"

DESCRIPTION: The cloud type and height by layer.
VALID TIMES: through current
COMMENTS: The Metar code only allows the reporting of CB (Cumulonimbus) and TC (Towering Cumulus) cloud types.

The "x" indicates the layer where:

1 = lowest cloud layer or obscuring phenomena
2 = 2nd cloud layer
3 = 3rd cloud layer
4 = 4th cloud layer
5 = 5th cloud layer
6 = 6th cloud layer

Cloud information pertaining to cloud type and cloud height is contained within one element per level. The DATA-VALUE portion of the record will appear as: XXYYY.

XXYYY constitutes the five character field where:

XX = Code for cloud type listed below.

YYY = Cloud height (hundreds of feet)

9's for any unknown value.

Generic cloud type or obscuring phenomena codes are:

CLOUD TYPE	ABBREVIATION
00 = None	
12 = Towering Cumulus	TCU
18 = Cumulonimbus	CB

DPTC

Dew Point Temperature in tenths degree Celsius.
VALID TIMES: through current
COMMENTS: The element DPTP (degrees Fahrenheit) is derived from the element DPTC (tenth=s degree Celsius).
The DATA-VALUE will appear as 00XXX.

Range of values: 00000 to 00600 (positive and negative)
Unknown or Missing: 00999
Measured to tenths degrees Celsius

DPTP

DESCRIPTION: Dew Point Temperature in degrees Fahrenheit.

VALID TIMES: Through current
COMMENTS: The element DPTP (degrees Fahrenheit) is derived from the element DPTC (tenth=s degree Celsius).

The DATA-VALUE will appear as 00XXX.
Range of values: 00000 to 00140 (positive and negative)
Measured or derived to whole degrees F.

HZVS

DESCRIPTION: The prevailing Horizontal Visibility
VALID TIMES: Through current

The DATA-VALUE will appear as XXXXX. Range of value = 00000 to 99999. A value of 99999 indicates unknown or unlimited visibility (> 100 miles). Horizontal visibility is usually reported at an elevation of 6 feet above the ground.

The following code is used:

HZVS CODE

Reported by ASOS	Archive Code	Actual visibility (in miles)
Yes	00019	3/16 (ASOS <1/4 miles)
Yes	00025	1/4 miles
Yes	00050	1/2 miles
Yes	00075	3/4 miles
Yes	00100	1 mile
Yes	00125	1 1/4 miles
Yes	00150	1 1/2 miles
Yes	00175	1 3/4 miles
Yes	00200	2 miles
Yes	00250	2 1/2 miles
Yes	00300	3 miles
Yes	00350	3 1/2 mi.
Yes	00400	4 miles
Yes	00500	5 miles
Yes	00600	6 miles
Yes	00700	7 miles
Yes	00800	8 miles
Yes	00900	9 miles
Yes	01000	10 miles(ASOS 10+ miles)

NOTE: The automated visibility sensors report values in the range of < 1/4 to 10+ miles. These reportable ASOS values are indicated in the table above.

PWTH

DESCRIPTION: The present (or prevailing) weather occurring at the time of the observation.
VALID TIMES: Through current

Present weather codes are two characters in length. The leftmost character indicates the general class of present weather while the rightmost character is a qualifier.

The two digit codes are stored into the five digits of the DATA-VALUE portion. ***If there is no occurrence of present weather the valid DATA-Value will always be 00000. Within the five digits used, the leftmost digit is always set to zero. The two-digit weather codes are right justified. For example, moderate snow is coded as 00041. If two types of weather occur for the same hour, the value field would appear as 0XXYY. For example, light rain and fog occurring on the same hour would be coded as 02070.

If more than two types occur for the same hour, they will be stored into additional PWTH records as necessary.

Consider the following examples:

On day 11 Feb 2000 at 1200 (noon) and 1300 hours no present weather occurred.

HLY00005264PWTHNA200002A1110021200b00000b11300b00000b1

On day 11 Feb 2000 at 1200 (noon) light snow, light freezing rain, ice fog, and blowing snow all occur. The records will appear as:

HLY000005264PWTHNA200002A111001120004026b1
HLY000052664PWTHNA198102A111001120007184b1

PRESENT WEATHER CODES descriptions follow:

CODE FOR PWTH RANGE 00.

00 ********** No Occurrence
where:

00 = No present weather occurred

CODE FOR PWTH RANGE 10 TO 19.

1X ********** Thunderstorm, Tornado, Squall
where:

X = 0 thunderstorm - lightning and thunder. Wind gust < 50 knots - hail < .75 inches. A thunderstorm is defined as a local storm produced by a cumulonimbus cloud that is accompanied by lighting and/or thunder.
= 2 report of tornado or water spout
= 4 moderate squall (A squall is a sudden increase of wind speed by at least 16 knots, reaching 22 knots or more and lasting for at least one minute)
= 7 funnel cloud
= 9 unknown

CODE FOR PWTH RANGE 20 TO 29

2X ********* Rain, Rain Showers, Freezing Rain

where:

X = 0 light rain
= 1 moderate rain
= 2 heavy rain
= 3 light rain showers
= 4 moderate rain showers
= 5 heavy rain showers
= 6 light freezing rain
= 7 moderate freezing rain
= 8 heavy freezing rain
= 9 unknown

CODE FOR PWTH RANGE 30 TO 39

3X ********* Rain Squalls, Drizzle, Freezing Drizzle
where:

X = 3 light drizzle
= 4 moderate drizzle
= 5 heavy drizzle
= 6 light freezing drizzle
= 7 moderate freezing drizzle
= 8 heavy freezing drizzle
= 9 unknown.

The Automated Surface Observing System (ASOS) can report unknown precipitation. This is an indication of light precipitation and is reported when the precipitation discriminator detects, but cannot recognize the type of precipitation.

CODE FOR PWTH RANGE 40 TO 49

4X ********* Snow, Snow Pellets, Ice Crystals
where:

X = 0 light snow
= 1 moderate snow
= 2 heavy snow
= 7 moderate ice crystals
= 9 unknown

Any occurrence of ice crystals is recorded as a 47.

CODE FOR PWTH 50 TO 59

5X ********* Snow Showers, Snow Squalls, Snow Grains
where:

X = 0 light snow showers
= 1 moderate snow showers
= 2 heavy snow showers
= 6 light snow grains
= 7 moderate snow grains
= 8 heavy snow grains
= 9 unknown

CODE FOR PWTH RANGE 60 TO 69

6X ********* Sleet, Sleet Showers, Hail
where:

X = 0 light ice pellet showers
= 1 moderate ice pellet showers
= 2 heavy ice pellet showers
= 3 light hail (see note below)
= 4 moderate hail (see note below)
= 5 heavy hail (see note below)
= 6 light small hail (see note below)
= 7 moderate small hail (see note below)
= 8 heavy small hail (see note below)

= 9 unknown

Hail is defined as hailstones 1/4 inch or larger in diameter; small hail and snow pellets are reported when less than 1/4 inch in diameter and are coded as 64 and 67, respectively.

CODE FOR PWTH RANGE 70 TO 79

7X ********* Fog, Blowing dust, Blowing Sand
where:

X = 0 fog/mist. Fog is redefined as a visible aggregate of minute water particles (droplets) which are based at the earth's surface and reduces the horizontal visibility to less than 5/8 statute miles. Mist is defined as a visible aggregate of minute water particles suspended in the atmosphere that reduces visibility to less than 7 statute miles but greater than or equal to 5/8 statute miles.
= 1 ice fog / freezing fog
= 2 ground fog
= 3 blowing dust
= 4 blowing sand
= 5 heavy fog
= 6 glaze (begin 1984)
= 7 heavy ice fog (begin 1984)
= 8 heavy ground fog (begin 1984)
= 9 unknown

All of the above values are recorded only when visibility is less than 7 miles. Ice fog is called freezing fog and is coded as 71.

CODE FOR PWTH RANGE 80 TO 89

8X ******** Smoke, Haze, Smoke and Haze, Blowing Snow, Blowing Spray, Dust
where:

X = 0 smoke
= 1 haze
= 2 smoke and haze
= 3 dust
= 4 blowing snow
= 5 blowing spray

= 6 dust storm
= 7 volcanic ash
= 8 not used
= 9 unknown

These values are recorded only when visibility is less than 7 miles.

CODE FOR PWTH RANGE 90 TO 97 AND 99

CODE FOR PWTH RANGE 90 TO 97

9X ****** Ice Pellets, Hail Showers, Small Hail/Snow Pellet Showers, Fog (partial, patches), snow (low drifting) where:

X = 0 light ice pellets
= 1 moderate ice pellets
= 2 heavy ice pellets
= 3 hail showers
= 4 small hail/snow pellet showers
= 5 partial fog
= 6 patches fog
= 7 low drifting snow
= 9 unknown

PWVC

DESCRIPTION: The present (or prevailing) weather occurring between 5 and 10 statute miles at the time of the observation in the vicinity of the observation.
VALID TIMES: through current.

PWVC weather codes are two characters in length. The two digit codes are stored into the five digits of the DATA-VALUE portion. ***If there is no occurrence of PWVC, the DATA-Value is not archived.

Within the five digits used, the leftmost digit is always set to zero. The two-digit weather codes are always right justified. For example, showers in the vicinity would be coded as 00002. If two types of weather in the vicinity occur for the same hour, the value field would appear as 0XXYY. For example, a thunderstorm in the vicinity and shower in the vicinity would be coded as 00102.

If more than two types of weather in the vicinity occur for the same hour, they will be stored into additional PWVC records as necessary. See element PWTH for examples.

PWVC DATA-VALUE code descriptions follow:

Code	Description
00	no occurrence
01	Thunderstorm in vicinity
02	Showers in vicinity
03	Sandstorm in vicinity
04	Sand / Dust whirls in vicinity
05	Dustorm in vicinity
06	Blowing snow in vicinity

07 Blowing sand in vicinity
08 Blowing dust in vicinity
09 Fog in vicinity

RHUM

DESCRIPTION: Relative Humidity
VALID TIMES: Through current.

Relative Humidity expressed in whole percent. The DATA-VALUE will appear as 00XXX.

Range of values: 00000 to 00100

SLVP

DESCRIPTION: Sea level pressure
VALID TIMES: Through current.

Pressure, reduced to sea level, expressed in millibars and tenths. The DATA-VALUE will appear as XXXXX.

Range of values: 09200 to 10900

TMCD

DESCRIPTION: Dry Bulb Air Temperature in tenths degree Celsius.
VALID TIMES: through current

COMMENTS: The element TMPD (whole degrees Fahrenheit) is derived from the element TMCD (tenths of degree Celsius).

The DATA-VALUE will appear as 00XXX.
Range of values: 00000 to 00600 (positive or negative)
Measured to tenths degree Celsius

TMPD

DESCRIPTION: Dry Bulb Air Temperature in whole degrees Fahrenheit.
VALID TIMES: Through current
COMMENTS: The element TMPD (whole degrees Fahrenheit) is derived from the element TMCD (tenths of degree Celsius).

The DATA-VALUE will appear as 00XXX.
Range of values: 00000 to 00140 (positive or negative)
Measured or derived to whole degrees F.

TMPW

DESCRIPTION: Wet bulb Temperature in degrees Fahrenheit to tenths.
VALID TIMES: Through current
COMMENTS: The element TMPW is derived from the dry bulb and dew point temperature. Dry bulb and dew point temperatures are observed in tenths of degree Celsius.

The DATA-VALUE will appear as 0XXXX.

Range of values: 00000 to 01400 (positive or negative)

WND2

DESCRIPTION: Wind Direction and Speed from ASOS
VALID TIMES: through current
COMMENTS: ASOS wind speeds are two-minute averages in knots. Direction is the direction (in tens of degrees) from which the wind is blowing.

The DATA VALUE portion of the record will appear as XXYYY where:

XX = The direction in tens of degrees. 00 = calm, 36 = 360 degrees.
YYY = The speed of the wind in knots.

Example: 28014 is a wind from 280 degrees at 14 knots. 28 = wind 280 degrees. 014 = wind speed is 14 knots.

Calm and variable winds are defined as follows:

Calm winds include wind speeds of 0 to 2 knots and are coded as 00000
Variable winds include wind speeds of 3-6 knots and are coded as 00003 through 00006

Example 00004 is a variable wind at 4 knots.

ELEMENT - UNITS

The unit and decimal position of the DATA-VALUE of this record.

ELEMENT-UNITS TABLE

DT	Wind direction in tens of degrees
F	Whole degrees Fahrenheit
HF	Hundreds of feet
HM	Miles and hundredths
IH	Inches and hundredths of mercury
IT	Inches and thousandths of mercury
KD	knots and direction in tens of degrees
KS	Knots and direction in 16 point WBAN Code
MT	Millibars and tenths
NA	No units applicable (non-dimensional)
N1	No units applicable - element to tenths
N2	No units applicable - element to hundredths percent
TC	Degrees Celsius in tenths
TF	Degrees Fahrenheit in tenths
WH	Watt hour per meter squared

NOTE: All entries are left justified and blank filled.

YEAR

This is the year of the record. Range of value is 1900 to the current year processed.

MONTH

This is the month of record. Range of value is 01-12.

SOURCE CODE-1

Contains a code indicating the primary source of the original record this element was taken from. Values are 1 or A.

SOURCE CODE TABLE

1	Original manuscript
A	ASOS

Source codes reflect normally expected data sources and do not necessarily indicate the actual source of a specific item.

SOURCE CODE-2

Contains a code indicating the back-up source of the original record this element was taken from. Values are 1 or A.

SOURCE CODE TABLE

1	Original Manuscript
A	ASOS

Pre-1984 data will be coded as a 1.

DAY

Contains the day of the record. Range 01-31.

NUM-VALUES

This notates the actual number of values reported. Range of values is 001-048.

NOTE: A record may contain fewer or more data values than you might expect. A daily record or hourly value may contain as few as one data value or as many as 24. If a particular data value was not taken or is unavailable there is no entry for it.

TIME-OF VALUE

Contains the hour and minute of the hourly element value. Range is 0000-2300. The hour is in the leftmost two digits and the minute is in the rightmost two digits. Minutes are always 00. Hour is reported using the 24 hour clock. The time entered is that of the record observation, taken within 10 minutes prior to the hour (e.g., 1353 punched 14 and now archived as 1400).

SIGN OF METEOROLOGICAL VALUE

This is the 'SIGN' of the meteorological data value (Tape Field 013). This field contains either 1) a blank indicating a positive value or 2) a minus sign indicating a negative value. A plus is not used to indicate a positive value.

DATA-VALUE

Actual data value. This field is a five-digit integer. Unit and decimal position of the data value are indicated in the ELEMENT-UNITS field described in Tape Field 004.

FLAG-1

The data measurement FLAG.

FLAG-1 TABLE (Measurement Value)

D	Derived value
E	Estimated value
G	Visibility > or = 100 miles (data value = 10000)
M	Visibility missing (data value = 99999)
N	Unlimited visibility (data value = 99999)
R	Dew Point and/or Relative Humidity, originally calculated with respect to ice have been recomputed with respect to water. (DPTP,RHUM)
U	Unlimited ceiling height (DATA-VALUE = 99999). (CLHT)
b	(blank) Flag not needed.

FLAG-2

FLAG.

FLAG-2 (Quality Flag)

0	Observed data has passed all internal consistency checks
1	Validity indeterminable (primarily for pre-1984 data)
2	Observed data has failed an internal consistency check
3	Observed data has failed a consistency check
4	Observed data value invalid

3. Start Date: 20001001

4. Stop Date: Ongoing.

5. Coverage: U.S.A., Caribbean Islands, Pacific Islands, and other overseas stations of the National Weather Service.

a. Southernmost Latitude: 90S
b. Northernmost Latitude: 90N
c. Westernmost Longitude: 180W
d. Easternmost Longitude: 180E

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
Phone: (828) 271-4800.

8. Technical Contact:

National Climatic Data Center

Federal Building
151 Patton Avenue
Asheville, NC 28801-5001
Phone: (828) 271-4800.

9. Known Uncorrected Problems: None.

10. Quality Statement: Quality of the Surface Airways Hourly data is considered quite good. The ASOS data receive various types of quality control at the station. For example, pressure is quality controlled by use of redundant sensors. If one or more of the six samples read each minute from one pressure sensor is missing, only the remaining sensors are used to determine the pressure. Sensor values for the same minute may not differ by more than 0.04 inches. The lowest pressure reading that does not differ from the other sensor readings by more than 0.04 inches mercury is considered the observed pressure. Discussion of quality control procedures for other sensors may be found in the ASOS USER'S GUIDE. This data set is run through an automated quality control system. In DSI-3280, Surface Airways Hourly, the flags are hand checked for quality control purposes.

11. Essential Companion Datasets: The use of NCDC's Station History file (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 4 through 11 of this data set with the corresponding station number in the Station History data set.

Station History Locations are known to the nearest minute of latitude and longitude. ASOS provides location to the nearest second.

12. References:

National Weather Service, August 1991: ASOS USER'S GUIDE, NOAA-NWS, Silver Spring, MD.

Environmental Information Summary C-2, Local Climatological Data, National Climatic Data Center (NCDC).