National Centers for Environmental Information (NCEI)
DATA DOCUMENTATION FOR DATA SET 6401 (DSI-6401)
ASOS SURFACE 5-MINUTE

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National Centers for Environmental Information
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1. Abstract: ASOS Surface 5-Minute Data is digital data set DSI-6401 archived and accessible at the National Centers for Environmental Information (NCEI). This dataset contains five-minute reports for elements that include wind speed and direction, visibility, present weather, temperature, dew point temperature, station altimeter, pressure and density altitude, and relative humidity for approximately 900 ASOS stations in the U.S., Puerto Rico, the U.S. Virgin Islands and some Pacific island territories.

The Automated Surface Observing Systems (ASOS) program is a joint effort of the National Weather Service (NWS), the Federal Aviation Administration (FAA), and the Department of Defense (DOD). ASOS is designed to support weather forecast activities and aviation operations and, at the same time, support the needs of the meteorological, hydrological, and climatological research communities. ASOS works non-stop, updating observations every minute, 24 hours a day, every day of the year. A basic strength of ASOS is that critical aviation weather parameters are measured where they are needed most: airport runway touchdown zone(s). Five-minute observations are available for some stations as early as the year 2000.

Station Data Time Averaging - The Automated Surface Observations System is designed to collect data continuously. Five-minute reports are computed from data accumulations over the following time periods prior to the report:

Cloud Height   30 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   1 hour*

*Precipitation in the first 5-minute period of an hour is the total for the 5-minute period, precipitation in the second 5-minute period of the hour is the total for previous 10-minutes, and so forth until the last 5-minute period of the hour which contains the total precipitation for the hour.

The record has fixed-length fields. The last field contains remarks and may range from 1 to 133 characters. The remarks field is blank filled as necessary to achieve a fixed length of 133 characters.

2.   Element Names and Definitions: Each data file contains data for one station-month. The filenames contain the 4-character call letter identifier (e.g. KNYC = New York Central Park, NY), the 4-digit year and two-digit month. The file extensions are ".dat".

Data are archived in a variable-length file structure. The first five fields in the record are fixed for a length of 28 characters. The remainder of each record contains the five minute data and remarks generated at the station and may be 1 to 472 characters in length.

Each variable-length logical record contains one station's 5-minute data
values for all reported meteorological elements. The record consists of
an identification portion and a data portion. The identification portion
includes the station number, ICAO call sign, station call sign, and
observation date and time (LST). The data portion contains the complete
unedited record as received from the observation site. Each element is
classified as numeric [N] or alphanumeric [A] as indicated after each
element name. Values recorded in numeric elements are right justified
with unused positions zero-filled; signed numbers always begin with a "+"
or a "-" in the left-most position. Recorded values in alphanumeric
elements are left-justified and unused positions are filled with blanks.

Missing and unknown values of numeric elements are generally indicated by
all nines; sometimes recorded as a signed number. In instances when all
nines in a numeric element could represent a value within the range of
values for the element, another numeric constant (outside the range of
values) will be used to indicate missing/unknown. Missing and unknown
values of alpha-numeric elements are recorded as all blanks.

WBAN NUMBER [N]
The WBAN (Weather Bureau, Army, Navy) number is a five-digit number
unique to the station.

ICAO CALL SIGN [A]
The ICAO Call Sign is a location identifier, four characters in length,
and may consist of letters and numbers. Authority for assignment of
numbers is coordinated with the FAA, Dept. of the Navy, Transport Canada,
FCC and NWS. Call signs are left-justified in the field.

STATION CALL SIGN [A]
The Call sign is a location identifier, three or four characters
in length, and may consist of letters and numbers. Authority for
assignment of numbers is coordinated with the FAA, Dept. of the Navy,
Transport Canada, FCC and NWS. Call signs are left-justified in the
field.

YEAR [N]
The four-digit year of the observation with reference to Local Standard
Time (LST).

MONTH [N]
The month of the observation (LST). The values range from 01 - 12.

DAY [N]
The day of the observation (LST). The values range from 01 - 31.

HOUR [N]
The hour of the observation (LST). The hour is recorded on the 24-hour
clock system (e.g. 3 am is 03, 3 pm is 15, midnight is 00). The hours
are whole numbers and range from 00 to 23.

MINUTE [N]
The minute of the observation. Observations are recorded on whole five-
minute increments. The values may be 00, 05, 10,...,50 55.

RECORD LENGTH [N]
The length of the record, with no spaces, starting at the end of this
element.

DATE [A]
The date of the observation (LST). The format is MM/DD/YY.

Time [N]
The time of the observation (LST). the format is HH:MM:SS.

DATA TYPE [A]
Always = " 5-MIN ".

STATION CALL SIGN [A]
The Call sign is a location identifier, four characters in length, and
may consist of letters and numbers. Authority for assignment of numbers
is coordinated with the FAA, Dept. of the Navy, Transport Canada, FCC and
NWS. Call signs are left-justified in the field.

DAY TIME [A]
The day and time of the observation (UTC). The format is (ddhhmmZ).

OBSERVATION TYPE [A]
Only present when observation is in auto mode = " AUTO ".

ESTIMATED WIND [A]
An "E" may appear in the field to indicate that the wind speed, direction
or both were estimated by an observer and edited into the record.
Otherwise, the field is blank.

WIND DIRECTION [N]
Wind direction is recorded in tens of degrees from true north. Values
range from 00 to 36, where 0 indicates calm and 36 indicates true north.
Missing/unknown values are recorded as 99.

WIND SPEED [N]
Wind speed is reported in whole knots. A zero in the field indicates
calm conditions. Sensor range: 0-125 knots. Missing/unknown values are
recorded as 999.

WIND CHARACTER [A]
The character of the wind is indicated with a "G" for gust or a "Q" for
squall. The field is blank if there was no occurrence.

WIND CHAR SPEED [N]
The speed associated with the wind character. Speeds are in knots.
Missing/unknown values are recorded as 999.

VISIBILITY [N]
Visibility measured in miles. Reportable values are <1/4, 1/4, 1/2, 3/4,
1, 11/4, 11/2, 13/4, 2, 21/2, 3, 31/2, 4, 5, 7 and 10 or 10+. The
symbols valid for this element are: <, /, + and digits 0-9 inclusive.

WEATHER AND OBSTRUCTIONS [A]
The Weather and Obstruction field is a twenty-character field that
specifies the weather and/or obstruction occurring at the time of the
observation. The ASOS system reports precipitation (P-, R-, R, R+, ZR-,
ZR, S-, S, S+) and obstructions (H or F). Only one obstruction is
reported in a single observation. Other weather types may be edited into
the record by the observer. For a complete list of weather and
obstruction types, see the NWS Observing Handbook No. 7, or the Federal
Meteorological Handbook No. 1 (FMH-1).

SKY CONDITION [A]
The Sky Condition field is a twenty-five character field that specifies
the height and amount of up to three cloud layers as determined by the
ASOS ceilometer. The layers occur up to 12,000 ft. A ceiling
designation "M" is prefixed to the lowest broken or overcast layer, "W"
for indefinite ceiling, "X" for obscuration, and "V" for variable
ceiling. The observer may edit an "E" into the record when the automated
sensor is inoperative and the ceiling height is estimated.

Heights are given in hundredths of feet above the ground, e.g. 15 is 1500
ft. If no layers are detected below 12,000 ft. the message, "CLR BLO 120"
is entered. The layer amounts are SCT, BKN and OVC. Valid contractions
for this element are: CLR, BLO, SCT, BKN and OVC.

TEMPERATURE [Signed N]
Temperature is recorded in whole degrees Fahrenheit. Sensor range: -80
degrees Fahrenheit to +130 degrees Fahrenheit. Missing/unknown values
are recorded as 999.

DEW POINT [Signed N]
Dew-point temperature is recorded in whole degrees Fahrenheit.
Sensor range: -30 degrees Fahrenheit to +86 degrees Fahrenheit
Missing/unknown values are recorded as 999.

ALTIMETER SETTING [N]
The pressure value to which an aircraft altimeter scale is set so that it
will indicate the altitude above mean sea level of the aircraft on the
ground at the location where the pressure was determined. (The altimeter
scale has a range of 28.00 to 31.00 inches. The altimeter setting is
determined by subtracting the station elevation from the pressure
altitude and converting the remainder to inches of mercury. The
altimeter setting will then fall within the range of the altimeter
scale.) The altimeter setting is recorded in hundredths of an inch of
mercury using the units, tenths, and hundredths digits, e.g. 015 means an
altimeter setting of 30.15 inches. Missing/unknown values are recorded
as 444.

SEA-LEVEL PRESSURE [N]
Sea-level pressure is given in tenths of hectopascals (millibars). The
last three digits are recorded, e.g. 125 means 1012.5 hPa, 890 means
989.0 Hpa. Sensor range: 16.9" Hg - 31.5" Hg (572.3 hPa - 1066.7 hPa)
missing/unknown values are recorded as 444.

PRESSURE ALTITUDE [Signed N]

The height of the standard atmosphere at which the station pressure would
be observed. Pressure altitude is recorded in whole feet.
Missing/unknown values are recorded as -9999.

RELATIVE HUMIDITY [N]
The ratio, expressed as a percentage, of the actual vapor pressure of the
air to the saturation vapor pressure. (The amount of water vapor in the
air expressed as a percentage of the amount of water vapor the air could
hold at that same temperature and pressure). Range of values: 001-100
inclusive. Missing/unknown values are recorded as 999.

DENSITY ALTITUDE [N]
The pressure altitude corrected for temperature variations from the
standard atmosphere. Density altitude is reported in whole feet.
Missing/unknown values are recorded as -9999.

WIND DIRECTION - MAGNETIC [N]
The direction of the wind related to magnetic north. Wind direction is
recorded in tens of degrees from magnetic north. Values range from 000
to 360, where 000 indicates calm and 360 indicates magnetic north.
Missing/unknown values are recorded as 999.

WIND SPEED - MAGNETIC [N]
Wind speed is reported in whole knots. All zeros in the field indicate
calm conditions. Wind speed - magnetic is the same as wind speed
associated with true north. Missing/unknown values are recorded as 999.

REMARKS [A]
Remarks provide additional information about the observation, conditions
in the vicinity of the station and conditions during the past 3- to 24-
hour period. Observers may manually enter remarks in accordance with
FMH-1 procedures in addition to the ASOS remarks listed here. Whenever
remarks are not included, one space is recorded in this REMARKS section.

*CIG: Sky condition at secondary ceilometer site (e.g. Runway 11). e.g.
CIG 10 RY11.

*VSBY: Visibility at secondary sensor site (e.g. Runway 11). e.g. VSBY 2
RY11.

5appp: Pressure tendency and change reported at 3-hourly UTC times (00,
03, 06, 09, 12, 15, 18, 21).   e.g. 58033.

6RRR/: Precipitation amount of .01 inch or more for the past 6 hours at
00, 06, 12, 18 UTC and for the past 3 hours at 03, 09, 15, 21 UTC. A
trace amount is recorded as 6000/. e.g. 6008/ indicates .08 inch fell
during the period.

7RRRR: 24-hour UTC precipitation amount reported at 12 UTC. e.g. 70024.

1sTTT: Maximum temperature in degrees Fahrenheit for the past 6 hours
recorded at 6-hourly UTC times. "s" is the sign, 0 indicates positive and
1 indicates negative. e.g. 10067.

2sTTT: Minimum temperature in degrees Fahrenheit for the past 6 hours recorded at 6-hourly UTC times. "s" is the sign, 0 indicates positive and 1 indicates negative. e.g. 21007.

4sTTTsTTT: 24-hour calendar day max and min temperature in degrees Fahrenheit recorded at midnight local standard time. e.g. 400720043.

CIG minVmax: Variable ceiling in 100's of feet. e.g. CIG 23V30.

TWR VSBY: Visibility in statute miles reported by airport tower personnel. e.g. TWR VSBY 2.

SFC VSBY: Visibility in statute miles reported by ASOS visibility sensor. e.g. SFC VSBY 1/2.

VSBY minVmax: Variable visibility in statute miles. e.g. VSBY 1 3/4V2 1/2.

_Btt_Ett: Beginning and Ending of weather in minutes past the hour. e.g. SB07SE38RB38.

PCPN rrrr: Hourly precipitation amount in .01 inches since the last hour. Trace is PCPN 0000. Missing is M. e.g. PCPN 0009.

WSHFT hhmm: Time (UTC) wind shift began. e.g. WSHFT 1715.

WND ddVdd: Variable wind direction in tens of degrees. e.g. WND 23V30.

PK WND ddff/hhmm: Peak wind in tens of degrees, whole knots and time (UTC). e.g. PK WND 2032/1725.

PRESRR: Pressure rising rapidly.

PRESFR: Pressure falling rapidly.

PRJMP pp/hhmm/hhmm: Pressure jump in .01 inches of mercury with beginning and ending times. e.g. PRJMP 13/1250/1312.

PWINO: Precipitation identifier sensor not operational.

ZRNO: Freezing rain sensor not operational.

TNO: Thunderstorm information not available.

$: Maintenance check indicator.

3.   Start Date: Data begin in January 2000 for some stations.

4.   Stop Date: Ongoing.

5.   Coverage: Stations are located in the contiguous United States, Alaska, Hawaii, Puerto Rico, and some Pacific islands.

6.   How to Obtain Data:

    Recent data can be downloaded from
https://www.ncei.noaa.gov/data/automated-surface-observing-system-five-minute/access/
     Historical data can be downloaded from
https://www.ncei.noaa.gov/pub/data/asos-fivemin/ within the ./6401-*YEAR*/
subdirectories, where *YEAR* is a 4-digit year from 2000 to present.

Customers can also contact NCEI's Customer Engagement Branch.
    Phone: 828-271-4800
    FAX: 828-271-4876
    E-mail: NCEI.Orders@noaa.gov

7.   Known Uncorrected Problems: None.

8.   Quality Statement: This data set receives limited quality control at
the station. A discussion of quality control procedures for sensors may
be found in the ASOS User's Guide. No attempt to edit data or correct
transmission errors has been made at the NCEI.

9.   References: The ASOS User's guide gives specifics about the
observations, instruments, etc. The guide is available at
https://www.weather.gov/media/asos/aum-toc.pdf.