

I. DOWNLOAD QUICK START

Bulk GHCNh station data download access is available in three ways:

1. Period of record station files (data for all years and variables for a particular station)
2. Station/year files (one year of data for a particular station)
3. A tar file of all stations with data in a particular year
(See below)

Data Access Locations	<ul style="list-style-type: none"> • HTTPS WAF: <ol style="list-style-type: none"> 1. <a href="https://www.ncei.noaa.gov/oa/global-historical-climatology-network/index.html#hourly/access/by-station/GHCNh_<station>_por.psv">https://www.ncei.noaa.gov/oa/global-historical-climatology-network/index.html#hourly/access/by-station/GHCNh_<station>_por.psv 2. <a href="https://www.ncei.noaa.gov/oa/global-historical-climatology-network/index.html#hourly/access/by-year/<YYYY>/GHCNh_<station>_<YYYY>.psv">https://www.ncei.noaa.gov/oa/global-historical-climatology-network/index.html#hourly/access/by-year/<YYYY>/GHCNh_<station>_<YYYY>.psv 3. <a href="https://www.ncei.noaa.gov/oa/global-historical-climatology-network/index.html#hourly/archive/<archived files>">https://www.ncei.noaa.gov/oa/global-historical-climatology-network/index.html#hourly/archive/<archived files> <p>Where <station> refers to the GHCN identifier</p> • Example file URL: <ul style="list-style-type: none"> • https://www.ncei.noaa.gov/oa/global-historical-climatology-network/index.html#hourly/access/by_year/GHCNh_USW00003812_2023.psv
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For the tar files containing all stations with data for a particular year under the /archive directory, the naming convention is as follows:

File Name Pattern	ghcn-hourly_v1.a.b_dYYYY_cYYYYMMDD.tar.gz
File Name Field Definitions	ghcn-hourly = ProductShortName d = data date (i.e., the year provided in the file) c = creation date v1.<a.b> = version number YYYYMMDD = date tar = tar file gz = zipped

To view the inventory of GHCNh stations, download the "ghcnh-station-list.txt" or "ghcnh-station-list.csv" from this /doc folder. The ghcnh-station-list contains the names and coordinates for each GHCNh station record. The names and coordinates come from inventories provided by the data source providers.

<https://www.ncei.noaa.gov/oa/global-historical-climatology-network/index.html#hourly/doc/<files>>

The tar file can be untarred and uncompressed by using, e.g., the following Linux command:

```
tar xzvf ghcn-hourly_v1.a.b_dYYYY_cYYYYMMDD.tar.gz
```

ALTERNATIVELY, if you need data for only one or a few specific stations you can:

- Find the station name and identifier in the "ghcnh-station-list" file (e.g., PHOENIX AP [Airport] is "USW00023183"); and
- Then download the data file (i.e., the ".psv" file) for that GHCN_h station identifier (e.g., "GHCN_h_USW00023183_por.psv" has the data for the whole period of record for the PHOENIX AP) in the /access folder.
(<https://www.ncei.noaa.gov/data/global-historical-climatology-network-hourly/v1beta/access/>)

II. FORMAT OF "ghcnh-station-list.txt and ghcnh-station-list.csv"

The [ghcnh-station-list](#) files provide an inventory of the GHCN_h identifiers and coordinates. The same information is provided in NCEI's [Historical Observing Metadata Repository](#) (HOMR) database.

Variable, Columns (for fixed format), Type

ID, 1-11, Character
LATITUDE, 13-20, Real
LONGITUDE, 22-30, Real
ELEVATION, 32-37, Real
STATE, 39-40, Character
NAME, 42-71, Character
GSN FLAG, 73-75, Character
HCN/CRN FLAG, 77-79, Character
WMO ID, 81-85, Character

These variables have the following definitions:

ID=the station identification code. Note that the first two characters denote the FIPS country code, the third character is a network code that identifies the station numbering system used, and the remaining eight characters contain the actual

station ID.

See "[ghcn-countries.txt](#)" for a complete list of country codes.

See "[ghcn-states.txt](#)" for a list of state/province/territory codes.

The network code has the following potential values:

A = Retired WMO Identifier used by the USAF 14th Weather Squadron

U = unspecified (station identified by up to eight alphanumeric characters)

C = U.S. Cooperative Network identification number (last six characters of the GHCN ID)

I = International Civil Aviation Organization (ICAO) identifier

M = World Meteorological Organization ID (last five characters of the GHCN ID)

N = Identification number used by a National Meteorological or Hydrological Center partner

L = U.S. National Weather Service Location Identifier (NWSLI)

W = WBAN identification number (last five characters of the GHCN ID)

LATITUDE= latitude of the station (in decimal degrees). North (+); South (-)

LONGITUDE=the longitude of the station (in decimal degrees). East (+); West (-)

ELEVATION=the elevation of the station (in meters, missing = -999.9).

STATE=the U.S. postal code for the state (for U.S. stations only).

NAME=the name of the station.

GSN FLAG=a flag that indicates whether the station is part of the GCOS Surface Network (GSN). The flag is assigned by cross-referencing the number in the WMO ID field with the official list of GSN stations. There are two possible values:

Blank = non-GSN station or WMO Station number not available

GSN = GSN station

HCN/=a flag that indicates whether the station is part of the U.S.

CRN FLAG=Historical Climatology Network (HCN) or U.S. Climate Reference Network (CRN). There are three possible values:

Blank = Not a member of the U.S. Historical Climatology or U.S. Climate Reference Networks

HCN = U.S. Historical Climatology Network station
CRN = U.S. Climate Reference Network or U.S. Regional Climate
Network Station

WMO ID=the World Meteorological Organization (WMO) number for the station. If the station has no WMO number (or one has not yet been matched to this station), then the field is blank.

III. FORMAT OF THE “.psv” (“pipe-separated values”) DATA FILES

Each station “psv” file is made up of a unique identifier and time step followed by 30 variable fields, each with 5 associated metadata/attribute fields (see below for further details). All fields are “pipe” separated (pipe = “|”). Each of the variables and metadata fields are described with explicit names in a header line at the beginning of each station file. Note that the header length is quite long and is also pipe delimited.

Pipe-separated (.psv) files can easily be viewed with spreadsheet programs (e.g. Excel) by specifying the delimiter as a pipe “|”.

The variable names and attribute fields are described below

First, each station record is indexed to a single GHCN Station_ID and accompanying Station_name, Latitude, Longitude and Elevation, which was extracted from metadata provided by one or more data sources. Each observation is also indexed to a single Year, Month, Day, Hour and Minute in Coordinated Universal Time (UTC). Following the identifier, coordinates and time stamp for the observation, there are 38 sets of observations for 38 variables and their accompanying metadata/attributes as follows:

variable (see section IV, Table 1)
variable_Measurement_Code (see section V, Table 2)
variable_Quality_Code (see section VI, Table 3)
variable_Report_Type (see section VII, Table 4)
variable_Source_Code (see section VII, Table 5)
variable_Source_Station_ID (original identifier provided in the data source)

Where *variable* refers to the list of variables in Table 1 and their units. A list of potential Measurement_Codes by variable type is provided in Table 2. The list of Quality_Codes is provided in Table 3. Table 4 provides the list of possible report types. All column numbers and names are provided in Appendix Table A1.

IV. List of elements/variable

Table 1: Elements/Variables

temperature = 2 meter (circa) Above Ground Level Air (dry bulb) Temperature (°C to tenths)

dew_point_temperature = Dew Point Temperature (°C to tenths)

station_level_pressure = the pressure that is observed at a specific elevation and is the true barometric pressure of a location. It is the pressure exerted by the atmosphere at a point as a result of gravity acting upon the "column" of air that lies directly above the point.
(hPa)

sea_level_pressure = reduction estimates the pressure that would exist at sea level at a point directly below the station using a temperature profile based on temperatures that actually exist at the station (hPa)

wind_direction = Wind Direction from true north using compass directions (e.g. 360 = true north, 180 = south, 270 = west, etc.). Note: A direction of "000" is given for calm winds.(whole degrees)

wind_speed = Wind Speed (meters per second)

wind_gust = Peak short duration (usually < 20 seconds) wind speed (meters per second) that exceeds the wind_speed average

precipitation = total liquid precipitation (rain or melted snow) for past hour; a "T" in the measurement code column indicates a trace amount of precipitation (millimeters)

relative_humidity = Relative humidity is calculated from air (dry bulb) temperature and dew point temperature (whole percent)

wet_bulb_temperature = Wet bulb temperature (°C to tenths)

pres_wx_MW1 = Present weather observation; MW1 - MW3 is sourced from manual reports; up to 3 observations per report (code)

pres_wx_MW2 = see above

pres_wx_MW3 = see above

pres_wx_AU1 = Present weather observation; AU1 - AU3 is sourced from automated ASOS/AWOS sensors; up to 3 observations per report (code)

pres_wx_AU2 = see above

pres_wx_AU3 = see above

pres_wx_AW1 = Present weather observation; AW1 - AW3 is sourced from automated sensors;
up to 3 observations per report (code)

pres_wx_AW2 = see above

pres_wx_AW3 = see above

snow_depth = depth of snowpack on the ground (centimeters/m)

visibility = horizontal distance at which an object can be seen and identified (kilometers)

altimeter = the pressure "reduced" to mean sea level using the temperature profile of the
"standard" atmosphere, which is representative of average conditions over the United
States at 40 degrees north latitude (millibars/hPa)

pressure_3hr_change = change in atmospheric pressure measured at the beginning and end of
a three hour period; accompanied by tendency code in measurement code field
(millibars/hPa)

sky_cover_1 = Fraction of total celestial dome with sky coverage; defines a layer in oktas (i.e.
eights) or tenths of sky covered by cloud; up to 3 observations (code); see Table X for
code definitions

sky_cover_2

sky_cover_3

Note: Since up to 3 cloud layers can be reported, the full state of the sky can best be
determined by the last layer's value. In other words if three layers are reported and the
third layer uses BKN then the total state of sky is BKN which is similar in definition to
"mostly cloudy." OVC is similar to "cloudy" or overcast and FEW or SCT is similar to
"partly cloudy." In cases where there are more than 3 cloud layers, the highest layers will
not be reported.

Values in oktas:

00:CLR:00

01:FEW:01

02:FEW:02

03:SCT:03

04:SCT:04

05:BKN:05

06:BKN:06

07:BKN:07

08:OVC:08

09:VV:09

10:X

sky_cover_baseht_1 = Discrete cloud base heights at lowest point of layer; up to 3 vertical
layers can be reported; clear skies reported as a single layer (meters)

sky_cover_baseht_2 = see above

sky_cover_baseht_3 = see above

precipitation_3_hour = 3-hour total liquid precipitation (rain or melted snow) accumulation from FM12/SYNOP reports; a "T" in the measurement code column indicates a trace amount of precipitation (millimeters); accumulations can be reported over 3, 6, 9, 12, 15, 18, 21 and 24 hours.

precipitation_6_hour = see above

precipitation_9_hour = see above

precipitation_12_hour = see above

precipitation_15_hour = see above

precipitation_18_hour = see above

precipitation_21_hour = see above

precipitation_24_hour = see above

remarks = Hourly Remarks present the raw surface observation data in the original format encoded into ICAO-standardized METAR (FM15) or FM12 (SYNOP), FM16 (SPECI) etc format for global dissemination. Further information on decoding these observations can be found in the Federal Meteorological Handbook (FMH) No. 1, Surface Weather Observations & Reports.

V. List of Measurement Codes

Table 2: Element Measurement Codes (where applicable)

Wind Speed / Wind Direction:

A-Abr-Beauf

B-Beaufort

C-Calm

H-5min-avg-spd

N-Normal

R-60min-avg-spd

Q-Squall

T-180min-avg-spd

V-Variable

9-Missing

Atmospheric Pressure Tendency (3-hour pressure change):

Note: in general a 0 through 3 here indicates an increase in pressure over the previous 3 hours and a 5 through 8 indicates a decrease over the previous 3 hours and 4 indicates no change during the previous 3 hours).

0-Incr-then-decr;-atm-pres-same-or-higher-than-3-hrs-ago

1-Incr-then-steady;-or-incr.-then-incr-more-slowly;-atm-pres-now-higher-than-3-hrs-ago

2-Incr-(steadily-or-unsteadily);-atm-pres-now-higher-than-3-hrs-ago
3-Decr-or-steady,-then-incr;-or-incr,-then-incr-more-rapidly;-atm-pres-now-higher-than-3-hrs-ago
4-Steady;-atm-pres-the-same-as-3-hrs-ago
5-Decr,-then-incr;-atm-pres-the-same-or-lower-than-3-hrs-ago
6-Decr,-then-steady;-or-decr,-then-decr-more-slowly;-atm-pres-now-lower-than-3-hrs-ago
7-Decr-(steadily-or-unsteadily);-atm-pres-now-lower-than-3-hrs-ago
8-Steady-or-incr,-then-decr;-or-decr,-then-decr-more-rapidly;-atm-pres-now-lower-than-3-hrs-ago
9-Missing

Visibility (code varies by source)

Sources 220, 221, 222, 223, 347, 348

A-Aircraft-horiz-vis
L-Aircraft-slant-rng-vis
M-Max
N-Min
P-Prevailing
S-Sector
9-Missing

Sources: 313, 314, 315, 322, 335, 343, 344, 345, 346

N-Not-variable
V-Variable
9-Missing

Precipitation (code varies by source)

Sources: 313, 314, 315, 335, 343, 344, 345, 346, 322

0-None
1-Measurement-impossible-or-inaccurate
2-Trace
3-Measurable
9-Missing

Sources: 220, 221, 222, 223, 347, 348

1-Measurement-impossible-or-inaccurate
2-Trace
3-Begin-accumulated-period-(precipitation-amount-missing-until-end-of-accumulated-period)
4-End-accumulated-period
5-Begin-deleted-period-(precipitation-amount-missing-due-to-data-problem)
6-End-deleted-period
7-Begin-missing-period
8-End-missing-period
E-Estimated-data-value-(eg-from-nearby-station)

I-Incomplete-precipitation-amount,-excludes-one-or-more-missing-reports,-such-as-one-or-more-15-minute-reports-not-included-in-the-1-hour-precipitation-total
J-Incomplete-precipitation-amount,-excludes-one-or-more-erroneous-reports,-such-as-one-or-more-1-hour-precipitation-amounts-excluded-from-the-24-hour-total
9-Missing

Sky cover:

00-None,SKC-or-CLR
01-One-okta-1/10-or-less-but-not-zero
02-Two-oktas-2/10-3/10-or-FEW
03-Three-oktas-4/10
04-Four-oktas-5/10,-or-SCT
05-Five-oktas-6/10
06-Six-oktas-7/10-8/10
07-Seven-oktas-9/10-or-more-but-not-10/10,-or-BKN
08-Eight-oktas-10/10,-or-OVC
09-Sky-obscured,-or-cloud-amount-cannot-be-estimated
10-Partial-obscuration
99-Missing

Snow depth (code varies by source):

Sources: 220, 221, 222, 223, 347, 348

0-None
1-Unmeasurable
2-Snow-cover-not-continuous
3-Measurable
9-Missing

Sources: 313, 314, 315, 335, 343, 344, 345, 346, 322

1-Measurement-impossible-or-inaccurate
2-Snow-cover-not-continuous
3-Trace
4-End-accumulated-period-(data-include-more-than-one-day)
5-End-deleted-period-(data-eliminated-due-to-quality-problems)
6-End-missing-period
E-Estimated-data-value-(eg,-from-nearby-station)
9-Missing

VI. List of Quality Check codes

Table 3: QC (code varies by source)

A general set of quality control checks is applied to a subset of variables after all sources are integrated into a set of unique period of record station files. These checks are described in Dunn

et al. (2016). In addition, GHCNh preserves the Quality Control information of its component sources. The set of general flags that apply to the integrated set of sources and the variables *temperature*, *dew_point_temperature*, *station_level_pressure*, *sea_level_pressure*, *wind_direction*, and *wind_speed*

The list of codes include:

"L" : "0," # failed Logical consistency
"o" : "1," # outlier check
"F" : "2," # Frequent value check
"U" : "3," # diurnal inconsistency check
"D" : "4," # Distribution 1
"d" : "5," # distribution 2
"W" : "6," # World records exceedance
"K" : "7," # Streak check
"C" : "8," # Climatological outlier
"T" : "9," # Timestamp issue
"S" : "10," # Spike check
"h" : "11," # humidity
"V" : "12," # Variance
"w" : "13," # winds
"N" : "14," # Neighbor comparison outlier
"E" : "15," # clean up
"p" : "16," # pressure
"H" : "17," # High flag rate

The Legacy Codes for Sources 313, 314, 315, 322, 335, 343, 344, 345, 346 include

0 = Passed gross limits check

1 = Passed all quality control checks

2 = Suspect

3 = Erroneous

4 = Passed gross limits check, data originate from an NCEI data source

5 = Passed all quality control checks, data originate from an NCEI data source

6 = Suspect, data originate from an NCEI data source

7 = Erroneous, data originate from an NCEI data source

9 = Passed gross limits check if element is present

A – Data value flagged as suspect, but accepted as good value.

U – Data value replaced with edited value.

P – Data value not originally flagged as suspect, but replaced by validator.

I – Data value not originally in data, but inserted by validator.

M – Manual change made to value based on information provided by NWS or FAA.

C – Temperature and dew point received from Automated Weather Observing Systems (AWOS) are reported in whole degrees Celsius. Automated QC flags these values, but they are accepted as valid.

R – Data value replaced with value computed by NCEI software.

And Legacy Codes for Sources: 220, 221, 222, 223, 347, 348 include

0 Not Checked

1 Good

2 Suspect

3 Erroneous

4 Calculated

5 Removed

Derived variables (relative humidity and wet-bulb temperature) can have the following QC flags:

o - Out of range (relative humidity only - with values < 1 or > 100)

f - Suspect or Error flags for 1 or more of the input measurements

VII. List of report types

Table 4: Report types

AERO:AERO-Aerological

AUST:AUST-Australia

AUTO:AUTO

BOGUS:BOGUS

BRAZ:BRAZ-Brazil

COOPD:COOPD-USCOOP-SOD

COOPS:COOPS-USCOOP-soiltemp

CRB:CRB-Clim-Ref-Book-from-CDMP

CRN05:CRN05-CRN5min

CRN15:CRN15-CRN15min

FM-12:FM12-SYNOP-fixed-land-stn

FM-13:FM13-SHIP-sea-stn

FM-14:FM14-SYNOP-MOBIL-mobile-land-stn

FM-15:FM15-METAR-Aviation-routine-wx

FM-16:FM16-SPECI-Aviation-selected-special-wx

FM-18:FM18-BUOY

GREEN:GREEN-Greenland

MESOH:MESOH-Hydro-MESONET-civ-govt

MESOS:MESOS-MESONET-civ-govt

MESOW:MESOW-Snow-MESONET-civ-govt

MEXIC:MEXIC-Mexico

NSRDB:NSRDB-Natl-Sol-Rad-Data-Base

PCP15:PCP15-US-15-min-precip-network

PCP60:PCP60-US-60-min-precip-network

S-S-A:SAA-Synoptic-airways-auto-merged
SA-AU:SAAU-Airways-auto-merged
SAO:SAO-Airways-incl-record-specials
SAOSP:SAOSP-Airways-special-excl-record-specials
SHEF:SHEF-Std-Hydro-Exch-Frmt
SMARS:SMARS-Supp-airways-stn
SOD:SOD-ASOS-AWOS
SOM:SOM-ASOS-AWOS
SURF:SURF-Surf-Rad-Net
SY-AE:SYAE-Synop-and-aero-merged
SY-AU:SYAU-Synop-and-auto-merged
SY-MT:SYMT-Synop-and-METAR-merged
SY-SA:SYSA-Synop-and-airways-merged
WBO:WBO
WNO:WNO-WashNavObs
99999:999999-Missing

VIII. Present weather code descriptors

Table 4(a-c): Present Weather Element and Measurement Codes

Weather codes (AU / AW / MW) describe precipitation or obstructions to vision occurring at the time of observation. It is not uncommon for one type of element to be reported without another. In other words, it is possible to have an AU element without an AW element or MW element. Depending on equipment used at the location, some automated stations report AW codes either with or instead of AU codes. Manually augmented stations report MW codes either with or instead of AU and AW codes. Definitions of element and measurement codes:

Table 4(a) – pres_wx_MW1[2][3] (sourced from manual reports)

00-Cloud
01-Clouds
02-State
03-Clouds
FU:04-Visibility-reduced-by-smoke,-e.g.-veldt-or-forest-fires,-industrial-smoke-or-volcanic-ashes
HZ:05-Haze
DU:06-Widespread-dust-in-suspension-in-the-air,-not-raised-by-wind-at-or-near-the-station-at-th
e-time-of-observation
DU:07-Dust-or-sand-raised-by-wind-at-or-near-the-station-at-the-time-of-observation-but-no-well
-developed-dust-whirl(s)-or-sand-whirl(s),-and-no-duststorm-or-sandstorm-seen-or,-in-the-ca
se-of-ships,-blowing-spray-at-the-station
DU:08-Well-developed-dust-whirl(s)-or-sand-whirl(s)-seen-at-or-near-the-station-during-the-prec
eding-hour-or-at-the-time-of-observation,-but-no-duststorm-or-sandstorm

DU:09-Duststorm-or-sandstorm-within-sight-at-the-time-of-observation,-or-at-the-station-during-the-preceding-hour

FG:11-Patches-of-shallow-fog-or-ice-fog-at-the-station,-whether-on-land-or-sea,-not-deeper-than-about-2-meters-on-land-or-10-meters-at-sea

FG:12-More-or-less-continuous-shallow-fog-or-ice-fog-at-the-station,-whether-on-land-or-sea,-not-deeper-than-about-2-meters-on-land-or-10-meters-at-sea

13-Lightning-visible,-no-thunder-heard

14-Precipitation-within-sight,-not-reaching-the-ground-or-the-surface-of-the-sea

15-Precipitation-within-sight,-reaching-the-ground-or-the-surface-of-the-sea,-but-distant,-i.e.,-estimated-to-be-more-than-5-km-from-the-station

16-Precipitation-within-sight,-reaching-the-ground-or-the-surface-of-the-sea,-near-to,-but-not-at-the-station

TS:17-Thunderstorm,-but-no-precipitation-at-the-time-of-observation

SQ:18-Squalls-at-or-within-sight-of-the-station-during-the-preceding-hour-or-at-the-time-of-observation

FC:19-Funnel-cloud(s)-(Tornado-cloud-or-waterspout)-at-or-within-sight-of-the-station-during-the-preceding-hour-or-at-the-time-of-observation

20-Drizzle-(not-freezing)-or-snow-grains-not-falling-as-shower(s)-(during-the-preceding-hour-but-not-at-the-time-of-observation)

21-Rain-(not-freezing)-not-falling-as-shower(s)-(during-the-preceding-hour-but-not-at-the-time-of-observation)

22-Snow-not-falling-as-shower(s)-(during-the-preceding-hour-but-not-at-the-time-of-observation)

23-Rain-and-snow-or-ice-pellets-not-falling-as-shower(s)-(during-the-preceding-hour-but-not-at-the-time-of-observation)

24-Freezing-drizzle-or-freezing-rain-not-falling-as-shower(s)-(during-the-preceding-hour-but-not-at-the-time-of-observation)

25-Shower(s)-of-rain-(during-the-preceding-hour-but-not-at-the-time-of-observation)

26-Shower(s)-of-snow-or-of-rain-and-snow-(during-the-preceding-hour-but-not-at-the-time-of-observation)

27-Shower(s)-of-hail-(Hail,-small-hail,-snow-pellets),-or-rain-and-hail-(during-the-preceding-hour-but-not-at-the-time-of-observation)

28-Fog-or-ice-fog-(during-the-preceding-hour-but-not-at-the-time-of-observation)

29-Thunderstorm-(with-or-without-precipitation)-(during-the-preceding-hour-but-not-at-the-time-of-observation)

DU:30-Slight-or-moderate-duststorm-or-sandstorm-has-decreased-during-the-preceding-hour

DU:31-Slight-or-moderate-duststorm-or-sandstorm-no-appreciable-change-during-the-preceding-hour

DU:32-Slight-or-moderate-duststorm-or-sandstorm-has-begun-or-has-increased-during-the-preceding-hour

DU:33-Severe-duststorm-or-sandstorm-has-decreased-during-the-preceding-hour

DU:34-Severe-duststorm-or-sandstorm-no-appreciable-change-during-the-preceding-hour

DU:35-Severe-duststorm-or-sandstorm-has-begun-or-has-increased-during-the-preceding-hour

DRSN:36-Slight-or-moderate-drifting-snow-generally-low-(below-eye-level)

DRSN:37-Heavy-drifting-snow-generally-low-(below-eye-level)

BLSN:38-Slight-or-moderate-blowing-snow-generally-high-(above-eye-level)
BLSN:39-Heavy-blowing-snow-generally-high-(above-eye-level)
FG:40-Fog-or-ice-fog-at-a-distance-at-the-time-of-observation,-but-not-at-the-station-during-the-
preceding-hour,-the-fog-or-ice-fog-extending-to-a-level-above-that-of-the-observer
FG:41-Fog-or-ice-fog-in-patches
FG:42-Fog-or-ice-fog,-sky-visible,-has-become-thinner-during-the-preceding-hour
FG:43-Fog-or-ice-fog,-sky-invisible,-has-become-thinner-during-the-preceding-hour
FG:44-Fog-or-ice-fog,-sky-visible,-no-appreciable-change-during-the-preceding-hour
FG:45-Fog-or-ice-fog,-sky-invisible,-no-appreciable-change-during-the-preceding-hour
FG:46-Fog-or-ice-fog,-sky-visible,-has-begun-or-has-become-thicker-during-the-preceding-hour
FG:47-Fog-or-ice-fog,-sky-invisible,-has-begun-or-has-become-thicker-during-the-preceding-ho
ur
FG:48-Fog,-depositing-rime,-sky-visible
FG:49-Fog,-depositing-rime,-sky-invisible
DZ:50-Drizzle,-not-freezing,-intermittent,-slight-at-time-of-observation
DZ:51-Drizzle,-not-freezing,-continuous,-slight-at-time-of-observation
DZ:52-Drizzle,-not-freezing,-intermittent,-moderate-at-time-of-observation
DZ:53-Drizzle,-not-freezing,-continuous,-moderate-at-time-of-observation
DZ:54-Drizzle,-not-freezing,-intermittent,-heavy-(dense)-at-time-of-observation
DZ:55-Drizzle,-not-freezing,-continuous,-heavy-(dense)-at-time-of-observation
FZDZ:56-Drizzle,-freezing,-slight
FZDZ:57-Drizzle,-freezing,-moderate-or-heavy-(dense)
DZ:58-Drizzle-and-rain,-slight
DZ:59-Drizzle-and-rain,-moderate-or-heavy
RA:60-Rain,-not-freezing,-intermittent,-slight-at-time-of-observation
RA:61-Rain,-not-freezing,-continuous,-slight-at-time-of-observation
RA:62-Rain,-not-freezing,-intermittent,-moderate-at-time-of-observation
RA:63-Rain,-not-freezing,-continuous,-moderate-at-time-of-observation
RA:64-Rain,-not-freezing,-intermittent,-heavy-at-time-of-observation
RA:65-Rain,-not-freezing,-continuous,-heavy-at-time-of-observation
FZRA:66-Rain,-freezing,-slight
FZRA:67-Rain,-freezing,-moderate-or-heavy
RA:68-Rain-or-drizzle-and-snow,-slight
RA:69-Rain-or-drizzle-and-snow,-moderate-or-heavy
SN:70-Intermittent-fall-of-snowflakes,-slight-at-time-of-observation
SN:71-Continuous-fall-of-snowflakes,-slight-at-time-of-observation
SN:72-Intermittent-fall-of-snowflakes,-moderate-at-time-of-observation
SN:73-Continuous-fall-of-snowflakes,-moderate-at-time-of-observation
SN:74-Intermittent-fall-of-snowflakes,-heavy-at-time-of-observation
SN:75-Continuous-fall-of-snowflakes,-heavy-at-time-of-observation
76-Diamond-dust-(with-or-without-fog)
SG:77-Snow-grains-(with-or-without-fog)
SN:78-Isolated-star-like-snow-crystals-(with-or-without-fog)
PL:79-Ice-pellets

SHRA:80-Rain-shower(s),-slight
 SHRA:81-Rain-shower(s),-moderate-or-heavy
 SHRA:82-Rain-shower(s),-violent
 SHRASN:83-Shower(s)-of-rain-and-snow-mixed,-slight
 SHRASN:84-Shower(s)-of-rain-and-snow-mixed,-moderate-or-heavy
 SHSN:85-Show-shower(s),-slight
 SHSN:86-Snow-shower(s),-moderate-or-heavy
 SH:87-Shower(s)-of-snow-pellets-or-small-hail,-with-or-without-rain-or-rain-and-snow-mixed,-slight
 SH:88-Shower(s)-of-snow-pellets-or-small-hail,-with-or-without-rain-or-rain-and-snow-mixed,-moderate-or-heavy
 SH:89-Shower(s)-of-hail-(hail,-small-hail,-snow-pellets),-with-or-without-rain-or-rain-and-snow-mixed,-not-associated-with-thunder,-slight
 SH:90-Shower(s)-of-hail-(hail,-small-hail,-snow-pellets),-with-or-without-rain-or-rain-and-snow-mixed,-not-associated-with-thunder,-moderate-or-heavy
 RA:91-Slight-rain-at-time-of-observation,-thunderstorm-during-the-preceding-hour-but-not-at-time-of-observation
 RA:92-Moderate-or-heavy-rain-at-time-of-observation,-thunderstorm-during-the-preceding-hour-but-not-at-time-of-observation
 93-Slight-snow,-or-rain-and-snow-mixed-or-hail-(Hail,-small-hail,-snow-pellets),-at-time-of-observation,-thunderstorm-during-the-preceding-hour-but-not-at-time-of-observation
 94-Moderate-or-heavy-snow,-or-rain-and-snow-mixed-or-hail-(Hail,-small-hail,-snow-pellets)-at-time-of-observation,-thunderstorm-during-the-preceding-hour-but-not-at-time-of-observation
 TS:95-Thunderstorm,-slight-or-moderate,-without-hail-(Hail,-small-hail,-snow-pellets),-but-with-rain-and/or-snow-at-time-of-observation,-thunderstorm-at-time-of-observation
 TS:96-Thunderstorm,-slight-or-moderate,-with-hail-(hail,-small-hail,-snow-pellets)-at-time-of-observation,-thunderstorm-at-time-of-observation
 TS:97-Thunderstorm,-heavy,-without-hail-(Hail,-small-hail,-snow-pellets),-but-with-rain-and/or-snow-at-time-of-observation,-thunderstorm-at-time-of-observation
 TS:98-Thunderstorm-combined-with-duststorm-or-sandstorm-at-time-of-observation,-thunderstorm-at-time-of-observation
 TS:99-Thunderstorm,-heavy,-with-hail-(Hail,-small-hail,-snow-pellets)-at-time-of-observation,-thunderstorm-at-time-of-observation

Table 4(b) pres_wx_AW1[2][3] (sourced from automated sensors)

Note: Codes 20-26 are used to report precipitation, fog, thunderstorm at the station during the preceding hour, but not at the time of observation

00-No-significant-weather-observed
 01-Clouds-generally-dissolving-or-becoming-less-developed
 02-State-of-sky-on-the-whole-unchanged-during-the-past-hr
 03-Clouds-generally-forming-or-developing-during-the-past-hr
 HZ:04-Haze,-smoke,-or-dust-in-suspension-in-the-air,-visibility-equal-to-or-greater-than-1km

FU:05

DU:07-Dust-or-sand-raised-by-wind-at-or-near-the-station-at-the-time-of-observation,-but-no-well-developed-dust-whirl(s)-or-sand-whirl(s),-and-no-duststorm-or-sandstorm-seen-or,-in-the-case-of-ships,-blowing-spra

y-at-the-station

BR:10-Mist

11-Diamond-dust

12-Distant-lightning

SQ:18-Squalls

20-Fog-(during-preceding-hour-but-not-at-time-of-observation)

21-Precipitation-(during-preceding-hour-but-not-at-time-of-observation)

22-Drizzle-(not-freezing)-or-snow-grains-(during-preceding-hour-but-not-at-time-of-observation)

23-Rain-(not-freezing)-(during-preceding-hour-but-not-at-time-of-observation)

24-Snow-(during-preceding-hour-but-not-at-time-of-observation)

25-Freezing-drizzle-or-freezing-rain-(during-preceding-hour-but-not-at-time-of-observation)

26-Thunderstorm-(with-or-without-precipitation)-(during-preceding-hour-but-not-at-time-of-observation)(during-preceding-hour-but-not-at-time-of-observation)

27-Blowing-or-drifting-snow-or-sand

28-Blowing-or-drifting-snow-or-sand,-visibility-equal-to-or-greater-than-1-km

29-Blowing-or-drifting-snow-or-sand,-visibility-less-than-1-km

FG:30-Fog

FG:31-Fog-or-ice-fog-in-patches

FG:32-Fog-or-ice-fog,-has-become-thinner-during-the-past-hour

FG:33-Fog-or-ice-fog,-no-appreciable-change-during-the-past-hour

FG:34-Fog-or-ice-fog,-has-begun-or-become-thicker-during-the-past-hour

FG:35-Fog,-depositing-rime

40-Precipitation

41-Precipitation,-slight-or-moderate

42-Precipitation,-heavy

43-Liquid-precipitation,-slight-or-moderate

44-Liquid-precipitation,-heavy

45-Solid-precipitation,-slight-or-moderate

46-Solid-precipitation,-heavy

47-Freezing-precipitation,-slight-or-moderate

48-Freezing-precipitation,-heavy

DZ:50-Drizzle

DZ:51-Drizzle,-not-freezing,-slight

DZ:52-Drizzle,-not-freezing,-moderate

DZ:53-Drizzle,-not-freezing,-heavy

FZDZ:54-Drizzle,-freezing,-slight

FZDZ:55-Drizzle,-freezing,-moderate

FZDZ:56-Drizzle,-freezing,-heavy

DZ:57-Drizzle-and-rain,-slight

DZ:58-Drizzle-and-rain,-moderate-or-heavy

RA:60-Rain
 RA:61-Rain,-not-freezing,-slight
 RA:62-Rain,-not-freezing,-moderate
 RA:63-Rain,-not-freezing,-heavy
 FZRA:64-Rain,-freezing,-slight
 FZRA:65-Rain,-freezing,-moderate
 FZRA:66-Rain,-freezing,-heavy
 RA:67-Rain-or-drizzle-and-snow,-slight
 RA:68-Rain-or-drizzle-and-snow,-moderate-or-heavy
 SN:70-Snow
 SN:71-Snow,-slight
 SN:72-Snow,-moderate
 SN:73-Snow,-heavy
 PL:74-Ice-pellets,-slight
 PL:75-Ice-pellets,-moderate
 PL:76-Ice-pellets,-heavy
 SG:77-Snow-grains
 IC:78-Ice-crystals
 80-Showers-or-intermittent-precipitation
 SHRA:81-Rain-showers-or-intermittent-rain,-slight
 SHRA:82-Rain-showers-or-intermittent-rain,-moderate
 SHRA:83-Rain-showers-or-intermittent-rain,-heavy
 SHRA:84-Rain-showers-or-intermittent-rain,-violent
 SHSN:85-Snow-showers-or-intermittent-snow,-slight
 SHSN:86-Snow-showers-or-intermittent-snow,-moderate
 SHSN:87-Snow-showers-or-intermittent-snow,-heavy
 89-Hail
 TS:90-Thunderstorm
 TS:91-Thunderstorm,-slight-or-moderate,-with-no-precipitation
 TS:92-Thunderstorm,-slight-or-moderate,-with-rain-showers-and/or-snow-showers
 TS-HAIL:93-Thunderstorm,-slight-or-moderate,-with-hail
 TS:94-Thunderstorm,-heavy,-with-no-precipitation
 TS:95-Thunderstorm,-heavy,-with-rain-showers-and/or-snow
 TS+HAIL:96-Thunderstorm,-heavy,-with-hail
 +FC:99-Tornado

Table 4(c) pres_wx_AU1[2][3] (sourced from automated ASOS/AWOS sensors)

Codes can be a sequential order/combination of several sub-codes for weather intensity, descriptor, precipitation, obscuration and other:

Intensity

- 1:- (light)
- 3:+ (heavy)

4:VC (vicinity-(apparent-but-not-at-point-of-observation))

Descriptor

MI = shallow

PR = partial

BC = patches

DR = low-drifting

BL = blowing

SH = showers

TS = thunderstorm

FZ = freezing

Precipitation

DZ:01-Drizzle

RA:02-Rain

SN:03-Snow

SG:04-Snow-Grains

IC:05-Ice-Crystals

PL:06-Ice-Pellets

GR:07-Hail

GS:08-Small-Hail-and/or-Snow-Pellets

UP:09-Unknown-Precipitation

Obscuration

BR:1-Mist

FG:2-Fog

FU:3-Smoke

VA:4-Volcanic-Ash

DU:5-Widespread-Dust

SA:6-Sand

HZ:7-Haze

PY:8-Spray

Other weather:

PO:1-Well-developed-dust/sand-whirls

SQ:2-Squalls

FC:3-Funnel-Cloud,-Waterspout-or-Tornado

SS:4-Sandstorm

DS:5-Duststorm

IX. List of Data Source Codes and attributes

Table 5: Data Source Codes

Source code	Source Data Policy	Dataset name	source_name	domain	First year	Last year
83	Open Access	Deutscher Wetterdienst	Deutscher Wetterdienst subdaily	Germany		
88	Creative Commons Attribution	unden_UERRA_algeria	Bulletin Meteorologique de Algerie—Contact: Per Unden	Algeria	1879	1968
158	Creative Commons Attribution 4.0	Met Eirann	Met Eirann Synoptic	Ireland		
171	Open Access	meteo_godisnjak_UERRA_europe	Meteoroloski godisnjak 1 Bulteni Available through NOAA CDMP	Europe	1877	2012
172	Open Access	kaspar_UERRA_europe	Cyprus Meteorological Returns Norwegian Meteorological Institute Contact: Cristian Lussana cristianl@met.no and Provi	Europe	1881	1922
173	Open Access	unden_UERRA_europe	Rocenka Contact: Per Unden Per.Unden@smhi.se	Europe	1948	1968
174	Open Access	egypt_daily_weather_UERRA_africa	Egypt Daily Weather Report	Africa	1948	1957

175	Open Access	romainian_met_UERRA_africa/europeG176	Romanian National Meteorological Administration Bulteni Available through NOAA CDMP	Africa/Europe	1950	1977
176	Open Access	dwd_UERRA_europe	UERRA_Deutscher Wetterdienst	Europe	1958	1978
177	Open Access	lussana_UERRA_europe	Instituto Nacional de Meteorología Banco de Datos Contact: Cristian Lussana cristianl@met.no	Europe	1959	1984
179	Open Access	slovenia_met_UERRA_europe	Slovenian Environmental Agency Available through NOAA CDMP	Europe	1950	1977
180	Open Access	yillik_UERRA_europe	UERRA_Yillik	Europe	1950	1971
220	WMO Resolution 40	USAF/14th Weather Squadron Surface Weather Observation database	Stations indexed to World Meteorological Organization (WMO) Identifier	Global		
221	WMO Resolution 40	USAF/14th Weather Squadron Surface Weather Observation database	Stations indexed to former World Meteorological Organization (WMO) Identifiers (termed "AFWA" id's)	Global		
222	WMO Resolution 40	USAF/14th Weather Squadron Surface Weather Observation database	NOAA Coastal -Marine Automated Network (C-MAN) stations	North America		
223	WMO Resolution 40	USAF/14th Weather Squadron Surface	Stations indexed to an International Civil	Global		

		Weather Observation database	Aviation Organization (ICAO) Identifier			
246	WMO resolution 40	ISPD_International Surface Pressure databank_Federal Climate Com	International Surface Pressure databank_Federal Complex Integrated Surface Data	Global	1928	1948
247	Open Access	ISPD_International Surface Pressure databank_CDMP SAO/1001 For	International Surface Pressure databank_CDMP SAO/1001 Forms USA	Global	1849	2000
248	Open Access	ISPD_International Surface Pressure databank_Russian Empire Station	International Surface Pressure databank_Russian Empire Stations	Global	1901	1973
249	Mixed data policy	ISPD_International Surface Pressure databank_Air Weather Service T	International Surface Pressure databank_Air Weather Service TD13 USA	Global	1833	2017
250	Open Access	ISPD_International Surface Pressure databank_Hadley Center UK_su	International Surface Pressure databank_Hadley Center UK	Global	1800	1980
251	WMO resolution 40	ISPD_International Surface Pressure databank_CDMP-International c	International Surface Pressure databank_CDMP-International collection	Global	1947	2007

252	Open Access	ISPD_International Surface Pressure databank_READER Antarctic&So	International Surface Pressure databank_READER Antarctic&Southern Hemisphere	Global	1911	2006
253	Creative Commons Attri	ISPD_International Surface Pressure databank_KNMI Holland_sub_d	International Surface Pressure databank_KNMI Holland	Global	1816	1932
254	Open Access	ISPD_International Surface Pressure databank_US Army Signal Service	International Surface Pressure databank_US Army Signal Service and other 19th Century Voluntary Obs	Global	1784	1961
255	Open Access	ISPD_International Surface Pressure databank_international stations	International Surface Pressure databank_international stations recovered by Atmospheric Circulation Reconstructions o	Global	1848	1915
256	Open Access	ISPD_International Surface Pressure databank_Early Arctic observation	International Surface Pressure databank_Early Arctic observations	Global	1877	1978
257	Open Access	ISPD_International Surface Pressure databank_EURO4M/MEDARE/C3	International Surface Pressure databank_EURO4M/MEDARE/C3 hourly SLP observations for North African stations	Global	1843	1914

258	Open Access	ISPD_International Surface Pressure databank_International stations	International Surface Pressure databank_International stations, University of South Carolina Historical Climate Lab	Global		
259	WMO resolution 40	ISPD_International Surface Pressure databank_Meteo_France_sub_d	International Surface Pressure databank_Meteo_France	Global	1822	1956
260	WMO resolution 40	ISPD_International Surface Pressure databank_University of Giessen	International Surface Pressure databank_University of Giessen worldwide early data	Global	1871	1996
261	WMO resolution 40	ISPD_International Surface Pressure databank_WASA Stations Obser	International Surface Pressure databank_WASA Stations Observations SLP	Global	1842	2004
262	Open Access	ISPD_International Surface Pressure databank_Environment Canada	International Surface Pressure databank_Environment Canada Pressure Obs	Global	1850	1980
263	Open Access	ISPD_International Surface Pressure databank_West African Synoptic	International Surface Pressure databank_West African Synoptic observations digitized by MeteoFrance	Global	1900	1956

264	WMO resolution 40	ISPD_International Surface Pressure databank_The Australian Bureau of Meteorology	International Surface Pressure databank_The Australian Bureau of Meteorology Station Pressure Dataset	Global	1803	1999
265	WMO resolution 40	ISPD_International Surface Pressure databank_Northern Italian Pressure data	International Surface Pressure databank_Northern Italian Pressure Observations	Global	1951	1980
266	Open Access	ISPD_International Surface Pressure databank_Hourly Surface observations	International Surface Pressure databank_Hourly Surface Observations for Brazile	Global	1850	2003
267	Open Access	ISPD_International Surface Pressure databank_Spanish Hourly Press	International Surface Pressure databank_Spanish Hourly Pressure Observations	Global	1876	2000
268	Open Access	ISPD_International Surface Pressure databank_German climate observations	International Surface Pressure databank_German climate observations	Global	1872	2002
269	Open Access	ISPD_International Surface Pressure databank_ZAMG Austrian station obs	International Surface Pressure databank_ZAMG Austrian station observations	Global	1964	2002

270	Open Access	ISPD_International Surface Pressure databank_Meteoswiss station collection	International Surface Pressure databank_Meteoswiss station collection	Global	1850	2003
271	Open Access	ISPD_International Surface Pressure databank_South African Weather Service	International Surface Pressure databank_South African Weather Service Meteorological collection	Global	1863	2007
272	Creative Commons Attribution	ISPD_International Surface Pressure databank_National Norwegian	International Surface Pressure databank_National Norwegian meteorological database	Global	1858	2005
273	WMO resolution 40	ISPD_International Surface Pressure databank_Croatian Meteorological Service	International Surface Pressure databank_Croatian Meteorological and Hydrological Service land stations	Global	1860	2006
274	Open Access	ISPD_International Surface Pressure databank_Signatures of environmental change in the observations of the Geophysical Institute	International Surface Pressure databank_Signatures of environmental change in the observations of the Geophysical Institute	Global	1815	1941

275	WMO resolution 40	ISPD_International Surface Pressure databank_French hourly SLP fro	International Surface Pressure databank_French hourly SLP from Meteo-France	Global	1788	1848
276	WMO resolution 40	ISPD_International Surface Pressure databank_Australia historical su	International Surface Pressure databank_Australia historical surface pressure	Global	1937	1999
277	Open Access	ISPD_International Surface Pressure databank_ACRE-Pacif ic: NIWA a	International Surface Pressure databank_ACRE-Pacific: NIWA and NZMet Service	Global	1920	1972
278	WMO resolution 40	ISPD_International Surface Pressure databank_Spanish Met Office st	International Surface Pressure databank_Spanish Met Office stations	Global	1755	1861
279	Mixed data policy	ISPD_International Surface Pressure databank_EMULATE Daily MSLP	International Surface Pressure databank_EMULATE Daily MSLP station data	Global	1951	2005
280	WMO resolution 40	ISPD_International Surface Pressure databank_Mozambiq ue station	International Surface Pressure databank_Mozambique station pressure	Global	1913	1938

281	Open Access	ISPD_International Surface Pressure databank_Japan Agency for Mar	International Surface Pressure databank_Japan Agency for Marine-earth Science and Technology (JAMSTEC) archive	Global	1899	1962
282	WMO resolution 40	ISPD_International Surface Pressure databank_African SLP from Met	International Surface Pressure databank_African SLP from Meteo France	Global	1972	2005
283	WMO resolution 40	ISPD_International Surface Pressure databank_Tanzania station pres	International Surface Pressure databank_Tanzania station pressure	Global	1950	2004
284	WMO resolution 40	ISPD_International Surface Pressure databank_Hourly pressure from	International Surface Pressure databank_Hourly pressure from China	Global	1965	2010
285	Open Access	ISPD_International Surface Pressure databank_All-Russia Research I	International Surface Pressure databank_All-Russia Research Institute of Hydrometeorological Information - World Data	Global	2004	2012
286	Open Access	ISPD_International Surface Pressure databank_Data from Russian Hydromet	International Surface Pressure databank_Data from Russian Hydrometcentre	Global	1835	1840

287	Open Access	ISPD_International Surface Pressure databank_Early Russian Empire	International Surface Pressure databank_Early Russian Empire Stations, , digitized in LDEO from Kupffers Annales	Global	1879	1900
288	WMO resolution 40	ISPD_International Surface Pressure databank_Australian Meteorolo	International Surface Pressure databank_Australian Meteorological Association, Todd Project team	Global	1798	1869
289	Open Access	ISPD_International Surface Pressure databank_Canadian Volunteer	International Surface Pressure databank_Canadian Volunteer Climate Data Rescue project	Global	1867	2011
290	Open Access	ISPD_International Surface Pressure databank_University of Aberde	International Surface Pressure databank_University of Aberdeen historical pressure observations	Global	1845	1873
291	WMO resolution 40	ISPD_International Surface Pressure databank_Icelandic Meteorolog	International Surface Pressure databank_Icelandic Meteorological Office (IMO) Sea Level Pressure	Global	1915	1946

292	Open Access	ISPD_International Surface Pressure databank_ERA-CLIM FFCUL_sub	International Surface Pressure databank_ERA-CLIM FFCUL	Global	1992	2013
293	WMO resolution 40	ISPD_International Surface Pressure databank_Australian Bureau of	International Surface Pressure databank_Australian Bureau of Meteorology—Australian Baseline Sea Level Monitoring	Global	1722	1865
294	Open Access	ISPD_International Surface Pressure databank_Project IMPROVE_su	International Surface Pressure databank_Project IMPROVE	Global	1811	1820
295	WMO resolution 40	ISPD_International Surface Pressure databank_University of Barcelo	International Surface Pressure databank_University of Barcelona	Global	1796	1863
296	Open Access	ISPD_International Surface Pressure databank_University of Bern_su	International Surface Pressure databank_University of Bern	Global	1756	2012
297	creative Commons Attri	ISPD_International Surface Pressure databank_Stockholm University	International Surface Pressure databank_Stockholm University	Global	1815	1817
298	Open access	ISPD_International Surface Pressure databank_University of East An	International Surface Pressure databank_University of East Anglia	Global	1815	1817

299	WMO resolution 40	ISPD_International Surface Pressure databank_University of Gdansk	International Surface Pressure databank_University of Gdansk	Global	1929	2010
300	Open Access	ISPD_International Surface Pressure databank_ACRE-Pacif ic: Cook Isl	International Surface Pressure databank_ACRE-Pacific: Cook Island Met Services	Global	1929	1950
301	Open Access	ISPD_International Surface Pressure databank_ACRE-Pacif ic: Pacific I	International Surface Pressure databank_ACRE-Pacific: Pacific Island Met Services	Global	1885	2011
302	WMO resolution 40	ISPD_International Surface Pressure databank_Hong Kong Hourly Pr	International Surface Pressure databank_Hong Kong Hourly Pressure Observations	Global	1866	1944
303	WMO resolution 40	ISPD_International Surface Pressure databank_Jakarta/Ba tavia Press	International Surface Pressure databank_Jakarta/Batavia Pressure Observations	Global	1768	1793
304	Open Access	ISPD_International Surface Pressure databank_William Hutchinson p	International Surface Pressure databank_William Hutchinson pressure, Liverpool	Global	1859	1913
305	Open Access	ISPD_International Surface Pressure databank_Jersey, Channel Islan	International Surface Pressure databank_Jersey, Channel Island Pressure Obs	Global	1841	1913

306	Open access	ISPD_International Surface Pressure databank_CMDP-US NO_sub_dai	International Surface Pressure databank_CMDP-USNO	Global	1843	1867
307	Open access	ISPD_International Surface Pressure databank_Russian Sitka Sea Lev	International Surface Pressure databank_Russian Sitka Sea Level Pressure, University of South Carolina Climate Lab	Global	1924	1924
308	Open access	ISPD_International Surface Pressure databank_University of Toronto	International Surface Pressure databank_University of Toronto British Everest Expedition meteorological observation co	Global	1814	1817
309	WMO resolution 40	ISPD_International Surface Pressure databank_University of Extrema	International Surface Pressure databank_University of Extremadura	Global	1800	1838
310	Open Access	ISPD_International Surface Pressure databank_University of Helsinki	International Surface Pressure databank_University of Helsinki	Global	1899	1941
311	Open Access	ISPD_International Surface Pressure databank_Antarctic Expeditions	International Surface Pressure databank_Antarctic Expeditions	Global	1882	1883
312	Open Access	ISPD_International Surface Pressure databank_Canadian Arctic Fort	International Surface Pressure databank_Canadian Arctic Fort Rae SLP	Global		

313	Open Access	NOAA CDMP_sub_daily_US	The Climate Database Modernization Program (CDMP) DSI 3850	USA	1892	1948
314	Open Access	NOAA CDMP_sub_daily_US	The Climate Database Modernization Program (CDMP) DSI 3851	USA	1928	1948
315	Open Access	NOAA CDMP_sub_daily_US	The Climate Database Modernization Program (CDMP) DSI 3853	USA	1948	1997
316	Open Access	DWRUK_sub_daily_e urope	The UK Met Office Daily Weather Reports	Europe	1899	1910
317	WMO resolution 40	NCAR_sub_daily_gre enland_iceland	NCAR's Greenland/Iceland dataset	Greenland/Ic eland	1976	1999
318	WMO resolution 40	BAM_sub_daily_braz il	Brazilian Air Ministry/Brazil. 1994 (NCAR/RDA)	Brazil	1951	1981
319	WMO resolution 40	ASODSO_sub_daily_ australia	Australia Summary of Day and Surface Observations (NCAR/RDA)	Australia	1799	2020
320	Open Access	NMB_UKMO_CCSP_ China_ACRE	Nanking Meteorological Bulletins -[pending	China	1930	1931
321	Open Access	DWD_overseas data_China_Pacific_T ogo	german meteorological service deutscher wetterdienst DWD	China, Sth Pacific	1890	1914
322	WMO resolution 40	Mexico_ISD	Mexico_ISD NCEI datasets	Mexico	1973	1999
323	Open Access	UNI_GIESSEN_India_ sbdy	Digitisation and QC funded by the University of Giessen, (India_sbdy)	India	1874	1890
324	Open Access	CHIMES	University of Bern	Switzerland	1708	1873
325	WMO resolution 40	Austrian pressure data	The Central Institution for Meteorology and Geodynamics (ZAMG)	Austria	1874	2002

326	Open Access	C3S_south_africa_data_rescue_Uni_Witwatersrand	University of Witwatersrand	South Africa	1819	1903
327	Open Access	MeteoCat_UERRA_sub_daily_spain	Meteorological Service of Catalonia	Spain	1988	2015
328	Open Access	Bulletin_Climatologique_UERRA_sub_daily_lebanon	Bulletin Climatologique, Lebanon	Lebanon	1930	1939
329	Open Access	Rocenka-annuaire_UERRA_sub_daily_czech	Rocenka-annuaire	Czech republic	1949	1984
330	Open Access	Bulletin_Meteoorologique_du_maroc_UERRA_sub_daily_Morocco	Bulletin Meteoorologique du Maroc	Morocco	1953	1968
331	Creative Commons Attribution	Met_No_UERRA_sub_daily_Norway	Met Norway	Norway	1959	2016
332	Creative Commons Attribution	Uerra_SMHI_sub_daily_sweden	SMHI, the Swedish Meteorological and Hydrological Institute	Sweden	1947	2015
333	WMO resolution 40??	Chile_Met_Service_hourly_data_chile	Chile Meteorological Directorate	Chile	1950	2020
334	Open Access	UNI_GIESSEN_Australia_sbdy	Digitisation and QC funded by the University of Giessen, (Australia-Adelaide_sbdy)	Australia	1876	1897
335	Open Access	NCEI DSI-3280	NOAA/NCEI			
336	Open Access	CMA_sub_Daily_china	National_Climate_Centre_CMA_ISPD3043	China	1902	1953
337	Open Access	CCSP_China_India_sbdy	CCSP_China_India	India /Sri Lanka	1934	1935

338	Open Access	ACRE_African_stations_late19thC_sbdy	ACRE_African_stations_late19thC_sbdy	Africa	1892	1907
339	Open Access	Metoe_lux_sbdy	Meteo Lux	Luxembourg	2011	2020
340	Open Access	ACRE_Solomon_Islands_sbdy	ACRE_Solomon_Islands	Solomon Islands	1909	1940
341	Open Access	ECC_Canada_hourly	Environment & Climate Change Canada	Canada	1953	ongoing
342	Open Access?	INMET_Brazil_Hourly_Daily	INMET brazilian met service	Brazil	1904	2021
343	Open Access	NCEI/ASOS/AWOS (NOAA Surface Weather Observations)	NOAA's National Centers for Environmental Information (NCEI) NCEI/ASOS/AWOS	USA	2004	ongoing
344	Open Access	NCEI/MAPSO	NOAA's National Centers for Environmental Information (NCEI) NCEI/MAPSO	USA	2004	ongoing
345	Open Access	NCEI/US CRN	NOAA's National Centers for Environmental Information (NCEI) NCEI/US CRN	USA	2001	ongoing
346	Open Access	NCEI/SURFRAD	NOAA's National Centers for Environmental Information (NCEI) NCEI/SURFRAD	USA	2004	ongoing
347	Open Access	NCEI/FAA	NOAA's National Centers for Environmental Information (NCEI)NCEI/FAA	USA		ongoing
348	Open Access	NCEI/CANA	NOAA's National Centers for Environmental Information (NCEI) NCEI/CANA	USA		ongoing
356	Open Access	Japan Met Service	JMA	Japan		2008

382	Open Access	Coop HPD v2	U.S. Coop Hourly Precipitation, Version 2	USA	ongoing
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Appendix

Table A1: Columns/Headers

Col#	Header
1	Station_ID
2	Station_name
3	Year
4	Month
5	Day
6	Hour
7	Minute
8	Latitude
9	Longitude
10	Elevation
11	temperature
12	temperature_Measurement_Code
13	temperature_Quality_Code
14	temperature_Report_Type
15	temperature_Source_Code
16	temperature_Source_Station_ID
17	dew_point_temperature
18	dew_point_temperature_Measurement_Code
19	dew_point_temperature_Quality_Code
20	dew_point_temperature_Report_Type
21	dew_point_temperature_Source_Code
22	dew_point_temperature_Source_Station_ID
23	station_level_pressure
24	station_level_pressure_Measurement_Code
25	station_level_pressure_Quality_Code
26	station_level_pressure_Report_Type
27	station_level_pressure_Source_Code
28	station_level_pressure_Source_Station_ID
29	sea_level_pressure
30	sea_level_pressure_Measurement_Code
31	sea_level_pressure_Quality_Code
32	sea_level_pressure_Report_Type
33	sea_level_pressure_Source_Code
34	sea_level_pressure_Source_Station_ID
35	wind_direction
36	wind_direction_Measurement_Code
37	wind_direction_Quality_Code
38	wind_direction_Report_Type
39	wind_direction_Source_Code
40	wind_direction_Source_Station_ID

41 wind_speed
42 wind_speed_Measurement_Code
43 wind_speed_Quality_Code
44 wind_speed_Report_Type
45 wind_speed_Source_Code
46 wind_speed_Source_Station_ID
47 wind_gust
48 wind_gust_Measurement_Code
49 wind_gust_Quality_Code
50 wind_gust_Report_Type
51 wind_gust_Source_Code
52 wind_gust_Source_Station_ID
53 precipitation
54 precipitation_Measurement_Code
55 precipitation_Quality_Code
56 precipitation_Report_Type
57 precipitation_Source_Code
58 precipitation_Source_Station_ID
59 relative_humidity
60 relative_humidity_Measurement_Code
61 relative_humidity_Quality_Code
62 relative_humidity_Report_Type
63 relative_humidity_Source_Code
64 relative_humidity_Source_Station_ID
65 wet_bulb_temperature
66 wet_bulb_temperature_Measurement_Code
67 wet_bulb_temperature_Quality_Code
68 wet_bulb_temperature_Report_Type
69 wet_bulb_temperature_Source_Code
70 wet_bulb_temperature_Source_Station_ID
71 pres_wx_MW1
72 pres_wx_MW1_Measurement_Code
73 pres_wx_MW1_Quality_Code
74 pres_wx_MW1_Report_Type
75 pres_wx_MW1_Source_Code
76 pres_wx_MW1_Source_Station_ID
77 pres_wx_MW2
78 pres_wx_MW2_Measurement_Code
79 pres_wx_MW2_Quality_Code
80 pres_wx_MW2_Report_Type
81 pres_wx_MW2_Source_Code
82 pres_wx_MW2_Source_Station_ID
83 pres_wx_MW3
84 pres_wx_MW3_Measurement_Code

85 pres_wx_MW3_Quality_Code
86 pres_wx_MW3_Report_Type
87 pres_wx_MW3_Source_Code
88 pres_wx_MW3_Source_Station_ID
89 pres_wx_AU1
90 pres_wx_AU1_Measurement_Code
91 pres_wx_AU1_Quality_Code
92 pres_wx_AU1_Report_Type
93 pres_wx_AU1_Source_Code
94 pres_wx_AU1_Source_Station_ID
95 pres_wx_AU2
96 pres_wx_AU2_Measurement_Code
97 pres_wx_AU2_Quality_Code
98 pres_wx_AU2_Report_Type
99 pres_wx_AU2_Source_Code
100 pres_wx_AU2_Source_Station_ID
101 pres_wx_AU3
102 pres_wx_AU3_Measurement_Code
103 pres_wx_AU3_Quality_Code
104 pres_wx_AU3_Report_Type
105 pres_wx_AU3_Source_Code
106 pres_wx_AU3_Source_Station_ID
107 pres_wx_AW1
108 pres_wx_AW1_Measurement_Code
109 pres_wx_AW1_Quality_Code
110 pres_wx_AW1_Report_Type
111 pres_wx_AW1_Source_Code
112 pres_wx_AW1_Source_Station_ID
113 pres_wx_AW2
114 pres_wx_AW2_Measurement_Code
115 pres_wx_AW2_Quality_Code
116 pres_wx_AW2_Report_Type
117 pres_wx_AW2_Source_Code
118 pres_wx_AW2_Source_Station_ID
119 pres_wx_AW3
120 pres_wx_AW3_Measurement_Code
121 pres_wx_AW3_Quality_Code
122 pres_wx_AW3_Report_Type
123 pres_wx_AW3_Source_Code
124 pres_wx_AW3_Source_Station_ID
125 snow_depth
126 snow_depth_Measurement_Code
127 snow_depth_Quality_Code
128 snow_depth_Report_Type

129 snow_depth_Source_Code
130 snow_depth_Source_Station_ID
131 visibility
132 visibility_Measurement_Code
133 visibility_Quality_Code
134 visibility_Report_Type
135 visibility_Source_Code
136 visibility_Source_Station_ID
137 altimeter
138 altimeter_Measurement_Code
139 altimeter_Quality_Code
140 altimeter_Report_Type
141 altimeter_Source_Code
142 altimeter_Source_Station_ID
143 pressure_3hr_change
144 pressure_3hr_change_Measurement_Code
145 pressure_3hr_change_Quality_Code
146 pressure_3hr_change_Report_Type
147 pressure_3hr_change_Source_Code
148 pressure_3hr_change_Source_Station_ID
149 sky_cover_1
150 sky_cover_1_Measurement_Code
151 sky_cover_1_Quality_Code
152 sky_cover_1_Report_Type
153 sky_cover_1_Source_Code
154 sky_cover_1_Source_Station_ID
155 sky_cover_baseht_1
156 sky_cover_baseht_1_Measurement_Code
157 sky_cover_baseht_1_Quality_Code
158 sky_cover_baseht_1_Report_Type
159 sky_cover_baseht_1_Source_Code
160 sky_cover_baseht_1_Source_Station_ID
161 sky_cover_2
162 sky_cover_2_Measurement_Code
163 sky_cover_2_Quality_Code
164 sky_cover_2_Report_Type
165 sky_cover_2_Source_Code
166 sky_cover_2_Source_Station_ID
167 sky_cover_baseht_2
168 sky_cover_baseht_2_Measurement_Code
169 sky_cover_baseht_2_Quality_Code
170 sky_cover_baseht_2_Report_Type
171 sky_cover_baseht_2_Source_Code
172 sky_cover_baseht_2_Source_Station_ID

173 sky_cover_3
174 sky_cover_3_Measurement_Code
175 sky_cover_3_Quality_Code
176 sky_cover_3_Report_Type
177 sky_cover_3_Source_Code
178 sky_cover_3_Source_Station_ID
179 sky_cover_baseht_3
180 sky_cover_baseht_3_Measurement_Code
181 sky_cover_baseht_3_Quality_Code
182 sky_cover_baseht_3_Report_Type
183 sky_cover_baseht_3_Source_Code
184 sky_cover_baseht_3_Source_Station_ID
185 precipitation_3_hour
186 precipitation_3_hour_Measurement_Code
187 precipitation_3_hour_Quality_Code
188 precipitation_3_hour_Report_Type
189 precipitation_3_hour_Source_Code
190 precipitation_3_hour_Source_Station_ID
191 precipitation_6_hour
192 precipitation_6_hour_Measurement_Code
193 precipitation_6_hour_Quality_Code
194 precipitation_6_hour_Report_Type
195 precipitation_6_hour_Source_Code
196 precipitation_6_hour_Source_Station_ID
197 precipitation_9_hour
198 precipitation_9_hour_Measurement_Code
199 precipitation_9_hour_Quality_Code
200 precipitation_9_hour_Report_Type
201 precipitation_9_hour_Source_Code
202 precipitation_9_hour_Source_Station_ID
203 precipitation_12_hour
204 precipitation_12_hour_Measurement_Code
205 precipitation_12_hour_Quality_Code
206 precipitation_12_hour_Report_Type
207 precipitation_12_hour_Source_Code
208 precipitation_12_hour_Source_Station_ID
209 precipitation_15_hour
210 precipitation_15_hour_Measurement_Code
211 precipitation_15_hour_Quality_Code
212 precipitation_15_hour_Report_Type
213 precipitation_15_hour_Source_Code
214 precipitation_15_hour_Source_Station_ID
215 precipitation_18_hour
216 precipitation_18_hour_Measurement_Code

217 precipitation_18_hour_Quality_Code
218 precipitation_18_hour_Report_Type
219 precipitation_18_hour_Source_Code
220 precipitation_18_hour_Source_Station_ID
221 precipitation_21_hour
222 precipitation_21_hour_Measurement_Code
223 precipitation_21_hour_Quality_Code
224 precipitation_21_hour_Report_Type
225 precipitation_21_hour_Source_Code
226 precipitation_21_hour_Source_Station_ID
227 precipitation_24_hour
228 precipitation_24_hour_Measurement_Code
229 precipitation_24_hour_Quality_Code
230 precipitation_24_hour_Report_Type
231 precipitation_24_hour_Source_Code
232 precipitation_24_hour_Source_Station_ID
233 remarks
234 remarks_Measurement_Code
235 remarks_Quality_Code
236 remarks_Report_Type
237 remarks_Source_Code
238 remarks_Source_Station_ID