I. Description - Monthly Normals (Supplemental)

The 2006-2020 U.S. Climate Normals are supplemental 15-year normals of many weather and climate variables. Normals are organized into hourly, daily, monthly, seasonal and annual normals. This document describes the elements of the monthly normals. These observations are compiled from many surface weather station records, predominantly from National Weather Service (NWS) and Federal Aviation Administration stations at airports, the NWS Cooperative Observer Network, and other sources. For the first time, 2006-2020 normals include precipitation from the USDA Snow Telemetry (SNOTEL) network and the citizen science Community Collaborative Rain, Hail and Snow (CoCoRaHS) Network. These records were merged and then subjected to a suite of quality assurance reviews at NOAA's National Centers for Environmental Information (NCEI).

The 2006-2020 U.S. monthly normals provide a suite of descriptive statistics based on daily and monthly observations at more than 13,000 stations from across the United States and its Pacific and Caribbean territories that have at least precipitation normals, and more than 5500 have temperature normals. Statistics are provided as 15-year averages and standard deviations, frequencies of occurrence, percentiles for each month of the year and probabilities of occurrence. These products are useful in examination of the annual cycle of a variable.

Monthly normals are based on both monthly and daily observations of temperature and precipitation that in the end yield about 100 different variables based on averages and statistics of both modified and raw values. While daily precipitation and snowfall are calculated as month-to-date averages, ratios are used to ensure that the last month-to-date values matched the average monthly totals found in this dataset. Daily temperature averages are constrained further, to match with the monthly temperature averages that have been corrected, or homogenized, for station changes during the 15-year period. These constrained temperature values are used for most statistics, including heating, cooling, and growing degree days, season length and frost probabilities, and percentiles. However, threshold exceedance counts are based on the raw temperature measurements.

The data for monthly normals are from the Global Historical Climatology Network (GHCN) Daily dataset (https://www.ncdc.noaa.gov/ghcn-daily-description), GHCN Monthly dataset (https://www.ncdc.noaa.gov/ghcn-monthly), and the North American monthly homogenized maximum and minimum temperature data set (https://www.ncei.noaa.gov/data/NorthAmerica), all compiled at NCEI. Normals are "standard" above 80% data availability (12 of 15 month-years), and will be calculated with 15 years if the station has at least 10 years of valid observations (considered "representative"), with the remaining years estimated using surrounding stations with more complete values. If a station does not have reliable surrounding neighbors to fill its 15-year period, a normal is still calculated and is flagged as "provisional". Below this 10-year criteria, temperature and precipitation averages will be estimated statistically from relationships with surrounding stations if at least two full years of data are available for all months. Observations for February 29 have been included in monthly averages and statistics.

II. Format/Element (Value) Definitions

(Note: the term 'element' is used throughout this document and refers to an individual meteorological / climatologicalmeasurement or statistical value such as temperature, precipitation, snowfall, etc.)

A. Initial section

Each record represents all selected elements available for a given station-month. The initial section of each record is ordered as follows with the following definitions:

STATION ID (11 characters) is the station identification code. Please see for a complete station metadata record the NCEI Historical Observing Metadata Repository at https://www.ncdc.noaa.gov/homr/.

STATION_NAME (max 50 characters) is the name of the station (usually city/airport name).

GEOGRAPHIC_LOCATION is the latitude (decimal degrees w/northern hemisphere values > 0, southern hemisphere values < 0), longitude (decimal degrees w/western hemisphere values < 0, eastern hemisphere values > 0) and elevation above mean sea level.

DATE is the month and day.

B. Elements (values) and flags (attributes)

Following this initial section of the record, all selected elements and flags are given in the following order:

1st Element, Measurement Flag, Completeness Flag, Number of Years, 2nd Element, Measurement Flag, Completeness Flag, Number of Years, 3rd Element…etc., for all elements selected.

Element(s)/Value(s) is/are defined in **Table 2** below. Please note only elements selected by user willappear in the specific output.

Measurement Flag (Attribute) is defined in **Table 1** below

Completeness Flag (Attribute) is defined in **Table 1** below

Flags accompany every Normals value and indicate certain measurement conditions (if necessary only, blank otherwise) and the completeness of the data record used to compute each value, accounting for methodological differences for different product classes. The flag options are described in **Table 1** below. Due to methodological differences, the flags are applied somewhat differently between the temperature-based normals and the precipitation-based normals. For the precipitation-based normals, the following flags were assigned independently for each normals value reported based on number of years available for that individual calculation. For temperature-based normals, strong precedence is given to the monthly normals of maximum and minimum temperature or derived from the flags for these two variables.

Table 1 (Flags)

Measurement Flags:

M Missing
V Year-round risk of frost-freeze; "too cold to compute"
W Not used
X Nonzero value has rounded to zero
Y Insufficient values to perform computation
Z Computed valued created logical inconsistency with other values

Completeness Flags:

S Standard - meets standards for data availability for 24 or more years (missing months are filled with estimates based on surrounding stations)

R Representative - meets standards for data availability for 10 or more years (missing months are filled with estimates based on surrounding stations)

P Provisional - meets standards for data availability for 10 or more years (missing months cannot be filled due to lack of surrounding stations)

E Estimated - meets standards for data availability for 2 or more years for all months (nearby stations with standard normals are available to estimate normals statistically)

Blank - the data value is reported as a special missing value such as -9999 when other values in the column are available

Table 2 (Elements/Values)

mly-tavg-normal	Long-term averages of monthly average temperature
mly-tavg-stddev	Long-term standard deviations of monthly average temperature
mly-tmax-normal	Long-term averages of monthly maximum temperature
mly-tmax-stddev	Long-term standard deviations of monthly maximum temperature
mly-tmin-normal	Long-term averages of monthly minimum temperature
mly-tmin-stddev	Long-term standard deviations of monthly minimum temperature
mly-dutr-normal	Long-term monthly mean of daily temperature range
mly-dutr-stddev	Long-term monthly standard deviations of daily temperature range
mly-cldd-base40	Long-term averages of monthly cooling degree days with base 40F
mly-cldd-base45	Long-term averages of monthly cooling degree days with base 45F
mly-cldd-base50	Long-term averages of monthly cooling degree days with base 50F
mly-cldd-base55	Long-term averages of monthly cooling degree days with base 55F
mly-cldd-base57	Long-term averages of monthly cooling degree days with base 57F
mly-cldd-base60	Long-term averages of monthly cooling degree days with base 60F
mly-cldd-base70	Long-term averages of monthly cooling degree days with base 70F

mly-cldd-base72	Long-term averages of monthly cooling degree days with base 72F
mly-cldd-normal	Long-term averages of monthly cooling degree days with base 65F
mly-grdd-base40	Long-term averages of monthly growing degree days with base 40F
mly-grdd-base45	Long-term averages of monthly growing degree days with base 45F
mly-grdd-base50	Long-term averages of monthly growing degree days with base 50F
mly-grdd-base55	Long-term averages of monthly growing degree days with base 55F
mly-grdd-base57	Long-term averages of monthly growing degree days with base 57F
mly-grdd-base60	Long-term averages of monthly growing degree days with base 60F
mly-grdd-base65	Long-term averages of monthly growing degree days with base 65F
mly-grdd-base70	Long-term averages of monthly growing degree days with base 70F
mly-grdd-base72	Long-term averages of monthly growing degree days with base 72F
mly-grdd-tb4886	Long-term avgs of monthly growing degree days with base 48F limit 86F
mly-grdd-tb5086	Long-term avgs of monthly growing degree days with base 50F limit 86F
mly-htdd-base40	Long-term averages of monthly heating degree days with base 40F
mly-htdd-base45	Long-term averages of monthly heating degree days with base 45F
mly-htdd-base50	Long-term averages of monthly heating degree days with base 50F
mly-htdd-base55	Long-term averages of monthly heating degree days with base 55F
mly-htdd-base57	Long-term averages of monthly heating degree days with base 57F
mly-htdd-base60	Long-term averages of monthly heating degree days with base 60F
mly-htdd-normal	Long-term averages of monthly heating degree days with base 65F
mly-prcp-normal	Long-term averages of monthly precipitation total
mly-prcp-25pctl	First quartile of monthly nonzero precipitation totals
mly-prcp-50pctl	Second quartile of monthly nonzero precipitation totals
mly-prcp-75pctl	Third quartile of monthly nonzero precipitation totals
mly-prcp-20pctl	First quintile of monthly nonzero precipitation totals
mly-prcp-40pctl	Second quintile of monthly nonzero precipitation totals
mly-prcp-60pctl	Third quintile of monthly nonzero precipitation totals
mly-prcp-80pctl	Fourth quintile of monthly nonzero precipitation totals
mly-prcp-33pctl	First tercile of monthly nonzero precipitation totals
mly-prcp-67pctl	Second tercile of monthly nonzero precipitation totals
mly-prcp-avgnds-ge001hi	Monthly number of days with precipitation >= 0.01 inches
mly-prcp-avgnds-ge010hi	Monthly number of days with precipitation >= 0.10 inches
mly-prcp-avgnds-ge025hi	Monthly number of days with precipitation >= 0.25 inches
mly-prcp-avgnds-ge050hi	Monthly number of days with precipitation >= 0.50 inches
mly-prcp-avgnds-ge100hi	Monthly number of days with precipitation >= 1.00 inches
mly-prcp-avgnds-ge200hi	Monthly number of days with precipitation >= 2.00 inches
mly-prcp-avgnds-ge400hi	Monthly number of days with precipitation >= 4.00 inches
mly-prcp-avgnds-ge600hi	Monthly number of days with precipitation >= 6.00 inches
mly-snow-normal	Long-term averages of monthly snowfall total
mly-snow-25pctl	First quartile of monthly nonzero snowfall totals
mly-snow-50pctl	Second quartile of monthly nonzero snowfall totals
mly-snow-75pctl	Third quartile of monthly nonzero snowfall totals
mly-snow-20pctl	First quintile of monthly nonzero snowfall totals
mly-snow-40pctl	Second quintile of monthly nonzero snowfall totals
mly-snow-60pctl	Third quintile of monthly nonzero snowfall totals
mly-snow-80pctl	Fourth quintile of monthly nonzero snowfall totals
mly-snow-33pctl	First tercile of monthly nonzero snowfall totals
mly-snow-67pctl	Second tercile of monthly nonzero snowfall totals

mly-snow-avgnds-ge001ti	Monthly number of days with snowfall >= 0.1 inch
mly-snow-avgnds-ge010ti	Monthly number of days with snowfall >= 1.0 inch
mly-snow-avgnds-ge020ti	Monthly number of days with snowfall >= 2.0 inches
mly-snow-avgnds-ge030ti	Monthly number of days with snowfall >= 3.0 inches
mly-snow-avgnds-ge040ti	Monthly number of days with snowfall >= 4.0 inches
mly-snow-avgnds-ge050ti	Monthly number of days with snowfall >= 5.0 inches
mly-snow-avgnds-ge100ti	Monthly number of days with snowfall >= 10 inches
mly-snow-avgnds-ge200ti	Monthly number of days with snowfall >= 20 inches
mly-snwd-avgnds-ge001wi	Monthly number of days with snow depth >= 1 inch
mly-snwd-avgndsge002wi	Monthly number of days with snow depth >= 2 inches
mly-snwd-avgnds-ge003wi	Monthly number of days with snow depth >= 3 inches
mly-snwd-avgnds-ge004wi	Monthly number of days with snow depth >= 4 inches
mly-snwd-avgnds-ge005wi	Monthly number of days with snow depth >= 5 inches
mly-snwd-avgnds-ge010wi	Monthly number of days with snow depth >= 10 inches
mly-snwd-avgnds-ge020wi	Monthly number of days with snow depth >= 20 inches
mly-tmin-avgnds-lsth000	Monthly number of days with minimum temperature <= 0F
mly-tmin-avgnds-lsth010	Monthly number of days with minimum temperature <= 10F
mly-tmin-avgnds-lsth020	Monthly number of days with minimum temperature <= 20F
mly-tmin-avgnds-lsth032	Monthly number of days with minimum temperature <= 32F
mly-tmin-avgnds-lsth040	Monthly number of days with minimum temperature <= 40F
mly-tmin-avgnds-lsth050	Monthly number of days with minimum temperature <= 50F
mly-tmin-avgnds-lsth060	Monthly number of days with minimum temperature <= 60F
mly-tmin-avgnds-lsth070	Monthly number of days with minimum temperature <= 70F
mly-tmax-avgnds-grth032	Monthly number of days with maximum temperature >= 32F
mly-tmax-avgnds-grth040	Monthly number of days with maximum temperature >= 40F
mly-tmax-avgnds-grth050	Monthly number of days with maximum temperature >= 50F
mly-tmax-avgnds-grth060	Monthly number of days with maximum temperature >= 60F
mly-tmax-avgnds-grth070	Monthly number of days with maximum temperature >= 70F
mly-tmax-avgnds-grth080	Monthly number of days with maximum temperature >= 80F
mly-tmax-avgnds-grth090	Monthly number of days with maximum temperature >= 90F
mly-tmax-avgnds-grth100	Monthly number of days with maximum temperature >= 100F
mly-tmax-avgnds-lsth032	Monthly number of days with maximum temperature <= 32F
mly-tmin-prbocc-lsth016	Probability of minimum temperature at least once monthly <= 16F
mly-tmin-prbocc-lsth020	Probability of minimum temperature at least once monthly <= 20F
mly-tmin-prbocc-lsth024	Probability of minimum temperature at least once monthly <= 24F
mly-tmin-prbocc-lsth028	Probability of minimum temperature at least once monthly <= 28F
mly-tmin-prbocc-lsth032	Probability of minimum temperature at least once monthly <= 32F
mly-tmin-prbocc-lsth036	Probability of minimum temperature at least once monthly <= 36F

III. Additional Information

C. Units

Degrees Fahrenheit to the nearest tenth (or Celsius if user specifies metric output option) for maximum, minimum, and average air temperatures, heating and cooling degree day normals, and standard deviations, e.g., 70.3.

Tenths of days for the number of days per month above or below certain threshold, such as days above 90 °F, e.g., 25.6 days.

Inches or millimeters for average monthly/seasonal/annual precipitation, month-to-date/year-to-date precipitation, and percentiles of precipitation days depending on user specification between standard or metric units.

Inches or millimeters for average monthly/seasonal/annual snowfall, month-to-date/year-to-date snowfall, and percentiles of snowfall days depending on user specification between standard or metric units.

Inches or millimeters for percentiles of snow depth days depending on user specification between standard or metric units.

Tenths of percent for probabilities of temperature, precipitation, snowfall, or snow depth exceeding a specific threshold, as well as cloud and wind percentages, e.g., 20.7 F.

A. Special values

-9999: missing or insufficient data (*.csv data)
blank: missing or insufficient data (pdf only)

B. Summary

2006-2020 U.S. Climate Normals averages, percentiles, and frequencies of occurrence of the above at monthly time scales are available at more than 13,000 locations for precipitation and more than 5,500 locations for temperature in the U.S. and its territories. Monthly normals provide a means of understanding how conditions change with the seasons at a location. For hourly, daily, and seasonal values, please use the normals products created for those timescales.

For more detailed information, view complete documentation of normals calculations are at:
https://www.ncei.noaa.gov/data/normals-monthly/2006-2020/doc/Normals_Calculation_Methodology_2020.pdf

For information on reading archive and access *.csv file versions of normals:
https://www.ncei.noaa.gov/data/normals-monthly/2006-2020/doc/Readme_By-Variable_By-Station_Normals_Files.txt