I. Description

The 1981-2010 Normals comprise all climate normals using the thirty year period of temperature, degree days, precipitation, snowfall, snow depth, wind, etc. Data is organized into hourly, daily, monthly, seasonal and annual normals. This document describes the elements and layout of the Hourly Normals which are derived from a composite of climate records from numerous sources that were merged and then subjected to a suite of quality assurance reviews.

The hourly normals provide a suite of descriptive statistics based on hourly observations at a few hundred stations from across the United States and its Pacific territories. Statistics are provided as 30-year averages, frequencies of occurrence, and percentiles for each hour and day of the year. These products are useful in examination of the diurnal change of a particular variable.

For temperature, dew point and mean sea level pressure an average hourly value as well as a 10^{th} and 90^{th} percentile of hourly values is given. For heating and cooling degree hours, an average hourly value is given using a 65 degree F base. Average hourly values are also given for heat index and wind chill. Cloud cover statistics include percent frequency of clear, few, scattered, broken and overcast conditions. Wind statistics include prevailing and secondary wind direction and percent frequency, average wind speed, percentage of calm winds and mean wind vector direction and magnitude.

The statistics are computed from the ISD-lite dataset for which more information can be found at http://www.ncdc.noaa.gov/oa/climate/isd/index.php?name=isd-lite. 262 stations were selected from the ISD-lite data, based on their completeness and membership in a list of what were known as "first order stations." These are typically airport locations with the needed 24 hours/day observations to make hourly normals meaningful. All stations had at least 27 of the 30 years represented.

Each hourly normal is computed on the basis of 450 possible values. This is the aggregation of the value for a particular date and time, plus and minus 7 days, over each of 30 years. If fewer than 350 valid values are present, the output is given as the special value 9999. No normals are computed for February 29, but data for February 29 is included in the 15 day window for leap years. The original data has been shifted from Greenwich Mean Time to an end product in local standard time.

II. Format/Element (Value) Definitions

(note: the term 'element' is used throughout this documentation and refers to an individual metorological/climatlogical measurement or statistical value such as temperature, precipitation (amount), etc.)

A. Initial section

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

STATION (17 characters) is the station identification code. Please see

ftp://ftp.ncdc.noaa.gov/pub/data/normals/1981-2010/station-inventories/

for a complete list of stations and their metadata.

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

GEOGRAPHIC_LOCATION (31 characters) is the latitude (decimated degrees w/northern hemisphere values > 0, southern hemisphere values < 0), longitude (decimated degrees w/western hemisphere values < 0, eastern hemisphere values > 0) and elevation above mean sea level (thousandths of meters). Optional field.

DATE is the year of the record (4 digits) followed by month (2 digits) and day (2 digits).

B. Elements (values) and flags (attributes)

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

Hour | 1st Element |Completeness Flag | 2nd Element | Completeness Flag| 3rd Element…etc., for all elements selected.

Hour is the local time hour within the date given in the Initial section. It uses a 24 hr. format (e.g. 18:00:00 means 6:00pm local time).

Elements/values are defined in Table 2 below. Please note only elements selected by user will appear in the specific output.

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

Flags accompany every Normals value and indicate the completeness of the data record used to compute each value, accounting for methodological differences for different product classes. There are six flag options described generally 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 and hourly 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 (Completeness Flag/Attribute)

C = complete (all 30 years used)
S = standard (no more than 5 years missing and no more than 3 consecutive years missing among the sufficiently complete years)
P = provisional (at least 10 years used, but not sufficiently complete to be labeled as standard or representative).

Blank = the data value is reported as a special value such as 9999 (see section B in III. Additional Information below for more information on Special Values)

Table 2 (Elements/Values)

hly-cldh-normal	Cooling degree hours
hly-clod-pctbkn	Clouds broken percentage
hly-clod-pctclr	Clouds clear percentage
hly-clod-pctfew	Clouds few percentage
hly-clod-pctovc	Clouds overcast percentage
hly-clod-pctsct	Clouds scattered percentage
hly-dewp-10pctl	Dew point 10th percentile
hly-dewp-90pctl	Dew point 90th percentile
hly-dewp-normal	Dew point mean
hly-hidx-normal	Heat index mean
hly-htdh-normal	Heating degree hours
hly-pres-10pctl	Sea level pressure 10th percentile
hly-pres-90pctl	Sea level pressure 90th percentile
hly-pres-normal	Sea level pressure mean
hly-temp-10pctl	Temperature 10th percentile
hly-temp-90pctl	Temperature 90th percentile
hly-temp-normal	Temperature mean
hly-wchl-normal	Wind chill mean
hly-wind- 1stdir	Prevailing wind direction (1-8)
hly-wind- 1stpct	Prevailing wind percentage
hly-wind- 2nddir	Secondary wind direction (1-8)
hly-wind- 2ndpct	Secondary wind percentage
hly-wind- avgspd	Average wind speed
hly-wind- pctclm	Percentage calm
hly-wind- vctdir	Mean wind vector direction
hly-wind- vctspd	Mean wind vector magnitude

III. Additional Information

A. Units

Tenths of degrees Fahrenheit (or Celsius if user specifies metric output option) for maximum, minimum, average, dew point, heat
index, wind chill, and air temperature normals and standard deviations.
e.g., "703" is 70.3F

Tenths of days for the number of days per month above or below certain threshold, such as days above 90F. e.g., "256" is 25.6 days.

Whole degrees Fahrenheit (or Celsius if user specifies metric output option) for heating and cooling degree days.

Tenths of degree hours for heating and cooling degree hours. (Fahrenheit or Celsius depending on user specification of metric or standard output)

HectoPascals or inches of mercury for mean sea level pressure normals depending on user specification of metric or standard output.

Tenths of percent for prevailing and secondary wind direction percentages. e.g., "299" is 29.9%

Prevailing and secondary wind directions can take on 8 values:
1=N, 2=NE, 3=E, 4=SE, 5=S, 6=SW, 7=W, 8=NW

Miles per hour or meters per second depending on user specification of metric or standard output for wind speeds and vector magnitudes.

Whole degrees for mean vector wind directions

B. Special values

-9999: missing or insufficient data (text data)
-7777: a non-zero value that would round to zero
-6666: parameter undefined; insufficient occurrences to compute
-4444: year-round risk of frost-freeze
blank: missing or insufficient data (pdf only)

C. Quality Control

The following conditions will cause a value to be flagged as invalid prior to the computation of normals:

1. Any value exceeding the world record for that variable.
2. Streaks of constant values longer than 24, 48, 72, and 24 hours for temperature, dew point, mean sea level pressure, and wind speed respectively.
3. Mean sea level pressures that exhibit "wrap-around" values where, for example, values in excess of 1059 hPa are recorded as 960 hPa.
4. A dew point value exceeds the temperature value. Both are flagged as invalid.
5. Within a 450 observation sample, temperature and dew point values outside 7 standard deviations of the mean value are removed. This process iterates up to 10 times until there are no values outside the 14 standard deviations range.

D. Derived variables

Heat index was computed when the temperature exceeded 80°F and relative humidity was greater than 40%. In instances when these criteria were not met, the temperature replaced the

heat index in the sample set. Thus the heat index normal is a temperature as influenced by heat index. Similarly, wind chill was computed when the temperature was less 50°F and the wind speed was greater than or equal to 3 mph. The wind chill value is set equal to the temperature if these conditions are not met. The wind chill normal is a temperature as influenced by the wind chill.

Wind normals are comprised of the following:

1. The average speed of all wind speed values.
2. The frequency of winds less than or equal to 3 mph/1.3 m/s.
3. The direction and magnitude of the mean wind vector. These are computed by first decomposing the wind observation into u and v components. The average of each component is computed. A mean wind vector is then assembled from the average components.
4. For winds greater than 3 mph, each is counted in a 45° wide directional bin centered on 0, 45, 90, …, 315 degrees. Counts in these bins are rescaled to account for a bias introduced by wind directions being even multiples of 10. The identity of the two bins with the highest counts, along with their overall frequencies, is provided.

Cloud frequencies in categories clear, few, scattered, broken, and overcast. These are computed from valid observation values from 0 to 8 inclusive representing eighths of sky coverage. An obvious observational preference was noticed to reporting values 0, 2, 4, 7, and 8. We therefore included any reports of 1, 3, 5, and 6 with the next higher category.

Cooling degree hour normals were computed by subtracting 65 from each valid temperature in the sample of 450. Positive differences were summed and divided by the number of valid values. Heating degree hour normals were computed in a similar manner.

E. Summary

Averages (normals), percentiles, and frequencies of occurrence of the above at the hourly time scale are available at 262 locations in the US and its territories. The recommended use of these products is in examination of the diurnal change of a particular variable and how that change may shift over the annual cycle. For daily, monthly, and seasonal values, please use the normals products created for those time scales.

For more detailed information, view complete documentation at:
http://www1.ncdc.noaa.gov/pub/data/normals/1981-2010/readme.txt.