GSOY (Global Summary of the Year) documentation

I. Description

The Global Summary of the Year (GSOY) dataset includes climate data for thousands of locations worldwide. Data files contain over 50 climatological variables computed from the summary of the day observations of the Global Historical Climatology Network Daily dataset (GHCN-D). A description of each of these is included below. GSOY data can be accessed at https://www.ncdc.noaa.gov/cdo-web/search?datasetid=GSOY or for bulk delivery at https://www.ncei.noaa.gov/data/gsoy/.

II. Format/Observation Definitions

Users are given the choice between the following two delivery formats:

1) Portable Document Format (PDF) output. All units are standard.

2) CSV file for use in spreadsheet applications. Users will be able to choose between standard or metric units with this option.

A. Data observations

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

STATION (11 characters) is the station identification code.

STATION_NAME (max 50 characters) is the name of the station (usually city/airport name). This is an optional output field.

LATITUDE (8 characters) is the latitude (decimated degrees w/Northern Hemisphere values > 0). This is an optional output field.

LONGITUDE (9 characters) is the longitude (decimated degrees w/Western Hemisphere values < 0 and Eastern Hemisphere values > 0). This is an optional output field.

ELEVATION (13 characters) is the elevation above mean sea level in meters (to nearest thousandth of a meter). This is an optional output field.

DATE is the year of the record (4 digits).

Table A (variables)

AWND – Annual Average Wind Speed. Given in miles per hour for PDF output and miles per hour or meters per second depending on user specification for CSV output.

AWND_ATTRIBUTES – S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

CDSD – Cooling Degree Days (season-to-date). Running total of monthly cooling degree days through the end of the season. Each month is summed to produce a season-to-date total. Season starts in January in Northern Hemisphere and July in Southern Hemisphere. Given in Fahrenheit degrees in PDF output and Celsius or Fahrenheit degrees depending on user specification in CSV output.

CDSD_ATTRIBUTES – S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

CLDD - Cooling Degree Days. Computed when daily average temperature is more than 65 degrees Fahrenheit/18.3 degrees Celsius. CDD = mean daily temperature - 65 degrees Fahrenheit/18.3 degrees Celsius. Each month is summed to produce an annual total. Annual totals are produced using a January - December year in the Northern Hemisphere and July – June year in the Southern Hemisphere. Given in Fahrenheit units on PDF output. CSV output is Fahrenheit or Celsius units depending on user specification.

CLDD_ATTRIBUTES – a,S where:

a = DaysMissing (Numeric value): The number of days (from 1 to 5) missing or flagged is provided
S = GHCN-Daily Dataset Source Code (values are given below in Table B)

DP01 – Number of days with >= 0.01 inch/0.254 millimeter in the year

DP01_ATTRIBUTES – S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

DP10 – Number of days with >= 0.1 inch/2.54 millimeters in the year.

DP10_ATTRIBUTES – S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

DP1X – Number of days with >= 1 inch/25.4 millimeters in the year.

DP1X_ATTRIBUTES – S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

DSND – Number of days with snow depth >= 1 inch/25 millimeters.

DSND_ATTRIBUTES – blank

DSNW – Number of days with snowfall >= 1 inch/25 millimeters.

DSNW_ATTRIBUTES – a,S where:

a = DaysMissing (Numeric value): The number of days (from 1 to 5) missing or flagged is provided
S = GHCN-Daily Dataset Source Code (values are given below in Table B)

DT00 – Number of days with maximum temperature <= 0 degrees Fahrenheit/-17.8 degrees Celsius.

DT00_ATTRIBUTES – S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

DT32 – Number of days with maximum temperature <= 32 degrees Fahrenheit/0 degrees Celsius.

DT32_ATTRIBUTES – S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

DX32 – Number of days with maximum temperature <= 32 degrees Fahrenheit/0 degrees Celsius.
DX32_ATTRIBUTES – S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

DX70 – Number of days with maximum temperature <= 70 degrees Fahrenheit/21.1 degrees Celsius.

DX70_ATTRIBUTES – S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

DX90 – Number of days with maximum temperature >= 90 degrees Fahrenheit/32.2 degrees Celsius.

DX90_ATTRIBUTES – S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

EMNT – Extreme minimum temperature for year. Lowest daily minimum temperature for the year. Given in Fahrenheit units on PDF output. CSV output is Fahrenheit or Celsius units depending on user specification.

EMNT_ATTRIBUTES – S,cc,d where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)
cc = two-digit date during the month when the EMNT value occurred (always latest date if more than one occurrence)
d = + if there is more than one date of occurrence, blank if only one date of occurrence

EMSD – Highest daily snow depth in the year. Given in inches for PDF output. CSV output is in inches or millimeters depending on user specification.

EMSD_ATTRIBUTES – M,S,cc,d where:

M = GHCN-Daily Dataset Measurement Flag (values are given below in Table C)
S = GHCN-Daily Dataset Source Code (values are given below in Table B)
cc = two-digit date during the month when the EMNT value occurred (always latest date if more than one occurrence)
d = + if there is more than one date of occurrence, blank if only one date of occurrence

EMSN – Highest daily snowfall in the year. Given in inches for PDF output. CSV output is in inches or millimeters depending on user specification.

EMSN_ATTRIBUTES – M,S,cc,d where:

M = GHCN-Daily Dataset Measurement Flag (values are given below in Table C)
S = GHCN-Daily Dataset Source Code (values are given below in Table B)
cc = two-digit date during the month when the EMNT value occurred (always latest date if more than one occurrence)
d = + if there is more than one date of occurrence, blank if only one date of occurrence

EMXP – Highest daily total of precipitation in the year. Given in inches for PDF output. CSV output is in inches or millimeters depending on user specification.

EMXP_ATTRIBUTES – M,S,cc,d where:

M = GHCN-Daily Dataset Measurement Flag (values are given below in Table C)
S = GHCN-Daily Dataset Source Code (values are given below in Table B)
cc = two-digit date during the month when the EMNT value occurred (always latest date if more than one occurrence)
d = + if there is more than one date of occurrence, blank if only one date of occurrence

EMXT – Extreme maximum temperature for year. Highest daily maximum temperature for the month/year. Given in Fahrenheit units on PDF output. CSV output is Fahrenheit or Celsius units depending on user specification.

EMXT_ATTRIBUTES – S,cc,d where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)
cc = two-digit date during the month when the EMNT value occurred (always latest date if more than one occurrence)
d = + if there is more than one date of occurrence, blank if only one date of occurrence

EVAP – Total Annual Evaporation. Given in inches for PDF output. CSV output is in inches or millimeters depending on user specification. Measurement Flags: T is used for trace amount.

EVAP_ATTRIBUTES = S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

FZF0 – Temperature value of first freeze (at or less than 32 degrees Fahrenheit/0 degrees Celsius) during August - December. Given in inches for PDF output. CSV output is in inches or millimeters depending on user specification.

FZF0_ATTRIBUTES = S,cccc where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)
cccc = 2-digit month/two-digit day when FZF0 occurred

FZF1 – Temperature value of first freeze (at or less than 28 degrees Fahrenheit/-2.2 degrees Celsius) during August - December. Given in inches for PDF output. CSV output is in inches or millimeters depending on user specification.

FZF1_ATTRIBUTES = S,cccc where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)
cccc = 2-digit month/two-digit day when FZF0 occurred

FZF2 – Temperature value of first freeze (at or less than 24 degrees Fahrenheit/-4.4 degrees Celsius) during August - December. Given in inches for PDF output. CSV output is in inches or millimeters depending on user specification.

FZF2_ATTRIBUTES = S,cccc where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)
cccc = 2-digit month/two-digit day when FZF0 occurred

FZF3 – Temperature value of first freeze (at or less than 20 degrees Fahrenheit/-6.7 degrees Celsius) during August - December. Given in inches for PDF output. CSV output is in inches or millimeters depending on user specification.

FZF3_ATTRIBUTES = S,cccc where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)
cccc = 2-digit month/two-digit day when FZF0 occurred

FZF4 – Temperature value of first freeze (at or less than 16 degrees Fahrenheit/-8.9 degrees Celsius) during August - December. Given in inches for PDF output. CSV output is in inches or millimeters depending on user specification.

FZF4_ATTRIBUTES = S,cccc where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)
cccc = 2-digit month/two-digit day when FZF0 occurred

FZF5 – Temperature value of last freeze (at or less than 32 degrees Fahrenheit/0 degrees Celsius) during January - July. Given in inches for PDF output. CSV output is in inches or millimeters depending on user specification.

FZF5_ATTRIBUTES = S,cccc where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)
cccc = 2-digit month/two-digit day when FZF0 occurred

FZF6 – Temperature value of last freeze (at or less than 28 degrees Fahrenheit/-2.2 degrees Celsius) during January - July. Given in inches for PDF output. CSV output is in inches or millimeters depending on user specification.

FZF6_ATTRIBUTES = S,cccc where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)
cccc = 2-digit month/two-digit day when FZF0 occurred

FZF7 – Temperature value of last freeze (at or less than 24 degrees Fahrenheit/-4.4 degrees Celsius) during January - July. Given in inches for PDF output. CSV output is in inches or millimeters depending on user specification.

FZF7_ATTRIBUTES = S,cccc where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)
cccc = 2-digit month/two-digit day when FZF0 occurred

FZF8 – Temperature value of last freeze (at or less than 20 degrees Fahrenheit/-6.7 degrees Celsius) during January - July. Given in inches for PDF output. CSV output is in inches or millimeters depending on user specification.

FZF8_ATTRIBUTES = S,cccc where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)
cccc = 2-digit month/two-digit day when FZF0 occurred

FZF9 – Temperature value of last freeze (at or less than 16 degrees Fahrenheit/-8.9 degrees Celsius) during January - July. Given in inches for PDF output. CSV output is in inches or millimeters depending on user specification.

FZF9_ATTRIBUTES = S,cccc where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)
cccc = 2-digit month/two-digit day when FZF0 occurred

HDSD – Heating Degree Days (season-to-date). Running total of monthly heating degree days through the end of the most recent month. Each month is summed to produce a season-to-date total. Season starts in July in Northern Hemisphere and January in Southern Hemisphere. Given in Fahrenheit degrees in PDF output and Celsius or Fahrenheit degrees depending on user specification in CSV output.

HDSD_ATTRIBUTES – S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

HNyz – Highest minimum soil temperature for the year. Given in Fahrenheit for PDF output and Fahrenheit or Celsius depending on user specification for CSV output. Note: "yz" portion of variable name correspond with values in Table E below.

HNyz_ATTRIBUTES = S,y,z where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)
y = ground cover code (see table E below)
z = soil depth code (see table E below)

HTDD - Heating Degree Days. Computed when daily average temperature is less than 65 degrees Fahrenheit/18.3 degrees Celsius. HDD = 65(F)/18.3(C) – mean daily temperature. Each month is summed to produce an annual total. Given in Fahrenheit units on PDF output. CSV output is Fahrenheit or Celsius units depending on user specification.

HTDD_ATTRIBUTES – a,S where:

a = DaysMissing (Numeric value): The number of days (from 1 to 5) missing or flagged is provided
S = GHCN-Daily Dataset Source Code (values are given below in Table B)

HXyz – Highest maximum soil temperature for the year. Given in Fahrenheit for PDF output and Fahrenheit or Celsius depending on user specification for CSV output. Note: "yz" portion of variable name correspond with values in Table E below.

HXyz_ATTRIBUTES = S,y,z where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)
y = ground cover code (see table E below)
z = soil depth code (see table E below)

LNyz – Lowest minimum soil temperature for the year. Given in Fahrenheit for PDF output and Fahrenheit or Celsius depending on user specification for CSV output. Note: "yz" portion of variable name correspond with values in Table E below.

LNyz_ATTRIBUTES = S,y,z where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

y = ground cover code (see table E below)
z = soil depth code (see table E below)

LXyz – Lowest maximum soil temperature for the year. Given in Fahrenheit for PDF output and Fahrenheit or Celsius depending on user specification for CSV output. Note: "yz" portion of variable name correspond with values in Table E below.

LXyz_ATTRIBUTES = a,M,Q,S,y,z where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)
y = ground cover code (see table E below)
z = soil depth code (see table E below)

MNPN – Monthly Mean Minimum Temperature of evaporation pan water. Given in Fahrenheit units for PDF output and Celsius or Fahrenheit units in CSV output depending on user specification.

MNPN_ATTRIBUTES = S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

MNyz – Annual Mean of daily minimum soil temperature. Given in Fahrenheit for PDF output and Fahrenheit or Celsius depending on user specification for CSV output.

MNyz_ATTRIBUTES = S,y,z where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)
y = ground cover code (see table E below)
z = soil depth code (see table E below)

MXPN – Annual Mean Maximum Temperature of evaporation pan water. Given in Fahrenheit units for PDF output and Celsius or Fahrenheit units in CSV output depending on user specification.

MXPN_ATTRIBUTES = S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

MXyz – Annual Mean of daily maximum soil temperature. Given in Fahrenheit for PDF output and Fahrenheit or Celsius depending on user specification for CSV output.

MXyz_ATTRIBUTES = S,y,z where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)
y = ground cover code (see table E below)
z = soil depth code (see table E below)

PRCP – Total Annual Precipitation. Given in inches for PDF output. CSV output is in inches or millimeters depending on user specification. Measurement Flags: T is used for trace amount.

PRCP_ATTRIBUTES = M, S where:

M = GHCN-Daily Dataset Measurement Flag (values are given below in Table C)
S = GHCN-Daily Dataset Source Code (values are given below in Table B)

PSUN – Annual Average of the daily percents of possible sunshine.
PSUN_ATTRIBUTES – S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

SNOW – Total Annual Snowfall. Given in inches for PDF output. CSV output is in inches or millimeters depending on user specification. Measurement Flags: T is used for trace amount.

SNOW_ATTRIBUTES = M, S where:

M = GHCN-Daily Dataset Measurement Flag (values are given below in Table C)
S = GHCN-Daily Dataset Source Code (values are given below in Table B)

TAVG – Average Annual Temperature. Computed by adding the unrounded monthly average temperatures and dividing by 2. Fahrenheit units on PDF output. CSV output is Fahrenheit or Celsius units depending on user specification.

TAVG_ATTRIBUTES – S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

TMAX – Average Annual Maximum Temperature. Average of mean monthly maximum temperatures given in Fahrenheit on PDF output. CSV output is given in Fahrenheit or Celsius depending on user specification.

TMAX_ATTRIBUTES = S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

TMIN – Average Annual Minimum Temperature. Average of mean monthly minimum temperatures given in Fahrenheit units on PDF output. CSV output is given in Fahrenheit or Celsius units depending on user specification.

TMIN_ATTRIBUTES = S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

TSUN – Annual total sunshine in minutes.

TSUN_ATTRIBUTES – S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

WDF1 – Wind Direction for Maximum Wind Speed/Fastest 1-Minute (WSF1). Given in 360-degree compass point directions (e.g. 360 = north, 180 = south, etc.).

WDF1_ATTRIBUTES – S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

WDF2 – Wind Direction for Maximum Wind Speed/Fastest 2-Minute (WSF2). Given in 360-degree compass point directions (e.g. 360 = north, 180 = south, etc.).

WDF2_ATTRIBUTES – S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

WDF5 – Wind Direction for Peak Wind Gust Speed – Fastest 5-second (WSF5). Given in 360-degree compass point directions (e.g. 360 = north, 180 = south, etc.).

WDF5_ATTRIBUTES – S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

WDFG – Wind Direction for Peak Wind Gust Speed (WSFG). Given in 360-degree compass point directions (e.g. 360 = north, 180 = south, etc.).

WDFG_ATTRIBUTES – S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

WDFI –Direction of highest instantaneous wind speed (WDFI). Given in 360-degree compass point directions (e.g. 360 = north, 180 = south, etc.).

WDFI_ATTRIBUTES – S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

WDFM – Wind Direction for Maximum Wind Speed/Fastest Mile (WSFM). Given in 360-degree compass point directions (e.g. 360 = north, 180 = south, etc.).

WDFM_ATTRIBUTES – S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

WDMV – Total Monthly Wind Movement over evaporation pan. Given in miles for PDF output and miles or kilometers depending on user specification for CSV output.

WDMV_ATTRIBUTES = S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

WSF1 - Maximum Wind Speed/Fastest 1-minute. Maximum wind speed for the month reported as the fastest 1-minute. Given in miles per hour for PDF output and miles per hour or meters per second depending on user specification for CSV output.

WSF1_ATTRIBUTES – S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

WSF2 – Maximum Wind Speed/Fastest 2-minute. Maximum wind speed for the month reported as the fastest 2-minute. Given in miles per hour for PDF output and miles per hour or meters per second depending on user specification for CSV output.

WSF2_ATTRIBUTES – S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

WSF5 – Peak Wind Gust Speed – Fastest 5-second wind. Maximum wind gust for the month. Given in miles per hour for PDF output and miles per hour or meters per second depending on user specification for CSV output.

WSF5_ATTRIBUTES – S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

WSFG – Peak Wind Gust Speed. Maximum wind gust for the year. Given in miles per hour for PDF output and miles per hour or meters per second depending on user specification for CSV output.

WSFG_ATTRIBUTES – S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

WSFI – Highest instantaneous wind speed for the year. Given in miles per hour for PDF output and miles per hour or meters per second depending on user specification for CSV output.

WSFI_ATTRIBUTES – S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

WSFM – Maximum Wind Speed/Fastest Mile. Maximum wind speed for the month reported as the fastest mile. Given in miles per hour for PDF output and miles per hour or meters per second depending on user specification for CSV output.

WSFM_ATTRIBUTES – S where:

S = GHCN-Daily Dataset Source Code (values are given below in Table B)

Table B - GHCN-Daily Dataset Source Codes:

Blank = No source (i.e., data value missing)
0 = U.S. Cooperative Summary of the Day (NCDC DSI-3200)
6 = CDMP Cooperative Summary of the Day (NCDC DSI-3206)
7 = U.S. Cooperative Summary of the Day -- Transmitted via WxCoder3 (NCDC DSI-3207)
A = U.S. Automated Surface Observing System (ASOS)
real-time data (since January 1, 2006)
a = Australian data from the Australian Bureau of Meteorology
B = U.S. ASOS data for October 2000-December 2005 (NCDC DSI-3211)
b = Belarus update
C = Environment Canada
E = European Climate Assessment and Dataset (Klein Tank et al., 2002)
F = U.S. Fort data
G = Official Global Climate Observing System (GCOS) or other government-supplied data
H = High Plains Regional Climate Center real-time data
I = International collection (non U.S. data received through personal contacts)
K = U.S. Cooperative Summary of the Day data digitized from paper observer forms
(from 2011 to present)
M = Monthly METAR Extract (additional ASOS data)
N = Community Collaborative Rain, Hail,and Snow (CoCoRaHS)
Q = Data from several African countries that had been "quarantined", that is, withheld from
public release until permission was granted from the respective meteorological services
R = NCEI Reference Network Database (Climate Reference Network and Regional Climate
Reference Network)
r = All-Russian Research Institute of Hydrometeorol Information-World Data Center
S = Global Summary of the Day (NCDC DSI-9618)

NOTE: "S" values are derived from hourly synoptic reports
exchanged on the Global Telecommunications System (GTS).
Daily values derived in this fashion may differ significantly
from "true" daily data, particularly for precipitation (i.e., use with caution).

s = China Meteorological Administration/National Meteorological Information Center/
Climatic Data Center (http://cdc.cma.gov.cn)
T = SNOwpack TELemtry (SNOTEL) data obtained from the U.S. Department of Agriculture's Natural
Resources Conservation Service
U = Remote Automatic Weather Station (RAWS) data obtained from the Western Regional
Climate Center
u = Ukraine update
W = WBAN/ASOS Summary of the Day from NCDC's Integrated Surface Data (ISD).
X = U.S. First-Order Summary of the Day (NCDC DSI-3210)
Z = Datzilla official additions or replacements
z = Uzbekistan update

Table C - GHCN-Daily Dataset Measurement Flags:

Blank = no measurement information applicable
B = precipitation total formed from two 12-hour totals
D = precipitation total formed from four six-hour totals
H = represents highest or lowest hourly temperature (TMAX or TMIN)
or the average of hourly values (TAVG)
K = converted from knots
L = temperature appears to be lagged with respect to reported
hour of observation
O = converted from oktas
P = identified as "missing presumed zero" in DSI 3200 and 3206
T = trace of precipitation, snowfall, or snow depth
W = converted from 16-point WBAN code (for wind direction)

Table E – Ground cover code (y) and soil depth code (z) for HXyz, HNyz, LXyz, LNyz, MNYZ and MXYZ

Y (ground cover):
1 = grass
2 = fallow
3 = bare ground
4 = brome grass
5 = sod
6 = straw mulch
7 = grass muck
8 = bare muck
0 = unknown

Z (soil depth):
1 = 2 inches or 5 centimeters depth
2 = 4 inches or 10 centimeters depth
3 = 8 inches or 20 centimeters depth
4 = 20 inches or 50 centimeters depth
5 = 40 inches or 100 centimeters depth
6 = 60 inches or 150 centimeters depth
7 = 72 inches or 180 centimeters depth
0 = unknown