Daymet V3

Single-Point Extraction Data
Data Guide
http://daymet.ornl.gov
June 16, 2016

Overview

Daymet is a collection of algorithms and computer software designed to interpolate and extrapolate from daily meteorological observations to produce gridded estimates of daily weather parameters over large regions. Weather parameters generated include daily continuous surfaces of minimum and maximum temperature, precipitation, humidity, and radiation. Daymet was developed to fulfill the need for continuous surfaces of daily weather data necessary for plant growth model inputs. The data generated from the Daymet model has broad applications over a wide variety of scientific and research fields including hydrology, terrestrial vegetation growth models, carbon cycle science, and regional to large scale climate change analysis. The daily time step, 1 km spatial resolution, and broad spatial extent of the dataset make it a unique and valuable contribution to the scientific community.

This document describes the use of the ***Single Pixel Data Extraction*** tool available from the ORNL DAAC Daymet web site. From this routine, a user can download daily Daymet in a CSV tabular file format for any one pixel and view the queried data as a graphical visualization. Daymet variables and units are defined and references and Daymet data use citations are provided.

Required Sign In

The ORNL DAAC as a NASA entity requires a NASA Earthdata Login prior to the download of Daymet data. There is a link to Sign In or Register with the NASA Earthdata Login on Daymet data download pages.

Input Specifications

The Single Pixel data access option allows a user to obtain daily Daymet data in a tabular format of variables for a single geographic point (pixel). The user specifies a single geographic point by latitude and longitude, in decimal degrees. Note that latitude values are positive for north, negative for south, while longitude values are positive for east, negative for west. All valid data points will therefore have positive latitude and negative longitude. It is necessary to place the balloon or enter a latitude/longitude pair that is on the Daymet land/water mask. If an error occurs, try repositioning the balloon if you're area of interest is near water. The user has the option to select all Daymet variables, a single variable, or a subset of variables by using the CTRL key to select. Similarly, all available years of data or a subset of years can be queried.

Additional Services

The Single Pixel Extraction tool allows for programmatic download of multiple coordinate locations. A multiple extractor script is available for download from the Data Access web page. In addition, a Daymet Single Pixel Extraction Web Service API is provided based on REST URL transfer architecture. This web service allows browser viewing (both table and graph form) or CSV file download of the data for lat/lon locations directly provided from the browser URL. CSV file download is also possible through command utilities such as Wget and cURL.

Output Process

When a user clicks "Get Data", a routine is executed on the Daymet server to translate the (lat, lon) coordinates into the Daymet projected (x, y) coordinates using the Generalized Cartographic Transformation Package (GCTP). These coordinates are used to access the Daymet database of daily interpolated surface weather variables. Daily data from the corresponding 1km x 1km Daymet grid cell are extracted from the database and formatted as a table with one column for each output variable and one row for each day.

All daily data for all available years are returned as a single (long) table, formatted for display in the browser window. At the top of this table is a link, "Download Data", to the same data in a CSV format, suitable for import into a spreadsheet or other data analysis software. The "Visualize Data" button takes the user to a graphic visualization of the individual Daymet variables for the selected year(s).

Output Data Format

The Download Data button will provide a CSV file named according to the Daymet TileID from which the data was extracted and the date of download. The table consists of 8 header lines, followed by daily records (one per line).

Header Lines

Line 1 – Requested latitude and longitude (decimal degrees).
Line 2 – File (x, y) Lambert Conformal Conic coordinates, in meters, from the Daymet data grid corresponding to the requested (lat, lon) location.
Line 3 – The Daymet tile ID within which the entered lat, lon is located.
Line 4 – Elevation from the Daymet DEM (in meters above sea level) for the requested location.
Line 5 – Daymet data and software version information.
Line 6 – Citation information
Line 7 – Blank
Line 8 – Variable names and units for the daily data columns (see descriptions below).

Variables and Units

1. **year** (no units): Year, repeated for each day in the year.

2. **yday** (no units): Integer representing day of year, values ranging from 1-365. Where:
   yday 1 = January 1
   yday 365 = December 31 for non-leap years ***or*** December 30 for leap-years

   NOTE: All Daymet years are 1 – 365 days, including leap years. The Daymet database includes leap-days. Values for December 31 are discarded from leap years to maintain a 365-day year.

3. **tmax** (degrees C): Daily maximum 2-meter air temperature.

4. **tmin** (degrees C): Daily minimum 2-meter air temperature.

5. **dayl** (s/day): Duration of the daylight period for the day. This calculation is based on the period of the day during which the sun is above a hypothetical flat horizon.

6. **prcp** (mm/day): Daily total precipitation, sum of all forms converted to water-equivalent.

7. **srad** (W/m^2): Incident shortwave radiation flux density, taken as an average over the daylight period of the day.

   NOTE: Daily Total Radiation (MJ/m^2/day) can be calculated as follows:
   ((srad (W/m^2) * dayl (s/day)) / 1,000,000)

8. **swe** (kg/m^2): Snow water equivalent. The amount of water contained within the snowpack.
   Please see below for a more detailed explanation of the SWE variable.

9. **vp** (Pa): Water Vapor Pressure. Daily average partial pressure of water vapor.

Snow Water Equivalent Clarification

Snowpack, quantified as snow water equivalent (SWE), is estimated as part of the Daymet processing in order to reduce biases in shortwave radiation estimates related to multiple reflections between the surface and atmosphere that are especially important when the surface is covered by snow (Thornton et al. 2000). The Daymet (v3.0) dataset includes estimated SWE as an output variable since this quantity may be of interest for research applications in addition to its primary intended use as a component of the Daymet shortwave radiation algorithm. An important caveat in the use of SWE from the Daymet (v3.0) dataset is that the algorithm used to estimate SWE is executed with only a single calendar year of primary surface weather inputs (daily maximum and minimum temperature and daily total precipitation) available for the estimation of a corresponding calendar year of snowpack. Since northern hemisphere snowpack accumulation is commonly underway already at the beginning of the calendar year, the SWE algorithm uses data from a single calendar year to make a two-year sequence of temperature and precipitation, then predicts the evolution of snowpack over this two-year period to provide an estimate of yearday 365 (December 31 for non-leapyears) snowpack as an

initial condition for the January 1 time step of the actual calendar year. The problem with this approach is that it ignores the dependence of January 1 snowpack on preceding calendar year temperature and precipitation conditions, and so generates potential biases in mid-season snowpack which can propagate to biases in late-season timing of snow melt. A better approach would be to calculate snowpack from the continuous stream of calendar years.

Daymet Calendar

The Daymet calendar is based on a standard calendar year. All Daymet years have 1 – 365 days, including leap years. For leap years, the Daymet database includes leap day. Values for December 31 are discarded from leap years to maintain a 365-day year.

Daymet Version Information

The Daymet dataset is stored as individual CF-Compliant netCDF file for each Daymet variable. On the server side, the Single Point Extraction Routine extracts from each of the CF-netCDF files and returns values for each variable for a single queried x, y projected value. The most current Daymet data is being delivered to the user in terms of both Daymet software and Daymet data versions. Version information is recorded in the header file of each of the CF-netCDF files within the Global Attribute fields Version_software and Version_data. All Daymet data is provisional and subject to revision.

Daymet Projection Definition

Though not directly relevant to the single pixel extraction data, the Daymet dataset downloaded from the daymet.ornl.gov web site is spatially referenced to the following projection.

The North American Daymet projection system and parameters:
Projection System: Lambert Conformal Conic

Parameters:

projection units:	meters
datum (spheroid):	WGS_84
1st standard parallel:	25 deg N
2nd standard parallel:	60 deg N
Central meridian:	-100 deg (W)
Latitude of origin:	42.5 deg N
false easting:	0
false northing:	0

The spatial resolution of the Daymet gridded dataset is 1 km.

Daymet Data Citation

When using the Daymet data acquired from the ORNL DAAC web site, please use the citation information found on the Daymet Web Site.

Daymet Publication Citation

The following should be used as the general citation for the methods used to generate the Daymet database:

> Thornton, P.E., S.W. Running, and M.A. White. 1997. Generating surfaces of daily meteorology variables over large regions of complex terrain. Journal of Hydrology 190:214-251.

For applications of the radiation and humidity data please include the following citation **in addition** to the general citation:

> Thornton, P.E., H. Hasenauer, and M.A. White. 2000. Simultaneous estimation of daily solar radiation and humidity from observed temperature and precipitation: An application over complex terrain in Austria. Agricultural and Forest Meteorology 104:255-271.

> Thornton, P.E. and S.W. Running. 1999. An improved algorithm for estimating incident daily solar radiation from measurements of temperature, humidity, and precipitation. Agriculture and Forest Meteorology. 93:211-228.