Package 'degday'

October 13, 2022

Type Package

Title Compute Degree Days

Version 0.4.0

Date 2022-09-09

Description Compute degree days from daily min and max temperatures for modeling plant and insect development.

License GPL (>= 3)

URL https://github.com/ucanr-igis/degday/

BugReports https://github.com/ucanr-igis/degday/issues/

Depends R (>= 3.5)

Imports crayon, magrittr, methods, zoo

Suggests cimir, dplyr, knitr, testthat (>= 3.0.0), tidyr, units

Config/testthat/edition 3

Encoding UTF-8

Language en-US

RoxygenNote 7.2.1

NeedsCompilation no

Author Andy Lyons [aut, cre] (<https://orcid.org/0000-0002-7505-6709>), Regents of the University of California [cph]

Maintainer Andy Lyons <andlyons@ucanr.edu>

Repository CRAN

Date/Publication 2022-09-13 10:00:02 UTC

R topics documented:

dd_calc *Estimate degree days from daily data*

Description

Estimate degree days from daily min and max temperature

Usage

```
dd_calc(
  daily_min,
  daily_max,
  nextday_min = daily_min,
  thresh_low = NULL,
  thresh_up = NULL,
  method = c("sng_tri", "dbl_tri", "sng_sine", "dbl_sine", "simp_avg")[0],
  cutoff = c("horizontal", "vertical", "intermediate")[1],
  digits = 2,
  cumulative = FALSE,
  no_neg = TRUE,
  simp_avg_zero_method = 1,
  interpolate_na = FALSE,
  quiet = FALSE,
  debug = FALSE
)

dd_simp_avg(
  daily_min,
  daily_max,
  thresh_low,
  thresh_up = NULL,
  simp_avg_zero_method = 1,
  digits = 2,
  cumulative = FALSE,
  quiet = FALSE
)

dd_sng_tri(
  daily_min,
  daily_max,
  thresh_low = NULL,
  thresh_up = NULL,
  cutoff = c("horizontal", "vertical", "intermediate")[1],
  digits = 2,
  cumulative = FALSE,
  quiet = FALSE
)
```

```
dd_sng_sine(
  daily_min,
  daily_max,
  thresh_low = NULL,
  thresh_up = NULL,
  cutoff = c("horizontal", "vertical", "intermediate")[1],
  digits = 2,
  cumulative = FALSE,
  quiet = FALSE
)

dd_dbl_tri(
  daily_min,
  daily_max,
  nextday_min = daily_min,
  thresh_low = NULL,
  thresh_up = NULL,
  cutoff = c("horizontal", "vertical", "intermediate")[1],
  digits = 2,
  cumulative = FALSE,
  quiet = FALSE
)

dd_dbl_sine(
  daily_min,
  daily_max,
  nextday_min = daily_min,
  thresh_low = NULL,
  thresh_up = NULL,
  cutoff = c("horizontal", "vertical", "intermediate")[1],
  digits = 2,
  cumulative = FALSE,
  quiet = FALSE
)
```

Arguments

daily_min	Daily minimum temperature
daily_max	Daily maximum temperature
nextday_min	Minimum temp the day after
thresh_low	Lower development threshold temperature
thresh_up	Upper development threshold temperature
method	Estimation method
cutoff	Estimation cutoff method
digits	Number of decimal places to round results to

cumulative	Return cumulative values
no_neg	Set negative values to zero
simp_avg_zero_method	How to handle temperatures in the simple average method that fall outside the upper and lower thresholds (see details)
interpolate_na	Interpolate missing values, logical
quiet	Suppress messages, logical
debug	Show additional messages

Details

Units for daily_min, daily_max, thresh_low, and thresh_up should all be the same (i.e., all Fahrenheit or all Celsius). The function does not check for unit consistency.

nextday_min is required for the double-triangle and the double-sine methods. These methods use the minimum temperature of the following day to model temperatures in the 2nd half of the day. If omitted or NA, the daily minimum temperature will be substituted.

no_neg = TRUE sets negative values to zero. This is generally preferred when using degree days to predict the timing of development milestones, if one assumes that growth can not go backwards.

The simple average method is taken from McMaster and Wilhelm (1997). This method requires passing a lower threshold (also called the base temp). There are two ways of handling temperatures that fall below the base temperature. Most studies and applications use the default method (simp_avg_zero_method = 1) which simply 'zeroes out' average daily temperatures that fall below the base temp. Some studies (notably corn) use method 2, which truncates the daily minimum and maximum temperature before computing the simple average. Method 2 also allows you to pass an upper threshold. For details, see McMaster and Wilhelm.

Missing values (NAs) in the temperatures will result in NA degree days. If interpolate_na = TRUE, missing degree days will be interpolated. NAs in the middle of the series will be linearly interpolated, and NAs at the ends will be filled with the adjacent values.

Value

A vector of estimated degree day values (either daily or cumulative, depending on the value of cumulative)

Functions

- dd_simp_avg(): Estimate degree days using the simple avg method
- dd_sng_tri(): Estimate degree days using the single-triangle method
- dd_sng_sine(): Estimate degree days using the single-sine method
- dd_dbl_tri(): Estimate degree days using the double-triangle method
- dd_dbl_sine(): Estimate degree days using the double-sine method

Examples

```
daily_temps <- system.file("extdata/espartoa-weather-2020.csv", package = "degday") %>%
  read.csv() %>%
    dplyr::mutate(date = as.Date(date)) %>%
    dplyr::slice(1:10)
daily_temps
## Simple average method
dd_simp_avg(daily_min = daily_temps$tmin,
            daily_max = daily_temps$tmax,
            thresh_low = 55)
## Single sine method
dd_sng_sine(daily_min = daily_temps$tmin, daily_max = daily_temps$tmax,
            thresh_low = 55, thresh_up = 93.9)
## Single triangle method
dd_sng_tri(daily_min = daily_temps$tmin, daily_max = daily_temps$tmax,
           thresh_low = 55, thresh_up = 93.9)
## Add next day min temp as an additional column
daily_temps_plus_tmin_next <- daily_temps %>% dplyr::mutate(tmin_next = dplyr::lead(tmin, n = 1))
daily_temps_plus_tmin_next
## Double-triangle method
dd_dbl_tri(daily_min = daily_temps_plus_tmin_next$tmin,
           daily_max = daily_temps_plus_tmin_next$tmax,
           nextday_min = daily_temps_plus_tmin_next$tmin_next,
           thresh_low = 55, thresh_up = 93.9)
```

Index