Package ‘degday’

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Type Package

Title Compute Degree Days

Version 0.4.0

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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), tidyrr, units

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NeedsCompilation no

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**dd_calc**

*Estimate degree days from daily data*

**Description**

Estimate degree days from daily min and max temperature

**Usage**

```r
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_calc

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)
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