Package ‘acdcR’

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Type Package

Title Agro-Climatic Data by County

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Description The functions are designed to calculate the most widely-used county-level variables in agricultural production or agricultural-climatic and weather analyses. To operate some functions in this package needs download of the bulk PRISM raster. See the examples, testing versions and more details from: <https://github.com/ysd2004/acdcR>.

Depends R (>= 4.0.0), raster, data.table, stats

License GPL (>= 2)

URL https://github.com/ysd2004/acdcR

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Contents

gddcal 2
gddprism 3
grid2stco 5
pptprism 6

Index **8**

`gddcal` *Calculating growing season degree days*

Description

The function calculates the growing season degree days (GDDs) using single/double triangulation/sine methods.

Usage

```
gddcal(tL, tU, tMin, tMax, tMin2 = NULL, method = NULL)
```

Arguments

`tL`	Lower temperature threshold
`tU`	Upper temperature threshold
`tMin`	Minimum temperature
`tMax`	Maximum temperature
`tMin2`	Minimum temperature for the second half day
`method`	GDD calculation methods (default = single sine method)

Details

`gddcal` is a function for calculating growing season degree days (GDDs) through four approaches popularly used in agricultural production or relevant fields.

- `method = 'stri'`: single triangulation method
- `method = 'dtri'`: double triangulation method (need `tMin2`)
- `method = 'ssin'`: single sine method
- `method = 'dsin'`: double sine method (need `tMin2`)

The default is the single sine method. i.e., if `method` is not specified, `gddcal` uses the single sine method. For two double methods (`'dtri'` and `'dsin'`), a second half day minimum temperature needs to be specified.

Value

A numeric of growing season degree days (GDDs)

References

Zalom, F. G., P. B. Goodell, Lloyd T. Wilson, W. W. Barnett, and W. J. Bentley. (1983) "Degree-Days, the Calculation and Use of Heat Units in Pest Management." *Division of Agriculture and Natural Resources, University of California*. 1-11.

See Also

gddprism

Examples

```
## Single Triangulation Method
gddcal(55,90,50,82,'stri')
## Double Triangulation Method
gddcal(55,90,50,82,45,'dtri')
## Single Sine Method
gddcal(55,90,50,82)
gddcal(55,90,50,82,'ssin')
## Double Sine Method
gddcal(55,90,50,82,45,'dsin')
```

---

gddprism — *Calculating GDDs by PRISM grids or Counties with PRISM raster*

Description

The function calculates the growing season degree days (GDDs) by grids or counties directly from a PRISM raster.

Usage

```
gddprism(
  minprism,
  maxprism,
  year,
  tL,
  tU,
  method = c("stri", "ssin"),
  out = NULL
)
```

Arguments

minprism	A PRISM raster of the minimum temperature
maxprism	A PRISM raster of the maximum temperature
year	year of the PRIsM raster of minprism and maxprism
tL	Lower temperature threshold
tU	Upper temperature threshold
method	GDD calculation methods: single sine or single triangulation only (default = single sine method)
out	Output value type: GDDs by PRISM grids or Counties (default = Counties)

Details

gddprism is a function for calculating growing season degree days (GDDs) by PRISM grids or Counties directly from a PRISM raster.

Only single methods (single sine or single triangulation) are applicable by specifying method.
- method = 'stri': single triangulation method
- method = 'ssin': single sine method (default)

The out is to specify the output values.
- out = 'grid': GDDs by PRISM grids projected on the NLCD map
- out = 'stco': GDDs by Counties of 2017 Agricultural Census (default)
If out is not specified, 'stco' is set as default.

When out='stco' is specified, the weights are applied as:
- year < 2004: agricultural areas in 2001 NLCD
- year = 2004 or 2005: agricultural areas in 2004 NLCD
- year = 2006 or 2007: agricultural areas in 2006 NLCD
- year = 2008, 2009, or 2010: agricultural areas in 2008 NLCD
- year = 2011 or 2012: agricultural areas in 2011 NLCD
- year = 2013, 2014, or 2015: agricultural areas in 2013 NLCD
- year = 2016, 2017, or 2018: agricultural areas in 2016 NLCD
- year >= 2019: agricultural areas in 2019 NLCD

To get a PRIMS raster, follow the instruction at https://prism.oregonstate.edu/documents/PRISM_downloads_FTP.pdf.

Value

A data.frame including GDDs (gdd), PRISM grid numbers (gridNum), or FIPS codes (stco)

See Also

gddcal, pptprism, grid2stco

Examples

```
#######################################################
## Note: Need PRISM rasters to run this code
#######################################################
## Not run:
## PRISM data import
maxdata <- raster('./PRISM_tmax_stable_4kmD1_19960701_bil.bil')
mindata <- raster('./PRISM_tmin_stable_4kmD1_19960701_bil.bil')
## Single Sine Methods over Counties
result1 <- gddprism(mindata,maxdata,1996,8,30,'ssin')
result2 <- gddprism(mindata,maxdata,1996,8,30,'ssin','stco')
## Single Sine Method over PRISM grids
result3 <- gddprism(mindata,maxdata,1996,8,30,'ssin','grid')
## Single Triangulation over Counties
result4 <- gddprism(mindata,maxdata,1996,8,30,'stri')
```

```
## End(Not run)
```

`grid2stco` *Convert PRISM grid data to agricultural area weighted county data*

Description

The function calculates agricultural area weighted county values from PRISM grid data.

Usage

```
grid2stco(griddata, year)
```

Arguments

`griddata`	An output data.frame from `gddprism` or `pptprism`
`year`	year of the griddata

Details

`grid2stco` converts an output data.frame from `gddprism` or `pptprism` to the county-level weighted average with agricultural areas in NLCD.
If a single PRISM result is converted from grid to stco, the results are the same with the `stco` specification in `gddprism` or `pptprism`.
This function would be helpful when cumulative precipitation or gdd are applied first and then calculate county-level values.
The GDDs and precipitations in Schlenker and Roberts (2009) are replicable with these functions.

The input of `griddata` should have the following variables.
- For an output of `gddprism`: gridNum, stco, and gdd
- For an output of `pptprism`: gridNum, stco, and ppt

With the specified data year of `year`, the weights are applied as:
- year < 2004: agricultural areas in 2001 NLCD
- year = 2004 or 2005: agricultural areas in 2004 NLCD
- year = 2006 or 2007: agricultural areas in 2006 NLCD
- year = 2008, 2009, or 2010: agricultural areas in 2008 NLCD
- year = 2011 or 2012: agricultural areas in 2011 NLCD
- year = 2013, 2014, or 2015: agricultural areas in 2013 NLCD
- year = 2016, 2017, or 2018: agricultural areas in 2016 NLCD
- year >= 2019: agricultural areas in 2019 NLCD

Value

A data.frame of FIPS codes (stco) and growing degree days (GDDs) or precipitation (ppt)

References

Schlenker, W. and M. Roberts. (2009) "Nonlinear temperature effects indicate severe damages to U.S. crop yields under climate change." *Proceedings of the National Academy of Sciences (PNAS)*. 15594-15598.

See Also

gddprism, pptprism

Examples

```
## PRISM data import
#######################################################
## Note: Need a PRISM raster to run this code
#######################################################
## Not run:
pptdata <- raster('./PRISM_ppt_stable_4kmD2_19960701_bil.bil')
## precipitation data by grid and stco
stcores <- pptprism(pptdata,1996,'stco')
gridres <- pptprism(pptdata,1996,'grid')
## Convert the gridres to stcores
converted <- grid2stco(gridres,1996)
## Compare the results
converted$ppt[1:10]
stcores$ppt[1:10]

## End(Not run)
```

---

pptprism — *Calculating precipitation by PRISM grids or Counties with PRISM raster*

Description

The function calculates the precipitation (mm) by grids or counties directly from a PRISM raster.

Usage

```
pptprism(mmprism, year, out = NULL)
```

Arguments

mmprism	A PRISM raster of the precipitation
year	year of the PRIsM raster
out	Output value type: precipitation by PRISM grids or Counties (default = Counties)

Details

`pptprism` is a function for calculating precipitation (mm) by PRISM grids or Counties directly from a PRISM raster.

The `out` is to specify the output values.
- `out = 'grid'`: precipitation by PRISM grids projected on the NLCD map
- `out = 'stco'`: precipitation by Counties of 2017 Agricultural Census (default)
If `out` is not specified, 'stco' is set as default.

When `out='stco'` is specified, the weights are applied as:
- year < 2004: agricultural areas in 2001 NLCD
- year = 2004 or 2005: agricultural areas in 2004 NLCD
- year = 2006 or 2007: agricultural areas in 2006 NLCD
- year = 2008, 2009, or 2010: agricultural areas in 2008 NLCD
- year = 2011 or 2012: agricultural areas in 2011 NLCD
- year = 2013, 2014, or 2015: agricultural areas in 2013 NLCD
- year = 2016, 2017, or 2018: agricultural areas in 2016 NLCD
- year >= 2019: agricultural areas in 2019 NLCD

To get a PRIMS raster, follow the instruction at https://prism.oregonstate.edu/documents/PRISM_downloads_FTP.pdf.

Value

A data.frame including precipitation (ppt), PRISM grid numbers (gridNum), or FIPS codes (stco)

See Also

gddprism, grid2stco

Examples

```
#######################################################
## Note: Need a PRISM raster to run this code
#######################################################
## Not run:
## PRISM data import
pptdata <- raster('./PRISM_ppt_stable_4kmD2_19960701_bil.bil')
## precipitation over Counties
result <- pptprism(pptdata,1996)
result2 <- pptprism(pptdata,1996,'stco')
## precipitation over PRISM grids
result3 <- pptprism(pptdata,1996,'grid')

## End(Not run)
```

Index

gddcal, 2, *4*
gddprism, *3*, 3, *6*, *7*
grid2stco, *4*, 5, *7*

pptprism, *4*, *6*, 6