Package 'adw'

April 15, 2024

Title Angular Distance Weighting Interpolation

Version 0.4.0

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Description
The irregularly-spaced data are interpolated onto regular latitude-longitude grids by weighting each station according to its distance and angle from the center of a search radius. In addition to this, we also provide a simple way (Jones and Hulme, 1996) to grid the irregularly-spaced data points onto regular latitude-longitude grids by averaging all stations in grid-boxes.

URL https://github.com/PanfengZhang/adw

BugReports https://github.com/PanfengZhang/adw/issues

Depends R (>= 4.2.0)

Imports methods, sf, terra, cnmap

License GPL-3

Encoding UTF-8

RoxygenNote 7.3.1

Suggests knitr, rmarkdown, ggplot2

VignetteBuilder knitr

NeedsCompilation no

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Repository CRAN

Date/Publication 2024-04-15 19:10:16 UTC

R topics documented:

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adw *Angular Distance Weighting Interpolation.*

Description

The irregularly-spaced data are interpolated onto regular latitude-longitude grids by weighting each station according to its distance and angle from the center of a search radius.

Usage

```
adw(ds, extent, gridsize = 5, cdd = 1000, m = 4, nmin = 3, nmax = 10)
```

Arguments

ds	a input dataframe which contains the column names of lon, lat, value.
extent	a extent numeric vector (latitude and longitude) of length 4 in the order c(xmin, xmax, ymin, ymax), or a polygon object with class 'sf' (package 'sf'), or a polygon object with class 'SpatVector' (package 'terra'). Assume that the coordinate reference system is WGS1984 (EPSG: 4326).
gridsize	the grid size, i.e. the grid resolution. units: degree.
cdd	correlation decay distance, i.e. the maximum search radius. unit: kilometer. default value: 1000km.
m	is used to adjust the weighting function further, higher values of m increase the rate at which the weight decays with distance. default value 4.
nmin	the minimum number of observation points required to interpolate a grid within the search radius (i.e. cdd); if the number of stations within the search ridius (cdd) is less than nmin, a missing value will be generated to fill this grid. default value 3.
nmax	The number of nearest points within the search radius to use for interpolation. default value 10.

Value

a regular latitude-longitude dataframe grid (interpoled values).

References

Caesar, J., L. Alexander, and R. Vose, 2006: Large-scale changes in observed daily maximum and minimum temperatures: Creation and analysis of a new gridded data set. Journal of Geophysical Research, 111, https://doi.org/10.1029/2005JD006280.

Examples

```
set.seed(2)
dd <- data.frame(lon = runif(100, min = 110, max = 117),
                 lat = runif(100, min = 31, max = 37),
                 value = runif(100, min = -10, max = 10))
head(dd)

# example 1
grd <- adw(dd, extent = c(110, 117, 31, 37), gridsize = 0.5, cdd = 500)
head(grd)

# example 2
hmap <- cnmap::getMap(code = "410000") |> sf::st_make_valid() # return a 'sf' object.
grd <- adw(dd, extent = hmap, gridsize = 0.5, cdd = 500)
head(grd)

# example 3
hmap <- cnmap::getMap(code = "410000", returnClass = "sv") # return a 'SpatVector' object.
grd <- adw(dd, extent = hmap, gridsize = 0.5, cdd = 500)
head(grd)
```

---

adw_sf *Angular Distance Weighting Interpolation for the extent of 'simple feature'.*

Description

The irregularly-spaced data are interpolated onto regular latitude-longitude grids by weighting each station according to its distance and angle from the center of a search radius.

Usage

```
adw_sf(ds, extent, gridsize = 5, cdd = 1000, m = 4, nmin = 3, nmax = 10)
```

Arguments

ds	a input dataframe which contains the column names of lon, lat, value.
extent	a polygon object with class 'sf' (package 'sf'). Assume that the coordinate reference system is WGS1984 (EPSG: 4326).
gridsize	the grid size, i.e. the grid resolution. units: degree.
cdd	correlation decay distance, i.e. the maximum search radius. unit: kilometer. default value: 1000km.

m	is used to adjust the weighting function further, higher values of m increase the rate at which the weight decays with distance. default value 4.
nmin	the minimum number of observation points required to interpolate a grid within the search radius (i.e. cdd); if the number of stations within the search ridius (cdd) is less than nmin, a missing value will be generated to fill this grid. default value 3.
nmax	The number of nearest points within the search radius to use for interpolation. default value 10.

Value

a regular latitude-longitude dataframe grid (interpoled values).

References

Caesar, J., L. Alexander, and R. Vose, 2006: Large-scale changes in observed daily maximum and minimum temperatures: Creation and analysis of a new gridded data set. Journal of Geophysical Research, 111, https://doi.org/10.1029/2005JD006280.

Examples

```
set.seed(2)
dd <- data.frame(lon = runif(100, min = 110, max = 117),
                 lat = runif(100, min = 31, max = 37),
                 value = runif(100, min = -10, max = 10))
head(dd)
hmap <- cnmap::getMap(code = "410000") |> sf::st_make_valid() # return a 'sf' object.
grd <- adw_sf(dd, extent = hmap, gridsize = 0.5, cdd = 500)
head(grd)
```

---

adw_sv *Angular Distance Weighting Interpolation for the extent of 'SpatVector'.*

Description

The irregularly-spaced data are interpolated onto regular latitude-longitude grids by weighting each station according to its distance and angle from the center of a search radius.

Usage

```
adw_sv(ds, extent, gridsize = 5, cdd = 1000, m = 4, nmin = 3, nmax = 10)
```

Arguments

ds	a input dataframe which contains the column names of lon, lat, value.
extent	a polygon object with class 'SpatVector' (package 'terra'). Assume that the coordinate reference system is WGS1984 (EPSG: 4326).
gridsize	the grid size, i.e. the grid resolution. units: degree.
cdd	correlation decay distance, i.e. the maximum search radius. unit: kilometer. default value: 1000km.
m	is used to adjust the weighting function further, higher values of m increase the rate at which the weight decays with distance. default value 4.
nmin	the minimum number of observation points required to interpolate a grid within the search radius (i.e. cdd); if the number of stations within the search ridius (cdd) is less than nmin, a missing value will be generated to fill this grid. default value 3.
nmax	The number of nearest points within the search radius to use for interpolation. default value 10.

Value

a regular latitude-longitude dataframe grid (interpoled values).

References

Caesar, J., L. Alexander, and R. Vose, 2006: Large-scale changes in observed daily maximum and minimum temperatures: Creation and analysis of a new gridded data set. Journal of Geophysical Research, 111, https://doi.org/10.1029/2005JD006280.

Examples

```
set.seed(2)
dd <- data.frame(lon = runif(100, min = 110, max = 117),
                 lat = runif(100, min = 31, max = 37),
                 value = runif(100, min = -10, max = 10))
head(dd)
# example
hmap <- cnmap::getMap(code = "410000", returnClass = "sv") # return a 'SpatVector' object.
grd <- adw_sv(dd, extent = hmap, gridsize = 0.5, cdd = 500)
head(grd)
```

---

adw_vector *Angular Distance Weighting Interpolation for the extent of vector.*

Description

The irregularly-spaced data are interpolated onto regular latitude-longitude grids by weighting each station according to its distance and angle from the center of a search radius.

Usage

```
adw_vector(ds, extent, gridsize = 5, cdd = 1000, m = 4, nmin = 3, nmax = 10)
```

Arguments

ds	a input dataframe which contains the column names of lon, lat, value.
extent	a extent numeric vector (latitude and longitude) of length 4 in the order c(xmin, xmax, ymin, ymax).
gridsize	the grid size, i.e. the grid resolution. units: degree.
cdd	correlation decay distance, i.e. the maximum search radius. unit: kilometer. default value: 1000km.
m	is used to adjust the weighting function further, higher values of m increase the rate at which the weight decays with distance. default value 4.
nmin	the minimum number of observation points required to interpolate a grid within the search radius (i.e. cdd); if the number of stations within the search ridius (cdd) is less than nmin, a missing value will be generated to fill this grid. default value 3.
nmax	The number of nearest points within the search radius to use for interpolation. default value 10.

Value

a regular latitude-longitude dataframe grid (interpoled values).

References

Caesar, J., L. Alexander, and R. Vose, 2006: Large-scale changes in observed daily maximum and minimum temperatures: Creation and analysis of a new gridded data set. Journal of Geophysical Research, 111, https://doi.org/10.1029/2005JD006280.

Examples

```
set.seed(2)
dd <- data.frame(lon = runif(100, min = 110, max = 117),
                 lat = runif(100, min = 31, max = 37),
                 value = runif(100, min = -10, max = 10))
head(dd)
# example
grd <- adw_vector(dd, extent = c(110, 117, 31, 37), gridsize = 0.5, cdd = 500)
head(grd)
```

awa *Area weighted average.*

Description

The large area, or hemispheric, or global averages can be calculated dependent on the area represented by the grid-point or grid-box. The weight of latitude-longitude grid-points-boxes should be the cosine of the latitude of the ith grid-point-box.

Usage

```
awa(dat, lat)
```

Arguments

dat	a numeric vector of grid data. The missing values are not allowed.
lat	a latitude numeric vector of grid data. The cosine of latitude is used as the weight coefficient.

Value

a scalar value, i.e the value of area weighted average.

References

Jones, P. D., and M. Hulme, 1996: Calculating regional climatic time series for temperature and precipitation: Methods and illustrations. Int. J. Climatol., 16, 361–377, https://doi.org/10.1002/(SICI)1097-0088(199604)16:4<361::AID-JOC53>3.0.CO;2-F.

Examples

```
# set.seed(2)
# dd <- data.frame(lon = runif(100, min = 110, max = 117),
#                  lat = runif(100, min = 31, max = 37),
#                  value = runif(100, min = -10, max = 10))
# grd <- points2grid(dd, extent = c(110, 117, 31, 37), gridsize = 0.5)
# grd <- na.omit(grd)
# awa(grd$value, grd$lat) # area weighted average
```

points2grid *Points were to converted grids using a local gridding method.*

Description

the irregularly-spaced data of points are converted onto regular latitude-longitude grids by averaging all stations in grid-boxes.

Usage

```
points2grid(dd, extent, gridsize = 0.5)
```

Arguments

dd	a input dataframe which contains the column names of lon, lat, value.
extent	a extent numeric vector (latitude and longitude) of length 4 in the order c(xmin, xmax, ymin, ymax), or a polygon object with class 'sf' (package 'sf'), or a polygon object with class 'SpatVector' (package 'terra'). Assume that the coordinate reference system is WGS1984 (EPSG: 4326).
gridsize	the grid size, i.e. the grid resolution. units: degree.

Value

a regular latitude-longitude dataframe grid (grid values).

References

Jones, P. D., and M. Hulme, 1996: Calculating regional climatic time series for temperature and precipitation: Methods and illustrations. Int. J. Climatol., 16, 361–377, https://doi.org/10.1002/(SICI)1097-0088(199604)16:4<361::AID-JOC53>3.0.CO;2-F.

Examples

```
# set.seed(2)
# dd <- data.frame(lon = runif(100, min = 110, max = 117),
#                  lat = runif(100, min = 31, max = 37),
#                  value = runif(100, min = -10, max = 10))
# head(dd)
#
# # example 1
# grd <- points2grid(dd, extent = c(110, 117, 31, 37), gridsize = 0.5)
# head(grd)
#
# # example 2
# hmap <- cnmap::getMap(code = "410000", return = "sf") |> sf::st_make_valid()
# grd <- points2grid(dd, extent = hmap, gridsize = 0.5)
# head(grd)
#
```

```
# # example 3
# hmap <- cnmap::getMap(code = "410000", return = "sv")
# grd <- points2grid(dd, extent = hmap, gridsize = 0.5)
# head(grd)
```

`points2grid_sf` *Points were to converted grids using a local gridding method.*

Description

the irregularly-spaced data of points are converted onto regular latitude-longitude grids by averaging all stations in grid-boxes.

Usage

```
points2grid_sf(dd, extent, gridsize = 5)
```

Arguments

`dd`	a input dataframe which contains the column names of lon, lat, value.
`extent`	a polygon object of simple feature (come from package 'sf'). Assume that the coordinate reference system is WGS1984 (EPSG: 4326).
`gridsize`	the grid size, i.e. the grid resolution. units: degree.

Value

a regular latitude-longitude dataframe grid (grid values).

References

Jones, P. D., and M. Hulme, 1996: Calculating regional climatic time series for temperature and precipitation: Methods and illustrations. Int. J. Climatol., 16, 361–377, https://doi.org/10.1002/(SICI)1097-0088(199604)16:4<361::AID-JOC53>3.0.CO;2-F.

Examples

```
# set.seed(2)
# dd <- data.frame(lon = runif(100, min = 110, max = 117),
#                  lat = runif(100, min = 31, max = 37),
#                  value = runif(100, min = -10, max = 10))
# head(dd)
# # example
# hmap <- cnmap::getMap(code = 410000) |> sf::st_make_valid()
# grd <- points2grid_sf(dd, extent = hmap, gridsize = 0.5)
# head(grd)
```

`points2grid_sv` *Points were to converted grids using a local gridding method.*

Description

the irregularly-spaced data of points are converted onto regular latitude-longitude grids by averaging all stations in grid-boxes.

Usage

```
points2grid_sv(dd, extent, gridsize = 5)
```

Arguments

`dd`	a input dataframe which contains the column names of lon, lat, value.
`extent`	a polygon object of SpatVector (from package 'terra'). Assume that the coordinate reference system is WGS1984 (EPSG: 4326).
`gridsize`	the grid size, i.e. the grid resolution. units: degree.

Value

a regular latitude-longitude dataframe grid (grid values).

References

Jones, P. D., and M. Hulme, 1996: Calculating regional climatic time series for temperature and precipitation: Methods and illustrations. Int. J. Climatol., 16, 361–377, https://doi.org/10.1002/(SICI)1097-0088(199604)16:4<361::AID-JOC53>3.0.CO;2-F.

Examples

```
# set.seed(2)
# dd <- data.frame(lon = runif(100, min = 110, max = 117),
#                  lat = runif(100, min = 31, max = 37),
#                  value = runif(100, min = -10, max = 10))
# head(dd)
# # example
# hmap <- cnmap::getMap(code = 410000, returnClass = "sv")
# grd <- points2grid_sv(dd, extent = hmap, gridsize = 0.5)
# head(grd)
```

points2grid_vector *Points were to converted grids using a local gridding method.*

Description

The irregularly-spaced data of points are converted onto regular latitude-longitude grids by averaging all stations in grid-boxes.

Usage

```
points2grid_vector(dd, extent, gridsize = 5)
```

Arguments

dd	a input dataframe which contains the column names of lon, lat, value.
extent	a extent numeric vector (latitude and longitude) of length 4 in the order c(xmin, xmax, ymin, ymax).
gridsize	the grid size, i.e. the grid resolution. units: degree.

Value

a regular latitude-longitude dataframe grid (grid values).

References

Jones, P. D., and M. Hulme, 1996: Calculating regional climatic time series for temperature and precipitation: Methods and illustrations. Int. J. Climatol., 16, 361–377, https://doi.org/10.1002/(SICI)1097-0088(199604)16:4<361::AID-JOC53>3.0.CO;2-F.

Examples

```
# set.seed(2)
# dd <- data.frame(lon = runif(100, min = 110, max = 117),
#                  lat = runif(100, min = 31, max = 37),
#                  value = runif(100, min = -10, max = 10))
# head(dd)
# # example
# grd <- points2grid(dd, extent = c(110, 117, 31, 37), gridsize = 0.5)
# head(grd)
```

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