Package 'climateStability'

November 21, 2019

Title Estimating Climate Stability from Climate Model Data

Version 0.1.3

Description Climate stability measures are not formalized in the literature and tools for generating stability metrics from existing data are nascent. This package provides tools for calculating climate stability from raster data encapsulating climate change as a series of time slices. The methods follow Owens and Guralnick <doi:10.17161/bi.v14i0.9786> Biodiversity Informatics.

Depends R (>= 3.5.0)

URL https://github.com/hannahlowens/climateStability

BugReports https://github.com/hannahlowens/climateStability/issues

License GPL-3

Encoding UTF-8

LazyData true

Imports raster

Suggests knitr, rangeBuilder

VignetteBuilder knitr

RoxygenNote 6.1.1

NeedsCompilation no

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Repository CRAN

Date/Publication 2019-11-21 12:30:02 UTC

R topics documented:

`absLatitudinalMean` *absLatitudinalMean*

Description

A function to calculate mean values of a raster at the absolute value of latitude, at the resolution of a given raster layer.

Usage

```
absLatitudinalMean(rasterForCalculation)
```

Arguments

`rasterForCalculation`
: A raster that contains data for plotting according to latitudinal value

Value

A vector of mean raster values for each absolute value of latitude.

References

Owens, H.L., Guralnick, R., 2019. climateStability: An R package to estimate climate stability from time-slice climatologies. Biodiversity Informatics 14, 8–13. https://doi.org/10.17161/bi.v14i0.9786

See Also

`latitudinalMean` for calculating mean values of rasters for all latitudinal bands.

Examples

```
data(precipDeviation)
precipStability <- 1/precipDeviation
alm <- absLatitudinalMean(rasterForCalculation = precipStability)
plot(alm, main = "Precipitation Stability by Absolute Latitude",
ylab = "Relative Stability", type = "l")
```

deviationThroughTime *Calculating Deviation Through Time*

Description

A function that reads time-slice rasters of data for a given climate (typically processed data from a climate model run, such as the results of an analysis using PaleoView (Fordham, *et al.* 2017, Ecography)) in a given directory and calculates average deviation per year across time slices.

Usage

```
deviationThroughTime(variableDirectory, timeSlicePeriod,
  fileExtension = "asc")
```

Arguments

variableDirectory	A directory containing at least two time slice rasters for a given climate variable.
timeSlicePeriod	Either a single number, in years, representing the time period elapsed between temporally-even climate variable raster slices, or a vector corresponding to periods, in years, between temporally-uneven time slices.
fileExtension	a character that describes the fileExtension corresponding to the all suported formats in writeFormats

Details

Make sure that files in the 'variableDirectory' are read into 'R' in order.

If you are specifying temporally-uneven time slices with 'timeSlicePeriod', make sure that each number corresponds to the number of years elapsed *between* time slices, *in the same order as the files were read into 'R'*. There should be one less number than the number of files.

Value

A raster showing the geographic distribution of climate deviation through time for a particular climate variable.

References

Owens, H.L., Guralnick, R., 2019. climateStability: An R package to estimate climate stability from time-slice climatologies. Biodiversity Informatics 14, 8–13. https://doi.org/10.17161/bi.v14i0.9786

See Also

precipDeviation and temperatureDeviation for examples of data produced using this function.

Examples

```
#Even time slices
precipDeviation <- deviationThroughTime("precipfiles/", 1000)

#Uneven time slices
precipDeviationUneven <- deviationThroughTime("unevenPrecipFiles",
                                              c(1000, 1000, 1000, 1000, 5000, 5000, 6000))
```

`latitudinalMean` *latitudinalMean*

Description

A function to calculate mean values of a raster at every line of latitude, at the resolution of a given raster layer. Put another way, for each row in the raster, it calculates a mean.

Usage

```
latitudinalMean(rasterForCalculation)
```

Arguments

`rasterForCalculation`
: A raster that contains data for plotting according to latitudinal value

Value

A vector of raster values for each absolute value of latitude.

References

Owens, H.L., Guralnick, R., 2019. climateStability: An R package to estimate climate stability from time-slice climatologies. Biodiversity Informatics 14, 8–13. https://doi.org/10.17161/bi.v14i0.9786

See Also

`absLatitudinalMean` to calculate mean value for each absolute value of latitude.

Examples

```
data(precipDeviation)
precipStability <- 1/precipDeviation
latMean <- absLatitudinalMean(rasterForCalculation = precipStability)
plot(latMean, main = "Precipitation Stability by Latitude",
ylab = "Relative Stability", type = "l")
```

precipDeviation *Worldwide deviation in annual precipitation over the last 21,000 years*

Description

Using *PaleoView* version 1.1 (Fordham, *et al.* 2017), 20 100-year climatological means of annual precipitation were generated over 1,000-year time slices from the TRaCE21ka experiments implemented using the CCSM 3.0 climate model. We then calculated deviation through time as the mean of standard deviations between time slices divided by the time elapsed between time slices. This calculation was performed using the 'deviationThroughTime()' function in the 'climateStability' package.

Usage

```
data(precipDeviation)
```

Format

An object of class `"raster"`

References

Owens, HL, and RP Guralnick. Submitted, Biodiversity Informatics.

See Also

`deviationThroughTime` for details on the calculation.

Examples

```
data(precipDeviation)
precipStability <- 1/precipDeviation; #calculate stability from deviation
```

rescale0to1 *Rescale raster from 0 to 1*

Description

A function to rescale a raster from 0 to 1. This is done using the formula (value-min)/(max-min).

Usage

```
rescale0to1(rasterForCalculation)
```

Arguments

`rasterForCalculation`
: A raster that contains data to be rescaled

Value

A raster that has been rescaled from 0 to 1

References

Owens, H.L., Guralnick, R., 2019. climateStability: An R package to estimate climate stability from time-slice climatologies. Biodiversity Informatics 14, 8–13. https://doi.org/10.17161/bi.v14i0.9786

Examples

```
data(precipDeviation)
precipStability <- 1/precipDeviation
relativeClimateStability <- rescale0to1(precipStability)
```

`temperatureDeviation` *Worldwide deviation in mean annual temperature over the last 21,000 years*

Description

Using *PaleoView* version 1.1 (Fordham, *et al.* 2017), 20 100-year climatological means of mean annual temperature were generated over 1,000-year time slices from the TRaCE21ka experiments implemented using the CCSM 3.0 climate model. We then calculated deviation through time as the mean of standard deviations between time slices divided by the time elapsed between time slices. This calculation was performed using the ‘deviationThroughTime()‘ function in the ‘climateStability‘ package.

Usage

```
data(temperatureDeviation)
```

Format

An object of class `"raster"`

References

Owens, HL, and RP Guralnick. Submitted, Biodiversity Informatics.

See Also

`deviationThroughTime` for details on the calculation.

Examples

```
data(temperatureDeviation)
tempStability <- 1/temperatureDeviation; #calculate stability from deviation
```

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