Package ‘RClimMAWGEN’

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Title RClimMAWGEN (R Climate Index Multi-site Auto-regressive Weather GENerator): a package to generate time series of climate indices from RMAWGEN generations.

Type Package

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Description This package contains wrapper functions and methods which allow to use `climdex.pcic` and `RMAWGEN` packages. With this simple approach it is possible to calculate climate change indices, suggested by the WMO-CCL, CLIVAR, ETCCDMI(http://www.climdex.org), on stochastic generations of temperature and precipitation time series, obtained by the application of RMAWGEN. Each index can be applied to both observed data and to synthetic time series produced by the Weather Generator, over a reference period (e.g. 1981-2010, as in the example). It contains also functions and methods to evaluate the generated time series of climate change indices consistency by statistical tests. Bugs/comments/questions/collaboration of any kind are warmly welcomed.

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Depends R (>= 2.10), climdex.pcic, RMAWGEN


Collate 'accepted.R' 'as.clindex.data.frame.R' 'as.data.frame.R' 'climdex.data.frame.R' 'ks.test.R' 'RClimMAWGEN-package.R' 'temperature_max.R' 'temperature_min.R' 'wilcox.test.R'

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**Description**

This package contains wrapper functions and methods which allow to use "climdex.pcic" and "RMAWGEN" packages.

**Details**

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**Note**

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Author(s)
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**Which generations pass the tests with success?**

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**Description**

This function lists the realizations which pass successfully Ks or Wilcoxon test.

**Usage**

```r
accepted(tests, significance = 0.05)
```

**Arguments**

tests  list of objects returned by `wilcox.test` and `ks.test`

significance  significance for statistical tests (maximum accepted p-value). Default is 0.05.

**Value**

Vector with names of successful realizations.

**See Also**

climdex.data.frame, ks.test, ks.test.climdex.data.frame, wilcox.test

**Examples**

```
# See the example of 'climdex.data.frame' function
```
as.climdex.data.frame  Coercion to a ClimDex Data Frame

Description
This function transforms a generic data object data into a climdex.data.frame-type S3 object.

Usage
as.climdex.data.frame(data)

Arguments
data

Author(s)
Emanuele Cordano, Annalisa Di Piazza

See Also
climdex.data.frame
climdex.data.frame

as.data.frame  Transformation of a ClimDex Data Frame to a Data Frame

Description
This method transforms a climdex.data.frame-type S3 object into a data.frame object.

Usage
## S3 method for class 'climdex.data.frame'
as.data.frame(x, ...)

Arguments
x

Author(s)
Emanuele Cordano, Annalisa Di Piazza
Emanuele Cordano, Annalisa Di Piazza
climdex.data.frame

See Also

as.climdex.data.frame, as.data.frame

climdex.data.frame  ClimDex Data Frame

Description

Create input object for climate index analysis from RMAWGEN output.

Usage

climdex.data.frame(data, station, realization_TN, realization_TX, realization_PREC, start_date = "1981-01-01", end_date = "2010-12-31", climate_index = "climdex.gsl", frequency = c("yearly", "monthly", "daily"), freq = c("default", "monthly", "annual"), date.series = seq(as.POSIXct(start_date, cal = "gregorian"), as.POSIXct(end_date, cal = "gregorian"), by = "days"), base.range = c(1990, 2002), n = 5, prefix = NULL, ...)

Arguments

data  data.frame containing realizations of weather variables, e.g. the one returned as output by ComprehensiveTemperatureGenerator
station  names of weather stations where to apply climate indices
realization_TN  realizations of daily minimum temperature (observed and simulated) time series on which climate index are calculated
realization_TX  realizations of daily maximum temperature (observed and simulated) time series on which climate index are calculated
realization_PREC  realizations of daily precipitation (observed and simulated) time series on which climate index are calculated. It is NULL if missing.
start_date  start date yyyy-mm-dd of weather time series
end_date  start date yyyy-mm-dd of weather time series
climate_index  climate indices to be calculated. The names must correspond to the name of the respective function contained in the climdex.pcic R package
yearly  logical value. If TRUE (Default) the index is calculated yearly per each year, otherwise the index is calculated monthly, i.e. per each month
base.range  see climdexInput.raw
n  see climdexInput.raw
prefix  name for time series on which climate indices are calculated.
date.series see `climdexInput.raw`. If missing, it is automatically calculated from `start_date` and `end_date`.

frequency string value. Default is c("yearly","monthly","daily"). Set one of these, if the climate indices are referred to each year, month or day respectively.

freq string value. Default is c("default","monthly","annual"). It has the same role of "frequency" and is used in several `cliCmdex.pCic` indices. If it is omitted (Default) the frequency is obtained by frequency argument. See `climdex.tn90p,climdex.tx90p`.

... further arguments

Value

a `climdex.data.frame` object (see the variable `climdex` in the examples.)

Author(s)

Emanuele Cordano, Annalisa Di Piazzaa

References

http://www.climdex.org

See Also

`as.climdex.data.frame,climdexInput.raw,climdex.tn90p,climdex.tx90p`

Examples

```r
rm(list=ls())
library(RClimMAWGEN)
# generated and observed daily temperature data for the considering period
# (1981-2010)(MAWGEN output data structure)
data (generation_p1)

#collected generated (realizations) and observed data (realizations$Tx_mes, realizations$Tn_mes)
realizations <- generation_p1$output
realizations$Tx_mes <- generation_p1$input$Tx_mes
realizations$Tn_mes <- generation_p1$input$Tn_mes

# realization scanarios used for 'climdex.data.frame'
realizations_TN <- c("Tn_mes","Tn_gen00002","Tn_gen00003","Tn_gen00004")
realizations_TX <- c("Tx_mes","Tx_gen00002","Tx_gen00003","Tx_gen00004")

stations <- names(realizations$Tn_mes)
start_date = "1981-01-01"
end_date = "2010-12-31"
```
# The indices `climdex.tn90p`, `climdex.tx90p` are considered in this example
climate_indices = c("climdex.tn90p","climdex.tx90p")

frequency = "monthly"

date.series = seq(as.POSIXct(start_date, cal = "gregorian"),
  as.POSIXct(end_date, cal = "gregorian"), by = "days")

base.range = c(1990, 2002)
n = 5
prefix = NULL

climdex <- climdex.data.frame(data=realizations, station=stations,
  realization_TN=realizations_TN, realization_TX=realizations_TX, realization_PREC=NULL,
  start_date= start_date, end_date = end_date ,climate_index = climate_indices,
  frequency = frequency,date.series = date.series,base.range = base.range,
  n = n, prefix = prefix)

str(climdex)

## Function 'climdex.data.frame' can be also used with annual frequency
## The following lines are now commented because the elapsed time is too long!!
## Please uncomment to run the following lines to run the function.
# climdex_annual <- climdex.data.frame(data=realizations, station=stations,
#  realization_TN=realizations_TN, realization_TX=realizations_TX, realization_PREC=NULL,
#  start_date= start_date, end_date = end_date ,climate_index = climate_indices,
#  frequency = "yearly",date.series = date.series,base.range = base.range,
#  n = n, prefix = prefix)
#
## str(climdex_annual)

# Wilcoxon test between observed and generated climate indices

observed <- "T0129__Tn_mes__climdex.tx90p"
generated <- c("T0129__Tn_gen00002__climdex.tx90p","T0129__Tn_gen00003__climdex.tx90p")
wxt <- wilcox.test(x=climdex,observed=observed,generated=generated)
wxt

# Kolgomorov-Smirnov test between observed and generated climate indices

kst <- ks.test(climdex.data.frame(data=climdex,observed=observed,generated=generated))
kst

accepted(wxt)
accepted(kst)
**ks.test.climdex.data.frame**

**Description**

This dataset contains `generation_p1`. It is a list object returned by `ComprehensiveTemperatureGenerator`. See `ComprehensiveTemperatureGenerator` for a detailed description. Some list elements, irrelevant for RClimMAWGEN examples, were removed from the variable `generation_p1` to save disk memory. It contains the following variables:

**Usage**

```r
data(generation_p1)
```

**Format**

list

**Details**

This data set can be regenerated using the R script 'generations.R' in the 'examples' package directory. See the Examples paragraph.

**Source**

This data set is obtained reducing the output of the function `ComprehensiveTemperatureGenerator` and can be reproduced through the R script ... This data set is intended for research purposes only, being distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY.

**Examples**

```r
# See file 'generations.R' to see how this dataset is obtained.
f <- system.file("examples/generations.R",package="RClmMAWGEN")

## This line is now commented because the elapsed time is too long!!
## Please uncomment to run this line.
# source(f) # Not Run
```

---

**ks.test.climdex.data.frame**

*Kolgomorov-Smirnov Tests for a ClimDex Data Frame*

**Description**

`ks.test` S3 method for 'climdex.data.frame'

**Usage**

```r
ks.test.climdex.data.frame(data, observed, generated, 
...)
```
temperature_max_daily

Arguments

data a `climdex.data.frame` object
observed name (String) of the column of data containing the observed climate indices
generated names (String vector) of the columns of data containing the climate index realizations which will be tested.
...
... further arguments

Author(s)

Annalisa Di Piazza, Emanuele Cordano

See Also

`climdex.data.frame`, `wilcox.test`, `ks.test`

Examples

```r
# See the example of 'climdex.data.frame' function
```

---

**temperature_max_daily**  *Daily Maximum Temperature*

Description

Extracts daily maximum temperature from an object of class `climdexInput-class`.

Usage

```r
temperature_max_daily(x)
```

Arguments

x an object of class `climdexInput-class`

Value

Daily Maximum Temperature

Author(s)

Emanuele Cordano, Annalisa Di Piazza

See Also

`climdexInput-class`, `climdexInput.raw`
Description
Extracts daily Minimum temperature from an object of class `climdexInput-class`.

Usage
\[
\text{temperature_min_daily}(x)
\]

Arguments
\[x\] an object of class `climdexInput-class`

Value
Daily Minimum Temperature

Author(s)
Emanuele Cordano, Annalisa Di Piazza

See Also
`climdexInput-class, climdexInput.raw`

trentino_1958_2010  Trentino Dataset

Description
It contains the following variables:

- `TEMPERATURE_MIN`  Data frame containing year, month, day and daily minimum temperature in 59 stations in Trentino region

- `TEMPERATURE_MAX`  Data frame containing year, month, day and daily maximum temperature in 59 stations in Trentino region

- `PRECIPITATION`  Data frame containing year, month, day and daily precipitation in 59 stations in Trentino region

- `STATION_NAMES`  Vector containing the names of the meteorological stations
ELEVATION Vector containing the elevations of the meteorological stations respectively

STATION_LATLON Matrix containing the latitude and longitude coordinates, respectively, of the meteorological stations

LOCATION Vector containing the names of the location of each meteorological station

TEMPERATURE_MEASUREMENT_START_DAY Vector containing the first days (expressed as decimal Julian day since 1970-1-1 00:00 UTC) of temperature measurement of each meteorological station

TEMPERATURE_MEASUREMENT_END_DAY Vector containing the last days (expressed as decimal Julian day since 1-1-1970 00:00 UTC) of temperature measurement of each meteorological station

PRECIPITATION_MEASUREMENT_START_DAY Vector containing the first days (expressed as decimal Julian day since 1-1-1970 00:00 UTC) of precipitation measurement of each meteorological station

PRECIPITATION_MEASUREMENT_END_DAY Vector containing the last days (expressed as decimal Julian day since 1-1-1970) of precipitation measurement of each meteorological station

Usage
data(trentino_1958_2010)

Format
Data frames and vectors

Details
This dataset stores all information about meteorological stations and instrumental timeseries. The user can easily use the package with his/her own data after replacing the values of such variables.

Source
Original data are provided by Provincia Autonoma di Trento (http://www.meteotrentino.it/), Fondazione Edmund Mach (www.iasma.it), Provincia Autonama di Bolzano/Autome Provinz Bozen (http://www.provincia.bz.it/meteo), ARPA Veneto (wwwarpa.veneto.it/meteo.htm).

This dataset is intended for research purposes only, being distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY.
wilcox.test S3 method for 'climdex.data.frame'

Usage

## S3 method for class 'climdex.data.frame'
wilcox.test(x, observed, generated, ...)

Arguments

x a climdex.data.frame object
observed name (String) of the column of data containing the observed climate indices
generated names (String vector) of the columns of data containing the climate index realizations which will be tested.
... further arguments

Author(s)

Emanuele Cordano, Annalisa Di Piazza

See Also

climdex.data.frame, ks.test, ks.test.climdex.data.frame

Examples

# See the example of 'climdex.data.frame' function
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