Package 'RClimMAWGEN'

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Title RClimMAWGEN (R Climate Index Multi-site Auto-regressive Weather GENeretor): 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

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`RClimMAWGEN-package` *RClimMAWGEN*

Description

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

Details

Package:	RClimMAWGEN
Type:	Package
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Depends:	climdex.pcic,RMAWGEN

Note

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accepted *Which generations pass the tests with success?*

Description

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

Usage

```
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 functions transforms a generic data object `data` in a `clindex.data.frame`-type S3 object

Usage

```
as.climdex.data.frame(data)
```

Arguments

`data`	the object to be transformed

Author(s)

Emanuele Cordano, Annalisa Di Piazza

See Also

`climdex.data.frame`

`climdex.data.frame`

as.data.frame *Trasformation 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`	the object to be transformed
`...`	further arguments

Author(s)

Emanuele Cordano, Annalisa Di Piazza

Emanuele Cordano, Annalisa Di Piazza

See Also

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

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climdex.data.frame *ClimDex Data Frame*

Description

Create input object for clim,ete index analyis 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.PCICt(start_date, cal =
  "gregorian"), as.PCICt(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 retured 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 voalue. If TRUE (Default) the index is calculeted 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 cilmdex.pcic indices. If it is omitted (Default) the frequency is obtaind 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

```
rm(list=ls())
library(RClimMAWGEN)
#  generated and observed daily temperature data for the considering period
#  (1981-2010)(RMAWGEN 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 \link{climdex.tn90p},\link{climdex.tx90p} are considered in this example
climate_indices = c("climdex.tn90p","climdex.tx90p")

frequency =  "monthly"

date.series = seq(as.PCICt(start_date, cal = "gregorian"),
 as.PCICt(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-Smirinov test between observed and generated climate indices

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

accepted(wxt)
accepted(kst)
```

---

generation_p1 *RClimMAWGEN Example Dataset*

Description

This dates 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

```
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

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

## 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

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

Arguments

data	a climdex.data.frame object
observed	name (String) of the column of data containing the obseved 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

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

---

temperature_max_daily *Daily Maximum Temperature*

Description

Extracts daily maximum temparature from an object of class climdexInput-class.

Usage

```
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

temperature_min_daily *Daily Minimum Temperature*

Description

Extracts daily Minimum temparature from an object of class climdexInput-class.

Usage

```
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 (www.arpa.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 *Wilcoxon Rank Sum and Signed Rank Tests a ClimDex Data Frame*

Description

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 obseved 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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