Package 'spdownscale'

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Type Package

Title Spatial Downscaling Using Bias Correction Approach

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Description Spatial downscaling of climate data (Global Circulation Models/Regional Climate Models) using quantile-quantile bias correction technique.

License GPL-2

LazyData TRUE

Imports stats, graphics

Depends R (>= 2.10)

RoxygenNote 5.0.1

NeedsCompilation no

Repository CRAN

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data_model *Data-sample*

Description

EC-EARTH (GCM) rainfall data at the Gold Coast Seaway meteorologican station, Australia (station number - 40764, Period- 1/1/2000 to 12/31/2012, Latitude/longitude - -27.9390/153.4283)

Usage

```
data_model
```

Format

A data.frame of time and precipitation in mm for every 3h interval.

data_model_future *Data-sample*

Description

EC-EARTH (GCM) furure (RCP 4.5) rainfall data at the Gold Coast Seaway meteorologican station, Australia (station number - 40764, Period- 1/1/2026 to 12/31/2045, Latitude/longitude - -27.9390/153.4283)

Usage

```
data_model_future
```

Format

A data.frame of time and precipitation in mm for every 3h interval.

data_observation *Data-sample*

Description

Observational rainfall data at the Gold Coast Seaway meteorologican station, Australia (station number - 40764, Period- 1/4/2000 to 12/31/2012, Latitude/longitude - -27.9390/153.4283)

Usage

```
data_observation
```

Format

A data.frame of time and precipitation in mm for every 3h interval

downscale *Spatial Downscaling*

Description

Generating the future climate data (rainfall)

Usage

```
downscale(obs_c, mod_c, obs_v, mod_v, mod_fut)
```

Arguments

obs_c	vector of observational climate data (rainfall) used for calibrating the model
mod_c	vector of GCM/RCM rainfall data (rainfall) used for calibrating the model
obs_v	vector of observational climate data (rainfall) used for validating the model
mod_v	vector of GCM/RCM climate data (rainfall) used for validating the model
mod_fut	vector of GCM/RCM future climate data (rainfall) need to be downscaled

Details

1) Dry-days correction / Defining threshold values

The relationship between the cumulative frequencies (thresholds) corresponding to the dry days of GCM/RCM data and that of the observational data is defined by a polynomial function given by;

threshold_obs = (threshold_mod)^n

n = ln(threshold_obs_c) / ln(threshold_mod_c)

2) wet-days correction / Correcting the intensity of the GCM/RCM data

Two parameter (shape and scale factors) gamma distribution function is used to model the frequency distributions of the rainfall data. The GCM/RCM rainfall above the threshold were corrected using unique correction factors for different cumulative frequencies.

corrected_mod_fut = mod_fut * F-1(F.mod_fut, sh_obs_c,,sc_obs_c)/ F-1 (F.mod_fut,sh_mod_c,,sc_mod_c)

where obs - observational data; mod - GCM/RCM data; n - constant; c - calibration; v - validation; fut - future data; sh - shape factor; sc- scale factor; F. - cumulative density function and F-1 - inverse of cumulative density function

Examples

```
#subsetting dat_model
  mod_calibration=subset(data_model,(year==2003|year==2005|year==2007|year==2009|year==2011))
  mod_validation= subset(data_model,(year==2004|year==2006|year==2008|year==2010|year==2012))
#subsetting data_observation
  obs_calibration=subset(data_observation,(year==2003|year==2005|year==2007|year==2009|year==2011))
  obs_validation=subset(data_observation,(year==2004|year==2006|year==2008|year==2010|year==2012))
#creating the input vectors
   obs_c=obs_calibration$pr
   mod_c=mod_calibration$pr
   obs_v=obs_validation$pr
   mod_v=mod_validation$pr
   mod_fut= data_model_future$pr

   downscale(obs_c,mod_c,obs_v,mod_v,mod_fut)
```

`ParaCal` *Calibration Parameters*

Description

Displays the shape factors, scale factors and the threshold values of the observation and GCM/RCM data set which ultimately define the model

Usage

```
ParaCal(obs_c, mod_c, obs_v, mod_v, mod_fut)
```

Arguments

`obs_c`	vector of observational climate data (rainfall) used for calibrating the model
`mod_c`	vector of GCM/RCM climate data (rainfall) used for calibrating the model
`obs_v`	vector of observational climate data (rainfall) used for validating the model
`mod_v`	vector of GCM/RCM climate data (rainfall) used for validating the model
`mod_fut`	vector of GCM/RCM future climate data (rainfall) need to be downscaled

Details

1) Dry-days correction / Defining threshold values

The relationship between the cumulative frequencies (thresholds) corresponding to the dry days of GCM/RCM data and that of the observational data is defined by a polynomial function given by;

threshold_obs = (threshold_mod)^n

n = ln(threshold_obs_c) / ln(threshold_mod_c)

2) wet-days correction / Correcting the intensity of the GCM/RCM data

Two parameter (shape and scale factors) gamma distribution function was used to model the frequency distributions of the rainfall data. The GCM/RCM rainfall above the threshold were corrected using unique correction factors for different cumulative frequencies.

corrected_mod_fut = mod_fut * F-1(F.mod_fut, sh_obs_c,,sc_obs_c)/ F-1 (F.mod_fut,sh_mod_c,,sc_mod_c)

where obs - observational data; mod - GCM/RCM data; n - constant; c - calibration; v - validation; fut - future data; sh - shape factor; sc- scale factor; F. - cumulative density function and F-1 - inverse of cumulative density function

Examples

```
#subsetting dat_model
  mod_calibration=subset(data_model,(year==2003|year==2005|year==2007|year==2009|year==2011))
  mod_validation= subset(data_model,(year==2004|year==2006|year==2008|year==2010|year==2012))
#subsetting data_observation
  obs_calibration=subset(data_observation,(year==2003|year==2005|year==2007|year==2009|year==2011))
  obs_validation=subset(data_observation,(year==2004|year==2006|year==2008|year==2010|year==2012))
#creating the input vectors
   obs_c=obs_calibration$pr
   mod_c=mod_calibration$pr
   obs_v=obs_validation$pr
   mod_v=mod_validation$pr
   mod_fut= data_model_future$pr

   ParaCal(obs_c,mod_c,obs_v,mod_v,mod_fut)
```

ResVal *Validation Summary*

Description

Displays the summary of the validation.

Usage

```
ResVal(obs_c, mod_c, obs_v, mod_v, mod_fut)
```

Arguments

obs_c	vector of observational climate data (rainfall) used for calibrating the model
mod_c	vector of GCM/RCM climate data (rainfall) used for calibrating the model
obs_v	vector of observational climate data (rainfall) used for validating the model
mod_v	vector of GCM/RCM climate data (rainfall) used for validating the model
mod_fut	vector of GCM/RCM future climate data (rainfall) need to be downscaled

Details

1) Dry-days correction / Defining threshold values

The relationship between the cumulative frequencies (thresholds) corresponding to the dry days of GCM/RCM data and that of the observational data is defined by a polynomial function given by;

threshold_obs = (threshold_mod)^n

n = ln(threshold_obs_c) / ln(threshold_mod_c)

2) wet-days correction / Correcting the intensity of the GCM/RCM data

Two parameter (shape and scale factors) gamma distribution function was used to model the frequency distributions of the rainfall data. The GCM/RCM rainfall above the threshold were corrected using unique correction factors for different cumulative frequencies.

corrected_mod_fut = mod_fut * F-1(F.mod_fut, sh_obs_c,,sc_obs_c)/ F-1 (F.mod_fut,sh_mod_c,,sc_mod_c)

where obs - observational data; mod - GCM/RCM data; n - constant; c - calibration; v - validation; fut - future data; sh - shape factor; sc- scale factor; F. - cumulative density function and F-1 - inverse of cumulative density function

Examples

```
#subsetting dat_model
  mod_calibration=subset(data_model,(year==2003|year==2005|year==2007|year==2009|year==2011))
  mod_validation= subset(data_model,(year==2004|year==2006|year==2008|year==2010|year==2012))
#subsetting data_observation
  obs_calibration=subset(data_observation,(year==2003|year==2005|year==2007|year==2009|year==2011))
  obs_validation=subset(data_observation,(year==2004|year==2006|year==2008|year==2010|year==2012))
#creating the input vectors
   obs_c=obs_calibration$pr
   mod_c=mod_calibration$pr
   obs_v=obs_validation$pr
   mod_v=mod_validation$pr
   mod_fut= data_model_future$pr

   ResVal(obs_c,mod_c,obs_v,mod_v,mod_fut)
```

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