

# Package ‘spdownscale’

February 16, 2017

**Type** Package

**Title** Spatial Downscaling Using Bias Correction Approach

**Version** 0.1.0

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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	<i>Data-sample</i>
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**Description**

EC-EARTH (GCM) rainfall data at the Gold Coast Seaway meteorological 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.

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data_model_future	<i>Data-sample</i>
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**Description**

EC-EARTH (GCM) future (RCP 4.5) rainfall data at the Gold Coast Seaway meteorological 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.

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data_observation	<i>Data-sample</i>
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**Description**

Observational rainfall data at the Gold Coast Seaway meteorological 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

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downscale	<i>Spatial Downscaling</i>
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**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;

$$\text{threshold\_obs} = (\text{threshold\_mod})^n$$

$$n = \ln(\text{threshold\_obs\_c}) / \ln(\text{threshold\_mod\_c})$$

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.

$$\text{corrected\_mod\_fut} = \text{mod\_fut} * F^{-1}(F(\text{mod\_fut}, \text{sh\_obs\_c}, \text{sc\_obs\_c}) / F^{-1}(F(\text{mod\_fut}, \text{sh\_mod\_c}, \text{sc\_mod\_c})))$$

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)
```

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ParaCal

*Calibration Parameters*

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## 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

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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

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#subsetting dat_model
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#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)
```

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 ResVal

*Validation Summary*


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## Description

Displays the summary of the validation.

## Usage

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

### Arguments

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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;

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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

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#subsetting data_observation
  obs_calibration=subset(data_observation, (year==2003|year==2005|year==2007|year==2009|year==2011))
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#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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