Package ‘CompoundEvents’

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Description Tools for extracting occurrences, assessing potential driving factors, predicting occurrences, and quantifying impacts of compound events in hydrology and climatology. Please see Hao Zengchao et al. (2019) <doi:10.1088/1748-9326/ab4df5>.
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Description

Tools for extracting occurrences, assessing potential driving factors, predicting occurrences, and quantifying impacts of compound events in hydrology and climatology.

Details

Examples of compound events in hydroclimatology include, but not limited to, compound dry-hot events and compound precipitation and surge (or sea level) events. Take the compound dry and hot event as an example. The function `GetDH` is used for extracting occurrences based on thresholds of dry and hot indicators. The function `DriverLGR` is used for assessing potential driving factors of compound events based on logistic regression model. The function `PredLGR` is used for predicting occurrences of compound events. The function `ImpactMG` is used for quantifying impacts of compound dry and hot events based on meta-Gaussian model.

Author(s)

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References


Usage

DriverLGR(Y, CI)
GetDC

Arguments

Y Occurrence of compound dry-hot events (0-1 binary variable)
CI Climate index as the driving factor of compound events (e.g., ENSO)

Value

slope parameter and associated p-value

References


Examples

CI=c(-0.7,-1.2,1.3,0.7,-0.6,1.1,-0.5,0.8,0.5,-0.5,1.6,-1.8,-0.5,-1.4,-0.1,2.2,-0.7,-1.1,0.6,-1.7)
Y=c(0,0,1,0,0,0,0,0,1,0,0,1,0,0,1,0,0,0,0)
res<DriverLGR(Y,CI)

GetDC Occurrence of compound dry-cold events

Description

Extract compound dry-cold occurrences based on thresholds of precipitation and temperature. The binary variable of the dry and cold (DC) event can be obtained.

Usage

GetDC(mp,mt,threp,thret)

Arguments

mp Precipitation
mt Temperature
threp Threshold of precipitation (e.g., 20th percentile)
thret Threshold of temperature (e.g., 20th percentile)

Value

The occurrence of compound wet-hot event (0-1 binary variable)

References

GetDH

Occurrence of compound dry-hot events

Description

Extract compound dry-hot (DH) occurrences based on thresholds of precipitation and temperature. The binary variable of the DH (or dry-warm) event can be obtained.

Usage

GetDH(mp, mt, threp, thret)

Arguments

mp
Precipitation

mt
Temperature

threp
Threshold of precipitation (e.g., 20th percentile)

thret
Threshold of temperature (e.g., 80th percentile)

Value

The occurrence of compound dry-hot events (0-1 binary variable)

References


Examples

mp = matrix(rnorm(120, 0, 1), ncol = 1)
mt = matrix(rnorm(120, 0, 1), ncol = 1)
threp = 20
thret = 80
DH <- GetDH(mp, mt, threp, thret)
**GetWH**

*Occurrence of compound wet-hot events*

**Description**

Extract compound wet-hot (WH) occurrences based on thresholds of precipitation and temperature. The binary variable of the WH (or wet-warm, WW) event can be obtained.

**Usage**

```r
GetWH(mp, mt, threp, thret)
```

**Arguments**

- `mp`: Precipitation
- `mt`: Temperature
- `threp`: Threshold of precipitation (e.g., 80th percentile)
- `thret`: Threshold of temperature (e.g., 80th percentile)

**Value**

The occurrence of compound wet-hot events (0-1 binary variable)

**References**


**Examples**

```r
mp = matrix(rnorm(120, 0, 1), ncol = 1)
mt = matrix(rnorm(120, 0, 1), ncol = 1)
threp = 80
thret = 80
WH <- GetWH(mp, mt, threp, thret)
```
ImpactMG

**Impacts under droughts and hot extremes**

**Description**

Use the meta-Gaussian model to construct conditional distributions of the impact variable (Y) given drought and hot conditions P(Y|PRC,TEM).

**Usage**

ImpactMG(PRC,TEM,Y,u0)

**Arguments**

- **PRC**: Precipitation or drought indicator corresponding to the impact variable Y
- **TEM**: Temperature or heat indicator corresponding to the impact variable Y
- **Y**: Impact variable (e.g., Crop yield)
- **u0**: Initial condition of (PRC,TEM)

**Value**

A vector of conditional mean and variance evaluated at u0

**References**


**Examples**

```r
PRC=matrix(rnorm(60,0,1),ncol=1)
TEM=matrix(rnorm(60,0,1),ncol=1)
Y=matrix(rnorm(60,0,1),ncol=1)
u0=c(-1.2,1.2) # Specify the compound dry-hot condition
ImpactMG(PRC,TEM,Y,u0)
```
**Description**

Compute joint probabilities of compound dry-hot events and the independent case.

**Usage**

```r
LMFDH(mp, mt, threp, thret)
```

**Arguments**

- `mp`: Precipitation
- `mt`: Temperature
- `threp`: Threshold of precipitation (e.g., 50th percentile)
- `thret`: Threshold of temperature

**Value**

Joint probability of DH divided by that of independent case

**References**


**Examples**

```r
mp=matrix(rnorm(120,0,1),ncol=1)
mt=matrix(rnorm(120,0,1),ncol=1)
threp=20
thret=80
res<-LMFDH(mp,mt,threp,thret)
```
PredLGR

**Prediction of compound event occurrences**

**Description**

Fit the logistic regression model (LGR) based on occurrences of compound events (Y) and climate index (CI). The output is the predicted probability of compound event occurrence for the given climate index value CI0.

**Usage**

`PredLGR(Y, CI, CI0)`

**Arguments**

- **Y**: Occurrences of compound dry-hot events (0-1 binary variable) (L lead time)
- **CI**: Climate index (CI) as the driving factor of compound events (e.g., ENSO)
- **CI0**: Specified CI value based on which the prediction is issued

**Value**

Probability of occurrences estimated at CI0

**References**


**Examples**

```r
CI=c(-0.7,-1.2,1.3,0.7,-0.6,1.1,-0.5,0.8,0.5,-0.5,1.6,-1.8,-0.5,-1.4,-0.1,2.2,-0.7,-1.1,0.6,-1.7)
Y=c(0,0,1,1,0,0,0,0,1,0,1,0,1,0,0,0,0,0)
PredLGR(Y,CI,2)
```
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