Package ‘drought’

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Description Provide tools for drought monitoring based on univariate and multivariate drought indicators. Statistical drought prediction based on Ensemble Streamflow Prediction (ESP) and drought risk assessments are also provided. Please see Hao Zengchao et al. (2017) <doi:10.1016/j.envsoft.2017.02.008>.
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R topics documented:

- drought-package .................................................. 2
- ACCU ................................................................. 3
- BiEmp ............................................................... 3
- ESPPred ............................................................. 4
- JDSI ................................................................. 4
- MDI ................................................................. 5
- SDI ................................................................. 6
- UMFreq ............................................................. 6
- UniEmp ............................................................. 7
Description

Provide tools for drought monitoring based on univariate and multivariate drought indicators. Statistical drought prediction based on Ensemble Streamflow Prediction (ESP) and drought risk assessments are also provided. Please see Hao Zengchao et al. (2017) <doi:10.1016/j.envsoft.2017.02.008>.

Details

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Author(s)

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References


Hao, Z., and V. P. Singh (2015), Drought characterization from a multivariate perspective: A review J. Hydrol., 527


Hao, Z. et al. (2014). Global integrated drought monitoring and prediction system. Scientific Data, 1 (and references therein)

Examples

```r
# X<-runif(120, min = 0, max = 100)
# Y0<-ACCU(X,ts=6) # Compute the 6 month accumulated series
# SPI<-SDI(X,ts=6) # Get the standardized drought index (or SPI)
# Y<-runif(120, min = 0, max = 100)
# fit<-JDSI(X,Y,ts=6) # Compute the 6 month multivariate drought index
# fit$JDSI # Get the empirical multivariate drought index
```
ACCU

Obtain the accumulation of monthly hydro-climatic variables

Description
Obtain the accumulation of monthly hydro-climatic variables

Usage
ACCU(X, ts = 6)

Arguments
X The vector of monthly hydro-climatic variables of n years. ts is the accumulated time scale.
ts The accumulated time scale

Examples
X=runif(120, min = 0, max = 100)
Y<-ACCU(X,ts=3) # Compute the 3 month accumulated series

BiEmp
Compute the bivariate empirical joint probability

Description
Compute the bivariate empirical joint probability

Usage
BiEmp(X, Y)

Arguments
X The vector of a monthly hydro-climatic variable of n years.
Y The vector of a monthly hydro-climatic variable of n years.

Value
The empirical joint probability time scale

Examples
X=runif(120, min = 0, max = 100)
Y=runif(120, min = 0, max = 100)
fit<-BiEmp(X,Y)
ESPPred  

**Description**

Drought prediction with ESP method

**Usage**

\[ \text{ESPPred}(X, Y, L = 1, m = 7, ts = 6) \]

**Arguments**

- \( X \) is the monthly variables.
- \( Y \) is the monthly variables.
- \( L \) is the lead time.
- \( m \) is the monthly variables.
- \( ts \) is the monthly variables.

**Value**

The prediction of univariate and multivariate drought index

**Examples**

\[
\text{X} = \text{runif}(120, \text{min} = 0, \text{max} = 100) \\
\text{Y} = \text{runif}(120, \text{min} = 0, \text{max} = 100) \\
\text{ESPPred}(X, Y, L = 1, m = 7, ts = 6)
\]

JDSI  

**Description**

Compute the multivariate drought index with joint distribution

**Usage**

\[ \text{JDSI}(X, Y, ts = 6, type = 1) \]

**Arguments**

- \( X \) is The vector of a monthly hydro-climatic variable of \( n \) years.
- \( Y \) is The vector of a monthly hydro-climatic variable of \( n \) years.
- \( ts \) is the accumulated time scale.
- \( type \) is the method used to compute the JDSI (1 is Joint distribution and 2 is the Kendall function).
**Value**

The multivariate drought index of different time scales from the marginal probability (or percentile)

**Examples**

```r
X=runif(120, min = 0, max = 100)
Y=runif(120, min = 0, max = 100)
fit<-JDSI(X,Y,ts=6)
z=matrix(t(fit$JDSI),ncol=1)
plot(z, type="l", col=1, lwd=2, lty=1, xlim=c(0,120),xlab="Time",ylab="JDSI")
```

**Description**

Based on the vector of a monthly hydro-climatic variable, the multivariate drought index is computed based on the marginal (or univariate) probability (or percentile) from the function SDI.

**Usage**

```r
MDI(X, Y, ts = 6)
```

**Arguments**

- **X** is The vector of a monthly hydro-climatic variable of n years.
- **Y** is The vector of a monthly hydro-climatic variable of n years.
- **ts** is the accumulated time scale.

**Value**

The multivariate drought index of different time scales from the marginal probability (or percentile)

**Examples**

```r
X=runif(120, min = 0, max = 100)
Y=runif(120, min = 0, max = 100)
fit<-MDI(X,Y,ts=6) # Compute the 6 month drought index
fit$ProbEmp2 # Get the empirival drought index
```
SDI

Compute the standardized drought index

Description
Based on the vector of monthly variables, the standardized drought index is computed. Note here the standardized precipitation index (SPI) is used as the example of the drought index in the univariate case. It also represents other drought indices computed in the similar way as SPI.

Usage
SDI(X, ts = 6, dist = "EmpGrin")

Arguments
- X: The vector of a monthly hydro-climatic variable of n years.
- ts: is the accumulated time scale.
- dist: is distribution function.

Details
Apart from the standardized drought index, the percentile (probability) is also provided.

Value
The univariate and multivariate drought index of different time scale from both the empirical and gamma distribution

Examples
X=runif(120, min = 0, max = 100)
fit<-SDI(X,ts=3) # Compute the 3 month drought index
fit$SDI # Get the empirical drought index
z=matrix(t(fit$SDI),ncol=1)
plot(z, type="l", col=1, lwd=2, lty=1, xlab="Time", ylab="SDI")

UMFreq

Univariate and multivariate return period (Gumbel copula)

Description
Univariate and multivariate return period (Gumbel copula)

Usage
UMFreq(X, Y, EL = 1)
**UniEmp**

**Arguments**

- **X** are the drought properties or indices
- **Y** are the drought properties or indices
- **EL** is the average recurrence time

**Value**

The univariate and multivariate return period

**Examples**

```r
X=runif(120, min = 0, max = 100)
Y=runif(120, min = 0, max = 100)
fit<-UMFreq(X,Y,1)
```

---

<table>
<thead>
<tr>
<th>UniEmp</th>
<th>Compute the univariate empirical joint probability (EMP)</th>
</tr>
</thead>
</table>

**Description**

Compute the univariate empirical joint probability (EMP)

**Usage**

```r
UniEmp(X, dist = "Gringorten")
```

**Arguments**

- **X** The vector of a monthly hydro-climatic variable of n years.
- **dist** is the function for the plotting position formula (Gringorten or Weibull).

**Value**

The univariate EMP

**Examples**

```r
X=runif(120, min = 0, max = 100)
fit<-UniEmp(X,dist = "Gringorten")
```
Index

ACCU, 3
BiEmp, 3
drought (drought-package), 2
drought-package, 2
ESPPred, 4
JDSI, 4
MDI, 5
SDI, 6
UMFreq, 6
UniEmp, 7