Package 'lmomPi'

August 25, 2025

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Title (Precipitation) Frequency Analysis and Variability with L-Moments from 'lmom'

Type Package

Description It is an extension of 'lmom' R package: 'pel...()','cdf...()',qua...()' function families are lumped and called from one function per each family respectively in order to create robust automatic tools to fit data with different probability distributions and then to estimate probability values and return periods. The implemented functions are able to manage time series with constant and/or missing values without stopping the execution with error messages. The package also contains tools to calculate several indices based on variability (e.g. 'SPI' , Standardized Precipitation Index, see <https://climatedataguide.ucar.edu/climate-data/standardized-precipitation-index-spi> and <http://spei.csic.es/>) for multiple time series or spatially gridded values.

Version 0.6.7

Date 2025-08-01

Repository CRAN

Depends R(>= 3.0.1),lmom,stringr

Suggests SPEI

Encoding UTF-8

RoxygenNote 7.3.2

NeedsCompilation no

Date/Publication 2025-08-25 07:50:08 UTC

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Contents

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cdf *Generic function for* cdf...: *probability distribution fitting with L-Moments.*

Description

These functions compute value(s) of cumulated probability or SPI-like (normal standardize) index from a sample or time series of x.

Usage

```
cdf(
  para,
  x,
  probability_distribution_attrname = "probability_distrib",
  indices = NULL,
  return.as.spi = FALSE,
  spi.scale = NA,
  distrib = NA,
  ...
)

spi.cdf(x, para, ...)

cdf.spi(x, para, ...)
```

Arguments

x, para, ...	L-moments and further parameters for cdf... and cdf
probability_distribution_attrname	attribute name for probability distribution
indices	vector of string working as factors or indices, e g. the month names or similar. It must be of the same length of x or the length equal to 1 other NULL, if not used. If used, it computes cdf for each factor.
return.as.spi	logical parameter. Default is FALSE. If it is TRUE probability value is transformed to a normalized random variable through standard qnorm, as for Standard Precipitation Index (SPI) (https://climatedataguide.ucar.edu/climate-data/standardized-precipitation-index-spi).
spi.scale	integer value or NA. If it greater than 1 x is filtered with the sum of a generic element of x and the previous spi.scale-1 ones (e.g. SPI-3,SPI-6, etc.). Default is NA (no filtering) which is equivalent to spi.scale=1.
distrib	character string indicating the probability distribution, it can be used in case para has no attributes. Default is NA and distribution info are all passed through para.

Value

A vector of cumulated probability value(s) or SPI-like Gaussianized values. It is a list of vectors in case of several probability parametric distribution functions (i.e. `para` is a list and `length(para)>1`).

See Also

pel,cdfexp,cdfgam,cdfgev,cdfglo,

cdfgpa,cdfgno,cdfgum,cdfkap,cdfln3,cdfnor,cdfpe3,cdfwak,cdfwei

Examples

```
# Sample L-moments of Ozone from the airquality data
data(airquality)
lmom <- samlmu(airquality$Ozone,nmom=6)

distrib <- c("exp","gam","gev","glo","gpa","gno","gum","kap",
"ln3","nor","pe3","wak","wei")

para_list <- pel(distrib=distrib,lmom=lmom)
cdf_list <- cdf(para=para_list,x=airquality$Ozone)

cdf_gam <- cdf(para=para_list$gam,x=airquality$Ozone)
cdf_gam2 <- cdf(para=para_list$gam,x=airquality$Ozone,distrib="gam")

if (any(cdf_gam!=cdf_gam2,na.rm=TRUE)) stop("Any possible errors after  0.6.3 package updates!")



## Comparison with the SPI/SPEI algorithms:  'SPEI::spi' ('SPEI' package)

if (requireNamespace("SPEI",quietly = TRUE)) {
 library(SPEI)
 data(wichita)

 distrib_wichita <- 'pe3'
 spi.scale <- 1

 month_wichita <- sprintf("M%02d",wichita$MONTH)
 para_whichita  <- pel(x=wichita$PRCP,indices=month_wichita,distrib=distrib_wichita,
spi.scale=spi.scale)
 spi_wichita   <- spi.cdf(x=wichita$PRCP,indices=month_wichita,para=para_whichita,
spi.scale=spi.scale)
 spi_wichita_speipkg   <- spi(data=wichita$PRCP,distrib='PearsonIII',scale=spi.scale)
 difference <- spi_wichita-spi_wichita_speipkg$fitted
}
```

pel *Generic function for* pel...

Description

Generic function for pel...: probability distribution fitting with L-Moments

Usage

```
pel(
 distrib = c("exp", "gam", "gev", "glo", "gpa", "gno", "gum", "kap", "ln3", "nor",
    "pe3", "wak", "wei"),
 lmom = NULL,
 probability_distribution_attrname = "probability_distrib",
 x = NULL,
 nmom = 5,
 sort.data = TRUE,
 ratios = sort.data,
 trim = 0,
 indices = NULL,
 spi.scale = NA,
 correction = NULL,
 ...
)

pel_x(x, ...)

pel_lmom(lmom, ...)
```

Arguments

distrib	character string indicating the probability distribution to fit
lmom, ...	L-moments and further parameters for pel...
probability_distribution_attrname	attribute name for probability distribution
x	vector containg sample. It is utiled to calculete L-moments in case lmom is set equal to NULL.
nmom, sort.data, ratios, trim	arguments for samlmu (nmom=5 by default). Thay are utilized if argument lmom is NULL.
indices	optional index or tag character vector of the same length of x used as INDEX for tapply. It is used to fit different probability distribution in one sample time series (e. g. months in an year).
spi.scale	integer value or NA. If it is greater than 1, x is filtered with the sum of a generic element of x and the previous spi.scale-1 ones (e.g. SPI-3,SPI-6, etc.). Default is NA (no filtering) which is equivalent to spi.scale=1.

`correction` numeric value correction for the 3rd (and higher) L-moment estimation. Default is `NULL` , generally it is not used. It is used and suggested to be `10^(-10)` in case of a massive function use with `lmom=NULL` (e.g. raster cell or zonal statistics).

Details

`pel_x` and `pel_lmom` are wrapper functions of `pel` whose first argument is `x` or `lmom` respectively.

Value

A numeric vector containing the parameters of the selected probability distribution. It is a list in case of selection of several probability distributions (i.e. `length(distrib)>1`).

See Also

`pel...`,`pelexp`,`pelgam`,`pelgev`,`pelglo`,`pelgpa`,

`pelgno`,`pelgum`,`pelkap`,`pelln3`,`pelnor`,

`pelpe3`,`pelwak`,`pelwei`,

`cdf`,`qua`

Examples

```
# Sample L-moments of Ozone from the airquality data
data(airquality)
lmom <- samlmu(airquality$Ozone,nmom=6)
distrib <- "gev"
# Fit a GEV distribution
out_gev <- pel(distrib=distrib,lmom=lmom)

distrib <- c("exp","gam","gev","glo","gpa","gno","gum","kap","ln3",
"nor","pe3","wak","wei")

out_list <- pel(distrib=distrib,lmom=lmom)
```

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qua *Generic function for* qua*...: probabilily distribution fitting with L-Moments*

Description

Generic function for `qua...`: probabilily distribution fitting with L-Moments

Usage

```
qua(
  para,
  f,
  probability_distribution_attrname = "probability_distrib",
  distrib = NA,
  ...
)
```

Arguments

f, para, ...	L-moments and further parameters for qua...
probability_distribution_attrname	attribute name for probability distribution
distrib	character string indicating the probability distribution, it can be used in case para has no attributes. Default is NA and distribution info are all passed through para.

Value

A vector of quantiles. It is a list of vectors of quantiles in case of several probability parametric distribution functions (i.e. para is a list and length(para)>1).

See Also

pel,quaexp,quagam,quagev,quaglo,quagpa,quagno,quagum,

quakap,qualn3,quanor,quape3, quawak,quawei

Examples

```
# Sample L-moments of Ozone from the airquality data
data(airquality)
lmom <- samlmu(airquality$Ozone,nmom=6)

distrib <- c("exp","gam","gev","glo","gpa","gno","gum","kap","ln3","nor",
"pe3","wak","wei")

para_list <- pel(distrib=distrib,lmom=lmom)
f <- (1:10)/10
qua_list <- qua(para=para_list,f=f)

qua_gam <- qua(para=para_list$gam,f=f)
qua_gam2 <- qua(para=as.vector(para_list$gam),f=f,distrib="gam")

if (any(qua_gam!=qua_gam2,na.rm=TRUE)) stop("Any possible errors after  0.6.3 package updates!")
```

Index