Package ‘lmomPi’

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Title (Precipitation) Frequency Analysis and Variability with L-Moments from ‘lmom’
Type Package
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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 spatio-temporal gridded values.

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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_atrname = "probability_distrib",
   indices = NULL, return.as.spi = FALSE, spi.scale = NA, ...)

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

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

Arguments

x, para, ... L-moments and further parameters for cdf... and cdf
probability_distribution_atrname
   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 transormed 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.

See Also

pel, cdfexp, cdfgam, cdfgev, cdfglo,
cdfgpa, cdfgno, cdfgum, cdfkap, cdfln3, cdfnor, cdfpe3, cdfwak, cdfwei
Examples

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


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

library(rasterList)
precf <- system.file("map/Mekrou_precipitation.grd", package="rasterList")
precs <- stack(precf)
prec_point <- precsf[143][,]

## month index
month <- as.character(as.Date(names(prec_point), format="%Y.%m.%d"), format="%M")
prec_point[(prec_point<1) & (month=="11"铰]) <- 0

distrib_prec2 <- c("gam")
para_vvv <- pel(x=prec_point, indices=month, distrib=distrib_prec2)
cdf_ <- cdf(x=prec_point, indices=month, para=para_vvv)
spi_ <- spi.cdf(x=prec_point, indices=month, para=para_vvv)

###
### Not run:
para_raster <- rasterList(precs, FUN=pel_x, indices=month, distrib=distrib_prec2)
spil_raster <- stack(RasterListApply(x=rasterList(precs), para=para_raster,
indices=list(month), FUN=spi))

para_raster_spi3 <- rasterList(precs, FUN=pel_x, indices=month, distrib=distrib_prec2,
spi.scale=3)
spi3_raster <- stack(RasterListApply(x=rasterList(precs), para=para_raster_spi3,
indices=list(month), spi.scale=3, FUN=spi.cdf))

### End(Not run)

### Comparison with the SPI/SPEI algorithms: 'SPEI::spi' ('SPEI' package)
library(SPEI)
data(wichita)
distrib_wichita <- 'pe3'
spi.scale <- 1

month_wichita <- sprintf("%M%02d", wichita$MONTH)
para_wichita <- pel(x=wichita$PRCP, indices=month_wichita, distrib=distrib_wichita,
spi.scale=spi.scale)
spi_wichita <- spi.cdf(x=wichita$PRCP, indices=month_wichita, para=para_wichita,
```
Description

This package contains wrapper functions of 'lmom' packages:
- **cdf**: generic distribution function;
- **qua**: generic quantile function;
- **pel**: fitting of probability distribution function through L-moments.

Details

The example functions are illustrated making use of CHIRPS rainfall meteorological data taken:

The package-provided datasets shall be only used as example datasets.

The package also contains wrapped functions 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 spatio-temporal gridded values. The function **spi.cdf** is compared against **SPEI::spi** in SPEI package (https://cran.r-project.org/package=SPEI). The differences in SPI estimation have order of magnitude averagely about 10^-8, due to the different fitting methods implemented in the two packages. (see **SPEI::spi** and **spi.cdf** for more details).

The development of this package has been sponsored by ACEWATER2 and "Water for Growth and Poverty Reduction in the Mekrou" projects of the Joint Research Centre of the European Commission (https://aquaknow.jrc.ec.europa.eu).

pel

Generic function for `pel`...
pel

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, ...)

pel_x(x, ...)

pel_lmom(lmom, ...)

Arguments

distrib character string incating 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.

Details

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

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,nnom=6)
distrib <- "gev"
# Fit a GEV distribution
out_gev <- pel(distrib=distrib, lmom=1mom)


out_list <- pel(distrib=distrib, lmom=1mom)

library(rasterList)
preccf <- system.file("map/Mekrou_precipitation.grd", package="rasterList")
precs <- stack(preccf)
prec_point <- precs[143][,]
## month index
month <- as.character(as.Date(names(prec_point), format="%Y.%m.%d"), format="%M%m")
distrib_prec <- c("gam", "pe3")
out_x <- pel(x=prec_point, indices=month, distrib=distrib_prec)
out_spi3_x <- pel(x=prec_point, indices=month, distrib=distrib_prec, spi.scale=3)
distrib_prec2 <- c("gam")
out_x <- pel(x=prec_point, indices=month, distrib=distrib_prec2)
out_spi3_x <- pel(x=prec_point, indices=month, distrib=distrib_prec2, spi.scale=3)

### example with PEL when x is always 0 or a fixed constant
xx <- array(0,50)
out_xx <- pel_x(x=xx, distrib=distrib_prec2)

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**qua**

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

**Description**

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

**Usage**

qua(para, f, probability_distribution_attrname = "probability_distrib", ...)

**Arguments**

f, para, ... L-moments and further parameters for qua...

probability_distribution_attrname

attribute name for probability distribution

**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)


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

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