Package ‘paleofire’

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Type Package
Title Analysis of Charcoal Records from the Global Charcoal Database
Version 1.2.4
Date 2019-12-01
Author Global Paleofire Working Group <paleofire@gmail.com>
Maintainer Olivier Blarquez <blarquez@gmail.com>
Description Tools to extract and analyse charcoal sedimentary data stored in
the Global Charcoal Database. Main functionalities includes data extraction
and sites selection, transformation and interpolation of the charcoal
records as well as compositing.
URL http://gpwg.paleofire.org
License GPL (>= 2)
Imports locfit, raster, ggplot2, plyr, rgdal, lattice
Suggests gtools, caTools, pscl, agricolae, Imap, sp, rworldmap, RColorBrewer
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R topics documented:
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The paleofire package provides tools to extract and analyse charcoal sedimentary data stored in the Global Charcoal Database. Main functionalities include data extraction and sites selection, transformation and homogenization of the charcoal records as well as regional to global compositing.
Details

Package: paleofire
Type: Package
Version: 1.1.9
Date: 2016-09-19
License: GPL (>=2)

Author(s)

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Maintainer

Olivier Blarquez <blarquez at gmail.com>

References


See Also

http://gpwg.paleofire.org

Examples

## Not run:
## Interactive sites selection:
# ID=pfInteractive()

## Site selection using criterions
# Boreal Eastern North American sites with at least one
data point each 2500 year
ID=pfSiteSel(lat>50, lat<70, long>-90, long<(-50), date_int<=2500, l12==1)
plot(ID, zoom="world")

## Modify plot
plot(ID, zoom="sites")

## Simple test for transforming data
# Select site 1 (Cygnet Lake)
ID1=pfSiteSel(id_site==1)
plot(ID1)
# Transformation of data
TR=pfTransform(ID1,method=c("MinMax", "Box-Cox", "Z-Score"))

# Plot Transformed and raw data
# First retrieve raw data for Cygnet using pfExtract
RAW=pfExtract(ID=1)

dev.off()
par(mfrow=(c(2,1)))

plot(RAW[,3],RAW[,4],type="l")
plot(TR$Age,TR$TransData,type="l")

## Transforming and Compositing
## Example 1: Usage as in Power et al. 2008
## Data transformation
TR1=pfTransform(ID, method=c("MinMax","Box-Cox","Z-Score"),BasePeriod=c(200,2000))

## Diagnostic pdf file with transformed series:
# pfDiagnostic(ID, method=c("MinMax","Box-Cox","Z-Score"),BasePeriod=c(200,2000),
# FileName = "Diagnostic.pdf")

## Compositing: basic binning procedure
COMP=pfComposite(TR1, binning=TRUE, bins=seq(0,8000,500))
plot(COMP)

## The result matrix can be saved
# write.csv(COMP$Result,file="temp.csv")

## Compositing: Using the locfit package equivalent procedure to Daniau et al. 2012
COMP2=pfCompositeLF(TR1, tarAge=seq(-50,8000,20), binhw=20, hw=500,nboot=100)
plot(COMP2)

## And save
write.csv(COMP2$Result,file="temp2.csv")

## End(Not run)

---

### Description

Check if GCD package is installed and up to date to ensure always using the most up to date GCD version. devtools package is required: on Windows install Rtools.exe depending on your R version http://cran.r-project.org/bin/windows/Rtools/
Usage
checkGCDversion()

Details
Last GCD database version is downloaded and installed using:
library(devtools)
install_github("GCD",username="paleofire",ref="master")

Author(s)
O. Blarquez

Examples

## Not run: checkGCDversion()

data(coast)

Description
World coastlines

Usage
data(coast)

Format
A data frame with 9865 observations on the following 2 variables.

Y Latitude
X Longitude

Source
http://www.naturalearthdata.com/downloads/10m-physical-vectors/

Examples
data(coast)
### contiguous

**Description**

The function checks whether cores have been sampled contiguously or with a depth resolution < 1 cm.

**Usage**

`contiguous(x, threshold = 1)`

**Arguments**

- `x` An object of the class "pfSiteSel"
- `threshold` Numeric, threshold for considering two samples as contiguous (default=1 cm)

**Value**

Summary table of sites with the added contiguous logical column (TRUE–FALSE)

**Author(s)**

O. Blarquez

**See Also**

`pfResolution`

**Examples**

```r
## Not run:
x = pfSiteSel(lat>12, lat<60, long<(-50), long>-140)
contiguous(x)
## End(Not run)
```

---

### contrib.pfCompositeLF

**Description**

Calculates the number of prebinned samples contributing to the composite curve. The number is calculated by counting the number of non null charcoal values at each tarAge from the prebinned charcoal series.
kdffreq

Usage

## S3 method for class 'pfCompositeLF'
contrib(x, ...)

Arguments

x A "pfCompositeLF" object.
...

Author(s)

O. Blarquez

Examples

## Not run:
ID=pfSiteSel(continent="North America", l12==1, long>=-160 & long<=-140)

TR=pfTransform(ID, method=c("MinMax","Box-Cox","MinMax","Z-Score"),
    BasePeriod=c(200,2000),QuantType="INFL")

COMP1=pfCompositeLF(TR, tarAge=seq(-50,4000,10), hw=200, nboot=100)

a=contrib(COMP1)
plot(COMP1$BinCentres,a)
## End(Not run)

kdffreq

Fire frequency using kernel density

Description

Computes paleo-fire frequency for a set of fire events (or frequency from other events types, see examples) using a gaussian kernel density estimation procedure based on a defined bandwidth (see Mudelsee 2004 for details). Pseudo-replicated values are used to correct for edge bias, equivalent to "minimum slope" correction in Mann (2004).

Usage

kdffreq(
    fevent,
    up = NULL,
    lo = NULL,
    interval = 10,
    bandwidth = NULL,
    boot = "full",
    ...
bootper = 0.1,
nbboot = NULL,
alpha = NULL,
pseudo = FALSE,
pseudo_per = NULL
)

Arguments

fevent Numeric vector, set of dates
up Numeric, upper age for fire frequency calculus
lo Numeric, lower age for fire frequency calculus
interval Numeric, interval between two points for fire frequency calculus (default 10 years)
bandwidth Numeric, bandwidth in years, or character for automatic bandwidth calculation (e.g. "bw.ucv" for unbiased cross validation) see bandwidth for details
boot Character, "full" or "partial" see @details
bootper Numeric, percentage of fire events randomly added or removed in the "partial" replication procedure (default 0.1)
nbboot Numeric, number of bootstrap replicates
alpha Numeric, confidence interval (default 0.01)
pseudo Logical, apply (TRUE) or not (FALSE) Mann (2004) correction (default=FALSE)
pseudo_per percentage of actual data used in reflection in the Mann (2004) correction

Details

By using boot="partial" option (beta!) fire dates are randomly removed or added within a defined percentage (by default between 1 and 10% of total number of events) in order to make new series that are then used to calculate ensemble members fire frequencies. This procedure differs slightly from the full bootstrapp where fire dates are randomly picked with replacement. Theoretically classic bootstrap could result in a sample where a single fire event date is replicated n times which makes no sense for fires. By randomly removing or adding fire dates the confidence intervals are narrower and likely better reflect the long term fire regime variability.

Value

ff data.frame, with fire frequency, bandwidth and CIs

Author(s)

O. Blarquez
References


See Also

plot.kdffreq

Examples

```r
## Not run:
set.seed(123)
fevent=c(round(abs(rnorm(20,mean=7,sd=5))*1000),round(abs(rnorm(10,mean=8,sd=1))*1000))
ff=kdffreq(fevent,bandwidth = 1000, nbboot=10)

# Estimate the frequency of armed conflicts from 1946 to 2014
# Data from the The Uppsala Conflict Data Program (UCDP) available at: https://www.prio.org
dat=read.csv('http://ucdp.uu.se/downloads/ucdpprio/ucdp-prio-acd-4-2016.csv')
res=kdffreq(dat$Year,bandwidth = "bw.ucv", nbboot=1000, up = 1946, lo = 2014, interval=1, pseudo=T)
plot(res, ylab="# armed conflict/year")
## End(Not run)
```

paleofire-internal Internal paleofire functions

Description

Internal paleofire functions and functions waiting for man.

pfAddData Add user defined charcoal data series to paleofire

Description

This function is used to create a "pfAddData" object, from user defined csv files containing charcoal data, to be passed to pfTransform. csv files must contain three columns with Depth, Age, Charcoal quantity in this same order (for type="NONE" argument). A metadata csv file could also be specified with sites location information (three columns with: SITE_NAME, LATITUDE, LONGITUDE). CharAnalysis data files could also be used, in this case the file must include the following columns: DepthTop, DepthBottom, AgeTop, AgeBottom, Volume and Charcoal value in this exact order. Then the files are passed to the pretreatment function in order to calculate Charcoal Accumulation Rates (see pretreatment for details).
Usage

pfAddData(
  files,
  metadata = NULL,
  type = "NULL",
  Int = TRUE,
  first = NULL,
  last = NULL,
  yrInterp = NULL,
  sep = ",",
  dec = "."
)

Arguments

  files Character, names and path to csv files.
  metadata Character, name and path to the (unique) metadata csv file.
  type Character, "NONE": user defined csv (default), "CharAnalysis": CharAnalysis data file.
  Int Logical specifying whether the pretreatment function interpolates particle zero counts, default TRUE.
  first, last Numeric, date of the first, last sample for accumulation rate calculation, if NULL first, last are automatically specified as the the minimum and maximum ages of the record respectively.
  yrInterp Numeric, temporal resolution of the interpolated accumulation rates, if NULL, yrInterp is automatically specified as the median resolution of the record.
  sep char, column separator for csv, "," by default
  dec char, decimal "." by default

Value

  out A list with merged data files that can be passed to pfTransform

Author(s)

  O. Blarquez

See Also

  pretreatment

Examples

  ## Not run:
  # Ad user own data from CharAnalysis file (csv)
pfBoxCox

# In this example we will use data from:
# Senici, D., A. Lucas, H. Y. H. Chen, Y. Bergeron, A. Larouche, B. Brossier, O.
# Blarquez, and A. A. Ali. 2013. Multi-millenial fire frequency and tree abundance
# differ between xeric and mesic boreal forests in central Canada. Journal of Ecology:
# 101, 356-367.

       "http://blarquez.com/public/data/Small.csv")
metadata=c("http://blarquez.com/public/data/metadata.csv")

mydata=pfAddData(files=files,metadata=metadata,type="CharAnalysis")

# Transform and compositing:
TR1=pfTransform(add=mydata, method=c("MinMax","Box-Cox","Z-Score"),
               BasePeriod=c(200,2000))
COMP2=pfCompositeLF(TR1, tarAge=seq(-50,8000,20), hw=500, nboot=100)
plot(COMP2)

# Three columns example (with semicolon csv files):
files=c("http://blarquez.com/public/data/Ben_area.csv",
       "http://blarquez.com/public/data/Small_area.csv")
mydata=pfAddData(files=files, sep=";")

# Transform and compositing:
TR1=pfTransform(add=mydata, method=c("MinMax","Box-Cox","Z-Score"),
               BasePeriod=c(200,2000))
COMP2=pfCompositeLF(TR1, tarAge=seq(-50,8000,20), hw=500, nboot=100)
plot(COMP2)

## End(Not run)

---

pfBoxCox  

**Box-Cox transformation of Charcoal series**

**Description**

Box-Cox transformation of charcoal series, the maximum likelihood estimation of lambda is derived from the boxcox.R function in the Venables and Ripley MASS library included in R 2.6.1

**Usage**

pfBoxCox(serie, alpha = 0.01, type = "BoxCox1964")

**Arguments**

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>serie</td>
<td>A vector of charcoal values.</td>
</tr>
<tr>
<td>alpha</td>
<td>Numeric, the &quot;shift&quot; parameter, default=0.01.</td>
</tr>
<tr>
<td>type</td>
<td>Character, the Box-Cox transformation formulation, can be either &quot;BoxCox1964&quot; (default) for the original Box &amp; Cox (1964) formulation, or &quot;JohnDraper&quot; for the John &amp; Draper (1980) modulus transformation.</td>
</tr>
</tbody>
</table>
Value

X Vector of transformed charcoal values

Author(s)

P. Bartlein

References


See Also

pfTransform

Examples

# Select a site
ID=pfSiteSel(site_name="Pas-de-Fond")

# Extract data
A=pfExtract(ID)

B=pfBoxCox(A[,4],0.1)
plot(B,type="l")

pfCircular

Circular block bootstrap procedure applied to charcoal records compositing results

Description

Block bootstrap has been proposed to test the significances of changes in stationary time series (Kunsch 1989). This procedure consists of splitting each charcoal series into n-b+1 overlapping blocks of data, where n is sample size and b the block size. These blocks are used to reconstruct resampled individual charcoal series that are in turn used to estimate the confidence intervals around the charcoal series composite mean.
pfCircular

Usage

pfCircular(comp, b = NULL, conf = c(0.05, 0.95), nboot = 1000, AgeLim = NULL)

Arguments

comp  A "pfComposite" object
b     A numeric giving block size, if NULL the optimal block size for a given series
      is given by: b = 2x(-1 /log(p)), where p is the lag one autocorrelation coefficient
      of that series (Adams, Mann & Ammann 2003).
conf  Numeric, calculated confidence intervals.
nboot Numeric, number of bootstrap replicates.
AgeLim Numeric, years defining a period to restrict the analysis to.

Value

out   A "pfCircular" object with estimated confidence intervals.

Author(s)

O. Blarquez

References

Kunsch, H. R. 1989. The jackknife and the bootstrap for general stationary observation s. The


Examples

## Not run:
ID = pfSiteSel(lat > 49, lat < 75, long > 6, long < 50)
plot(ID, zoom = "world")
TR1 = pfTransform(ID, method = c("MinMax", "Box-Cox", "Z-Score"), BasePeriod = c(200, 2000))

## Circular block bootstrapp
COMP = pfComposite(TR1, binning = TRUE, bins = seq(0, 2000, 100))
circ = pfCircular(COMP, conf = c(0.005, 0.025, 0.975, 0.995), nboot = 100)
plot(circ)

## End(Not run)
pfComposite

Produce a composite serie from multiple charcoal records

Description

Produce a composite serie from multiple charcoal records using bootstrap resampling, the sites charcoal values are binned and the mean in each bin is calculated prior the bootstrap procedure. This procedure is equivalent to Power et al. 2008.

Usage

pfComposite(
  TR,
  bins = NULL,
  nboot = 1000,
  binning = TRUE,
  conf = c(0.05, 0.95)
)

Arguments

- **TR**: An object returned by `pfTransform`
- **bins**: Numeric, the sequence for binning given in years (e.g. bins=seq(from=0, to=10000, by=200)). If unspecified the sequence is defined as bins=seq(from=min age, to=max age, by=median resolution).
- **nboot**: Numeric, a number specifying the number of bootstrap replicates.
- **binning**: Logical, set to TRUE (default) for binning, if transformed data are first interpolated this argument can be set to FALSE (no binning).
- **conf**: Numeric, define confidence levels.

Value

Object of the class "pfComposite"

Author(s)

O.Blarquez

References


Examples

```r
## Not run:
## Composite charcoal record for boreal Canada:
ID=pfSiteSel(country="Canada" & l12==1)
plot(ID)
## Transform data
res3=pfTransform(ID,method=c("MinMax","Box-Cox","Z-Score"),BasePeriod=c(200,4000))
## Composite
comp=pfComposite(res3,bins=seq(from=0,to=12000,by=200))
plot(comp)
## End(Not run)
```

pfCompositeLF

- **Produce a composite serie from multiple charcoal records using a local regression procedure (from the locfit package)**

Description

Produces a composite series from multiple charcoal records by using a robust locally weighted scatterplot smoother (LOWESS). The robust LOWESS uses the locfit function from the locfit package and is applied repeatedly (nboot times) on bootstrapped charcoal sites samples. The records charcoal values are pre-binned prior to sites resampling. This procedure is equivalent to Daniau et al. (2012).

Usage

```r
pfCompositeLF(
  TR,
  hw = 250,
  tarAge = NULL,
  binhw = NULL,
  nboot = 1000,
  conf = c(0.05, 0.95),
  pseudodata = FALSE,
  verbose = TRUE
)
```
Arguments

TR: An object returned by `pfTransform`

hw: Numeric, the half window width for the locfit procedure (in years).

tarAge: Numeric, the target ages for prebinning given in years (e.g., tarAge = seq(0, 10000, 20)). If unspecified the sequence is defined as tarAge=seq(from=min age, to=max Age, by=median resolution).

binhw: Numeric, bin half width for the prebinning procedure (use the same value as tarAge intervals for overlapping bins or tarAge intervals/2 for non-overlapping bins, default).

nboot: Numeric, a number specifying the number of bootstrap replicates.

conf: Numeric, define confidence levels.

echlor: Logical, if TRUE 10 percent of the data is reflected at the top and the bottom of the resampled serie prior of each locfit regression in order to correct for the edge effect introduced by the local regression, see Cowling & Hall (1996). Equivalent to "minimum slope" correction in Mann(2004).

verbose: Logical: verbose or not...

Value

out: A "pfCompositeLF" object.

Author(s)

O.Blarquez

References


Examples

## Not run:

ID = pfSiteSel(continent == "North America", l12 == 1, long >= -160 & long <= -140)
plot(ID, xlim = c(-180, -130), ylim = c(40, 80))
TR = pfTransform(ID, method = c("MinMax", "Box-Cox", "MinMax", "Z-Score"),
    BasePeriod = c(200, 2000), QuantType = "INFL")
COMP1 = pfCompositeLF(TR, tarAge = seq(-50, 4000, 10), hw = 200, nboot = 100)
plot(COMP1)

## Note: comparing confidence intervals based on 100 replicates is not recommended
# (100 is used to decrease analysis time)

## End(Not run)

pfDiagnostic

Print diagnostic pdf for individual transformed series

Description

Print diagnostic pdf for individual transformed series, successive transformations could be specified
(see example)

Usage

pfDiagnostic(
    ID,
    add = NULL,
    Age = 0,
    Interpolate = FALSE,
    method = "Box-Cox",
    BasePeriod = c(-100, 1e+09),
    span = 0.3,
    RunWidth = 500,
    RunQParam = 0.5,
    stlYears = 500,
    alpha = 0.01,
    type = "BoxCox1964",
    FileName = "Diagnostic.pdf",
    QuantType = "ALL"
)

Arguments

ID An object returned by pfSiteSel or pfTransform
add An object returned by pfAddData
**pfDiagnostic**

**Age**
Numeric, if Interpolate=TRUE, Age is used to specified the ages where the interpolation took place. If Age=0 the interpolated ages are automatically specified using the median resolution of the record(s) If Age is specified as a vector (e.g. Age=(from=0,to=10000, by=10)) the interpolation took place at specified ages.

**Interpolate**
Logical, indicates wether data should be interpolated or not, default=FALSE

**method**

**BasePeriod**
Numeric, a parameter specifying the base period for calculating Z-score given in years BP (e.g. BasePeriod=c(0, 4000)), if empty or unspecified the base period corresponds to record length.

**span**
Numeric, the span parameter for the LOESS or Smoothing spline methods

**RunWidth**
Numeric, the width of the window for the"RunMed", "RunMean", "RunQuantile", "RunMin", and "RunMax" methods in years.

**RunQParam**
Numeric, the parameter specifying which quantile should be calculated for the method "RunQuantile" (default=0.5 i.e. median).

**stlYears**
Numeric, the bandwith for stl decomposition, default=500 years.

**alpha**
Numeric, alpha value to add before BoxCox calculation, see pfBoxCox.

**type**
Character, the type of Box-Cox transformation, see pfBoxCox for details

**FileName**
Character, define output pdf file name e.g. FileName="mydata.pdf"

**QuantType**
Character, by default QuantType="INFL" and influx are automatically calculated, otherwise use QuantType="NONE" (not recommended).

---

**Value**

**Filename.pdf**
A diagnostic file is printed, each sites being printed on separate pages (specified using FileName="myfile.pdf"

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**Author(s)**

O. Blarquez

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**Examples**

```r
## Not run:
# Select boreal sites from Levavasseur 2012 PNV in Western North America
ID=pfSiteSel(continent=="North America", l12=1, long>=-160 & long<=-140)

# Print a diagnostic pdf for Box-Cox, Smoothed and Z-score tranformed data
# (base period = 200-2000 BP)
pfDiagnostic(ID,method=c("Box-Cox", "SmoothSpline","Z-Score"),
             span=0.3,BasePeriod=c(200,4000))
```
pfDotMap

Produce maps of paleofire data

Description

Produce map graphics representing spatial variability in charcoal data from the Global Charcoal Database.

Usage

pfDotMap(
  TR,
  tarAge,
  hw,
  binhw = 0.5 * mean(diff(tarAge)),
  fig.base.name = NULL,
  base.map = "coasts",
  grd.res = 5,
  grd.ext = c(-180, 180, -90, 90),
  grd.lonlat = NULL,
  proj4 = "+proj=longlat +ellps=WGS84 +datum=WGS84 +no_defs",
  n.boot = 1000,
  cx.minsize = 0.3,
  cx.mult = 1
)

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR</td>
<td>An object returned by <code>pfTransform</code></td>
</tr>
<tr>
<td>tarAge</td>
<td>Numeric, the target ages for prebinning given in years (e.g. <code>tarAge = seq(0, 10000, 20)</code>). If unspecified the sequence is defined as <code>tarAge = seq(from=min_age, to=max Age, by=median resolution)</code></td>
</tr>
<tr>
<td>hw</td>
<td>Numeric, the half window width for the locfit procedure (in years).</td>
</tr>
<tr>
<td>binhw</td>
<td>Numeric, bin half width for the prebinning procedure (use the same value as <code>tarAge</code> intervals for overlapping bins or <code>tarAge</code> intervals/2 for non-overlapping bins).</td>
</tr>
<tr>
<td>fig.base.name</td>
<td>Character sequence representing the base name for the figures. Can be preceded by a path as long as all directories in the path exist. One figure will be produced for each time bin, with years (and file suffix) appended to the base name automatically. A value of <code>NULL</code> (default) causes figures to be plotted to the current device in sequence.</td>
</tr>
</tbody>
</table>
Currently, either 'coasts' or 'countries' to choose which base map (from required library 'rworldmap') to be plotted as the base map for all plots. Could easily be modified to accept any SpatialPolygons object.

Desired grid resolution and extent in degrees. If `grd.res` is a single number, the grid will be defined with equal lon/lat resolution; a two-element vector (lon,lat) can also be supplied for unequal resolution. `grd.ext` is specified as a vector of the form c(min-lon,max-lon,min-lat,max-lat).

A data frame of coordinates for every grid cell center, to be used in cases where an irregular grid is desired. Columns must be named 'lon' and 'lat'. If specified, `grd.res` and `grd.ext` are ignored. Note that this option could have undesirable results for unusual grid definitions. In particular, the maximum radius for including sites in a grid cell is always calculated at the equator. For a regular lon/lat grid, this guarantees all sites will be included in at least one cell, because equatorial cells are largest at the equator. If an irregular grid is specified such that this is not true, the maximum radius calculated could lead to sites excluded from all cells. In this case a warning is printed but the function proceeds anyway.

proj4

proj.4 string representing the desired projection for plotted maps. Default is unprojected. See http://www.spatialreference.org to look up the string for your favorite projections.

Number of bootstrap replicates to use when creating confidence intervals around each grid-cell mean. In each time bin X grid cell combination, replicates consist of composite z-score values for that bin, randomly sampled (with replacement) from sites within the grid cell (see 'Details' for precise description of sites included in each cell). I.e., no temporal bootstrapping is done here, so that bootstrap CI reflect only spatial variability.

Parameters that crudely adjust plotted dot size. `cx.minsize` defines the minimum `cex` applied to any point in any map, `cx.mult` scales all points by an equivalent factor.

Details

Takes any `pfTransform` object as input, and allows any set of one or more time bins to be specified for plotting (one plot per bin). Time bins are specified as for `pfCompositeLF` (which is called by `pfSimpleGrid`). The extent, resolution, and projection of the desired grid are also user-specified.

Results will be plotted on a regular lon/lat grid. To determine which sites contribute to each grid cell value, the code searches within a specified great circle distance (i.e. on the surface of the globe) around each grid cell center. To avoid missing any sites, the distance is set equal to the greatest distance from a grid cell center to its most distant corner, which occurs at the equator where grid cells are largest. This conservative approach will result in many sites falling within multiple grid boxes. At all latitudes, the defined radii will overlap near the edges of the grid boxes. At higher latitudes, the lon/lat grid cells are physically much smaller, so overlap will be considerably greater.

There are alternatives, like using a grid that is irregular in terms of lon/laton, or changing the area of grid cells depending on latitude. But all have their tradeoffs, and this one is simple.

Current version produces plots of mean CHAR, number of sites per grid cell, and number of grid cells contributed to by each site (due to overlapping radii described above). The mean plot additionally shows points in two sizes, representing those mean values whose 95% confidence intervals
do (small dots) or do not (large dots) contain zero. Finally, a time series is plotted in each figure with the current time bin highlighted.

**Value**

Plots are produced on the current device or in pdf files defined by `fig.base.name`. In addition, a named list of useful objects is returned:

- **COMP**: The binned composite generated for plotting.
- **bins**: The list of bin endpoints.
- **sp.grd**: A `SpatialPointsDataFrame-class` object containing all the grid-level statistics produced and plotted (mean influx value, bootstrap confidence interval, and number of sites per grid cell).
- **sp.sites**: A `SpatialPointsDataFrame-class` object representing the number of grid cells influenced by each site.
- **plots**: A list with one element for each bin. These elements are themselves named lists of trellis objects representing each of the plots produced ("mean", "sitesPerCell", "cellsPerSite", "timeSeries"). Note that these objects can be edited to some degree with the `update.trellis` function, and plotted or used in layouts as any other trellis graphics can.

**Author(s)**

R. Kelly

**References**


**Examples**

```r
## Not run:
## Composite charcoal record for North America:
ID=pfSiteSel(continent=="North America", long<(-100),lat==1 & long<(-130))
plot(ID)
## Transform data
```
res3=pfTransform(ID, method=c("MinMax","Box-Cox","Z-Score"), BasePeriod=c(200,4000))

## Plot maps for 1000-yr bins spanning 3-0 kBP
# dev.new(width=10,height=10) # A big plot area helps.
dotmap = pfDotMap(TR=res3, tarAge=seq(0,2000,1000), hw=500, grd.ext=c(-170,-80,40,80),
               cx.minsize=2,cx.mult=3)
summary(dotmap)

# Plot the mean map from the first time bin
# newmap = update(dotmap$plots[[1]]$mean, main="A relabeled map")
# newmap

## End(Not run)

---

**pfExtract**

Extract charcoal data for a list of sites

**Description**

Extract charcoal data from an object returned by `pfSiteSel`

**Usage**

pfExtract(ID)

**Arguments**

- **ID**
  
  An object returned by `pfSiteSel`.

**Value**

- **out**
  

**Author(s)**

O. Blarquez

**Examples**

```r
## Not run:
## Retrieve a site
ID=pfSiteSel(site_name=="Pas-de-Fond")
## Or a group of sites (Western North America)
ID=pfSiteSel(continent=="North America", long<(-100))

## Extract data
A=pfExtract(ID)
```
pfGridding

# Plot the first site raw charcoal data
plot(A[,1]==ID$id_site[1],A[,1]==ID$id_site[1],4,type="l",main=ID$site_name[1],
     xlab="Age",ylab="raw Char")

## End(Not run)

pfGridding

Produce gridded maps of transformed charcoal values.

Description

The function uses weighted spatio-temporal interpolation to produce gridded maps of transformed charcoal values. Spatial grids are used to interpolate transformed charcoal values for a key period defined by Age. For each grid cell the function search charcoal sites located in a radius defined by distance_buffer from the grid centre and at an elevation within a range defined by elevation_buffer from the mean elevation of the cell. Then the function search for charcoal samples within a temporal range from the key date defined by time_buffer. Finally a tricube distance weighting function is applied to each sample by considering its spatial distance to the grid centre and its temporal distance to the key date. This approach that weight samples according to their spatio-temporal location also down-weight charcoal sites that are poorly sampled.

Usage

pfGridding(
    data,
    cell_sizex = NULL,
    cell_sizey = NULL,
    age = 0,
    cell_size = NULL,
    time_buffer = NULL,
    distance_buffer = NULL,
    raster_extent = NULL,
    elevation_buffer = NULL,
    proj4 = NULL,
    sea_mask = TRUE,
    other_mask = NULL,
    verbose = TRUE
)

Arguments

data An object returned by pfTransform.
cell_sizex Numeric, grid cell width (m).
cell_sizey Numeric, grid cell height (m).
age Numeric, key date (years BP).
cell_size Numeric, grid cell size (bypass cell_sizex and cell_sizey and produce square cells).
time_buffer Numeric, temporal distance (years) from the key date to search for charcoal samples.
distance_buffer Numeric, spatial distance from the grid centres to search for charcoal samples (m).
raster_extent Numeric, define custom extent for the analysis such as raster_extent = c(xmin, xmax, ymin, ymax)
elevation_buffer Numeric, elevation range from the mean grid cell elevation to search for charcoal sites.
proj4 String, proj.4 string representing the desired projection for plotted maps. Default is Robinson ("+proj=robin +lon_0=0 +x_0=0 +y_0=0 +ellps=WGS84 +datum=WGS84 +units=m +no_defs"). See http://www.spatialreference.org to look up the string for your favorite projections.
sea_mask Logical, mask cells falling in the sea.
other_mask A sp object (SpatialPolygonsDataFrame) used to mask data i.e. for not interpolating pixels under the mask (classical usage: ice extent mask). Note that the SpatialPolygonsDataFrame projection must be used in the analysis and defined using proj4 argument, otherwise the mask should be reprojected (e.g. using rgdal::spTransform).
verbose Logical, verbose or not...

Value
A "pfGridding" object (list) that could be plotted using plot.pfGridding.

Author(s)
O.Blarquez

See Also
plot.pfGridding, pfTransform, pfDotMap

Examples
## Not run:
ID=pfSiteSel(continent="North America", l12==1, long>-85)

TR=pfTransform(ID,method=c("MinMax","Box-Cox","Z-Score"),BasePeriod=c(200,4000))

p=pfGridding(TR,age=1000)
summary(p)

require(raster)
plot(p$raster)

## Example of other_mask usage: we will use here Dyke 2003 ice extent map for North
pfInteractive

Description
Interactive selection of GCD sites by drawing a polygon on a map.

Usage
pfInteractive(addata = NULL)

Arguments
addata An optional XY matrix of coordinates to specify a polygon to be drawn on the map.

Value
An object of the class "pfSiteSel".
pfKruskal

Author(s)
O. Blarquez

See Also
pfSiteSel

Examples

```r
## Not run:
# Type:
ID=pfInteractive()
# And follow text instructions
## End(Not run)
```

pfKruskal

Analyse composite records by a Kruskal-Wallis ANOVA

Description

The function applies a Kruskal-Wallis ANOVA on binned data issued from a "pfComposite" object (of directly on "pfTransform" objects), in order to test the difference in biomass burning activity between different time periods.

Usage

pfKruskal(data, p.adj = "none", alpha = 0.05, bins = NULL, verbose = TRUE)

Arguments

- `data`: An object returned by `pfComposite` or `pfTransform`.
- `alpha`: Numeric, confidence level.
- `bins`: Numeric, bins to use if a "pfTransform" object is provided.
- `verbose`: Logical, verbose or not...

Value

A "pfKruskal" object containing multiple comparison results.

Author(s)
O. Blarquez
pfMinMax

See Also

plot.pfKruskal.kruskal

Examples

## Not run:
## Composite charcoal record for Western Boreal North America:
ID=pfSiteSel(continent=="North America", long<(-100) & l12==1)
plot(ID)
## Transform data
res3=pfTransform(ID,method=c("MinMax","Box-Cox","Z-Score"),BasePeriod=c(200,4000))
## Composite
comp=pfComposite(res3,bins=seq(from=-500,to=12500,by=1000))
plot(comp)
## Kruskal Wallis Anova
comparison=pfKruskal(comp)
## End(Not run)

---

pfMinMax  

MiniMax transformation of a charcoal serie

Description

MiniMax transformation of a charcoal serie

Usage

pfMinMax(serie)

Arguments

serie  

Numeric, a vector of charcoal values.

Value

out  

A vector of minimax transformed values.

Author(s)

O. Blarquez

See Also

pfTransform
Examples

## Retrieve a site
ID=pfSiteSel(site_name=="Pas-de-Fond")
## Or a group of sites
ID=pfSiteSel(continent=="Africa")

## Extract data
A=pfExtract(ID)

## Plot the first site raw charcoal data
par(mfrow=c(1,2))
plot(A[A[,1]==ID$id_site[1],3],A[A[,1]==ID$id_site[1],4],type="l",main=ID$site_name[1],
xlab="Age",ylab="raw Char")
## Minimax transformation
B=pfMinMax(A[A[,1]==ID$id_site[1],4])
## Plot the first site Minimax transformed charcoal data
plot(A[A[,1]==ID$id_site[1],3],B,type="l",main=ID$site_name[1],
xlab="Age",ylab="Minimax")

---

tpPublication

### Get citations for charcoal sites

**Description**

Get citations for charcoal sites

**Usage**

pfPublication(x, output = "data.frame")

**Arguments**

- **x** A "pfSiteSel" object
- **output** Defines the output as a "list" or a "data.frame" (default).

**Value**

A list or data frame with citation informations related to charcoal sites.

**Author(s)**

O. Blarquez

**Examples**

x=pfSiteSel(id_site %in% c(1:4))
pfPublication(x, output="list")
pfResolution

*Calculates age resolution indicators for charcoal records*

**Description**

Calculates age resolution indicators for charcoal records selected using `pfSiteSel` or `pfInteractive` functions.

**Usage**

```r
pfResolution(ID, AgeLim = NULL)
```

**Arguments**

- `ID`  
  An object of the class "pfSiteSel"

- `AgeLim`  
  Numeric, defines age limits for age resolution calculations (e.g. `AgeLim=c(-50,6000)`)

**Value**

*data.frame*  
A data frame with the following informations: ID_SITE, SITE_NAME, Median Resolution of the record, Mean Resolution and Standard deviation

**Author(s)**

O. Blarquez

**Examples**

```r
## Not run:
ID=pfSiteSel(lat>40, lat<90, long>-100, long<=-50)
Res=pfResolution(ID,AgeLim=c(-50,8000))
head(Res)
## End(Not run)
```

---

pfSimpleGrid

*Produce simple gridded maps of paleofire data*

**Description**

Produce gridded map graphics representing spatial variability in charcoal data from the Global Charcoal Database.
Usage

pfSimpleGrid(
    TR,
    tarAge,
    hw,
    binhw = 0.5 * mean(diff(tarAge)),
    fun = mean,
    n.boot = 0,
    prob.CI = c(0.025, 0.975),
    test.val = 0,
    proj4 = "+proj=longlat +ellps=WGS84 +datum=WGS84 +no_defs",
    res = 5,
    ext = c(-180, 180, -90, 90),
    fig.file.name = NULL,
    show.plot = TRUE,
    title.text = "",
    cols = NULL,
    cuts = NULL,
    zlim = NULL,
    base.map = "coasts",
    base.map.col = grey(0.7),
    base.map.lwd = 0.5
)

Arguments

TR
   An object returned by pfTransform

tarAge
   Numeric, the target ages for prebinning given in years (e.g. tarAge = seq(0, 10000, 20)). If unspecified the sequence is defined as tarAge=seq(from=min age, to=max Age, by=median resolution).

hw
   Numeric, the half window width for the loctfit procedure (in years).

binhw
   Numeric, the half width for the prebinning procedure (use the same value as tarAge intervals for overlapping bins or tarAge intervals/2 for non-overlapping bins).

fun
   Function to be used for aggregating across sites.

n.boot
   Number of bootstrap replicates to use when creating confidence intervals around each grid-cell value.

prob.CI
   Vector of two quantiles to define the bootstrap CI for significance testing.

test.val
   Test value for bootstrap significance test.

proj4
   proj4 string representing the desired projection for plotted maps. Default is unprojected. See http://www.spatialreference.org to look up the string for your favorite projections.

res, ext
   Desired grid resolution and extent. If grd.res is a single number, the grid will be defined with equal x/y resolution; a two-element vector (x,y) can also be supplied for unequal resolution. grd.ext is specified as a vector, matrix, or Extent object, as for the function raster::extent.
pfSimpleGrid

**fig.file.name**  Character sequence representing the file name for the output figures. Can be preceded by a path as long as all directories in the path exist. The file will be a PDF with one figure per time bin, each on a separate page.

**show.plots**  Logical indicating whether plots will be printed to the screen.

**title.text**  Character sequence for labeling figures. Time bin bounds will be added automatically.

**cols**  Vectors of color specifications and values defining the plot legend. Grid-cell values will be binned by cuts and assigned the colors in cols. If either are NULL, the function tries to guess at a good scheme. cuts may also be a single value specifying the number of bins.

**cuts**  Defines range and resolution of color scale

**zlim**  Two-element vector representing the bounds of the color scale. Ignored if cuts is fully specified, but otherwise used in defining the color bins.

**base.map**  Currently, either 'coasts' or 'countries' to choose which base map (from required library 'rworldmap') to be plotted as the base map for all plots. Could easily be modified to accept any SpatialPolygons object.

**base.map.col**  Color specifications for plotting the basemap.

**base.map.lwd**  Line width specifications for plotting the basemap.

**Details**

Takes any pfTransform object as input, and allows any set of one or more time bins to be specified for plotting (one plot per bin). Time bins are specified as for pfCompositeLF (which is called by pfSimpleGrid. The extent, resolution, and projection of the desired grid are also user-specified.

Records are first composited, and then aggregated with other sites falling in the same grid cell according to the specified function 'fun' (defaults to mean). This is a considerably simpler approach than the distance-based spatial binning used by pfDotMap, although it has its own tradeoffs (e.g. grid cells are unlikely to represent equal area).

A flexible bootstrapped significance test is implemented. Within each time bin X grid cell combination, composite z-score values are randomly sampled (with replacement) from sites within the grid cell. The function is applied to the sampled values. Quantiles of all bootstrap function evaluations are computed, and significance is reported if a user-specified test value is outside of these bootstrap CI. Note that bootstrap CI calculated here reflect only spatial variability, as no temporal resampling is performed.

**Value**

Plots are produced on the current device and/or in pdf files according to input arguments. In addition, a named list of useful objects is returned:

**COMP**  The binned composite generated for plotting.

**tarAge**  The list of target ages used for temporal binning.

**sg.rast**  A Raster-class object containing the gridded output data

**sg.plots**  A list of trellis objects representing the composed plots. Note that these objects can be edited to some degree with the update.trellis function, and plotted or used in layouts as any other trellis graphics can.
Author(s)

R. Kelly

References


See Also

pfGridding

Examples

```r
## Not run:
ID=pfSiteSel(continent=="North America", l12==1 & long<(-130))
plot(ID)

## Transform data
res3=pfTransform(ID,method=c("MinMax","Box-Cox","Z-Score"),BasePeriod=c(200,4000))

## Plot maps for 1000-yr bins spanning 3-0 kBP
# dev.new(width=10,height=10) # A big plot area helps.
gridmap = pfSimpleGrid( TR=res3, tarAge=seq(0,2000,1000), hw=500, ext=c(-170,-80,40,80))
summary(gridmap)

# Plot the mean map from the first time bin
newmap = update(gridmap$sg.plots[[1]], main="A relabeled map")
newmap

## End(Not run)
```

pfSiteSel  

GCD sites selection methods
pfSiteSel

Description
Main function used for site selection, uses data stored in data(paleofiresites) to perform site selection according to multiple criterion, those criterions could be either geographic, based on series attributes (e.g. # of datings), or on sites attributes (e.g. biome).

Usage
pfSiteSel(...)

Arguments
... Any combination of conditions defined by relational operators and or logical operators that are applied on the "paleofiresites" dataset. See examples below:

Details
Use data(paleofiresites):names(paleofiresites) to retrieve the conditions that could be used to select sites i.e.: id_site, site_name, lat, long, elev, pref_units, biome, id_region, id_country, id_site_type, water_depth, id_basin_size, id_catch_size, id_land_desc, dating_type, min_est_age, max_est_age, num_dating, age_model, data_source, qtype, rf99, l12, num_samp, date_int.

Value
An object of the class "pfSiteSel" (list) with "id_site" and "site_name" components.

Author(s)
O. Blarquez

See Also
paleofiresites

Examples

## Sites selection examples

## Select all sites
ID=pfSiteSel()

## Savana sites in Ramankutty and Foley (1999)
ID=pfSiteSel(rf99==9)
plot(ID,zoom="world")

## Tropical forest and tundra such as Levavasseur et al. (2012)
ID=pfSiteSel(l12==6 | l12==7)
plot(ID,zoom="world")

## Sites in North America by geographic location
ID=pfSiteSel(lat>25, lat<75, long<-45, long>-150)
pfToKml

Export selected site to Google Earth kml format

Description

Export sites selected using pfSiteSel function to Google Earth kml format.

Usage

pfToKml(x, file = "NULL")

Arguments

x
  An object of the class "pfSiteSel"

file
  File location and name with kml extension e.g. file="/Users/Olivier/Desktop/truc.kml"

Value

No value returned.
pfTransform

Author(s)
O. Blarquez

Examples

```r
## Not run:
x = pfSiteSel(id_site == 222)
pfToKml(x, file = "site222.kml")

## End(Not run)
```

Description

Charcoal data transformation, background estimation and homogenization for unique to multiple series, accepts objects returned by pfSiteSel.

Usage

```r
pfTransform(
    ID = NULL,
    add = NULL,
    Interpolate = FALSE,
    Age = NULL,
    method = "Z-Score",
    BasePeriod = c(-100, 1e+09),
    span = 0.3,
    RunWidth = 500,
    RunQParam = 0.5,
    stlYears = 500,
    type = "BoxCox1964",
    alpha = 0.01,
    QuantType = "INFL",
    MethodType = NULL,
    verbose = TRUE
)
```

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>An object returned by pfSiteSel or pfTransform</td>
</tr>
<tr>
<td>add</td>
<td>An object returned by pfAddData</td>
</tr>
<tr>
<td>Interpolate</td>
<td>Logical, indicates whether data should be interpolated or not, default=FALSE</td>
</tr>
</tbody>
</table>
pfTransform

Age Numeric. If Interpolate=TRUE, Age is used to specified the ages where the interpolation took place. If Age=NULL (default) the interpolated ages are automatically specified using the median resolution of the record(s). If Age is specified as a vector (e.g. Age=(from=0,to=10000, by=10)) the interpolation took place at specified ages.


BasePeriod Numeric, a parameter specifying the base period for calculating Z-score given in years BP (e.g. BasePeriod=c(0, 4000)), if empty or unspecified the base period corresponds to record length.

span Numeric, the span parameter for the LOESS or Smoothing spline methods

RunWidth Numeric, the width of the window for the"RunMed", "RunMean", "RunQuantile", "RunMin", and "RunMax" methods in years.

RunQParam Numeric, the parameter specifying which quantile should be calculated for the method "RunQuantile" (default=0.5 i.e. median).

stlYears Numeric, the bandwidth for stl decomposition, default=500 years.

type Character, the type of Box-Cox transformation, see pfBoxCox for details.

alpha Numeric, alpha value to add before BoxCox calculation, see pfBoxCox.

QuantType Character, by default QuantType="INFL," and influx are automatically calculated, otherwise use QuantType="NONE" (not recommended).

MethodType Character, by default (MethodType=NULL) imply that when for a specific site two charcoal unit exist the function pick the one define by pref_unit. By passing different arguments to MethodType user can modify the analysis to pick non preferred units by referring to more general methods for instance MethodType = "POLS" will choose charcoal records from pollen slides, or MethodType = "SIEV" sieved macro charcoal series. Type (paleofiredata); levels(paleofiredata$METHOD) for available methods.

verbose Logical, verbose or not...

Value An object of the class "pfTransform".

Author(s) O. Blarquez

Examples

## Not run:
## Select the site Pas-de-Fond
ID=pfSiteSel(site_name=="Pas-de-Fond")

# Transform data sequentially using pfTransform function
tr=pfTransform(ID,method=c("MinMax","Box-Cox"))

## Plot transformed data for the first site
plot(tr$Age[,1],tr$TransData[,1],type="l")

## End(Not run)

---

### Description

Plot an object of the class "CHAR" returned by the pretreatment function. Original accumulation rates are presented using grey bars, accumulation rates interpolated at equal time steps are presented by a black curve.

### Usage

```r
## S3 method for class 'CHAR'
plot(
x,
xlim = NULL,
ylim = NULL,
xlab = NULL,
ylab = NULL,
frame = TRUE,
main = NULL,
...
)
```

### Arguments

- `x` An object of the class "CHAR".
- `xlim` `x` limit.
- `ylim` `y` limit.
- `xlab` x axis label.
- `ylab` y axis label.
- `frame` TRUE by default
- `main` main plot title
- `...`
Author(s)
O. Blarquez

Examples

## Not run:
## In this example we will use the charcoal record of the Lac du Loup (Blarquez et al. 2010)
## Load raw charcoal data in mm^2
A=read.csv("http://blarquez.com/public/code/loupchar.csv")
C_=A[,6] # charcoal areas
P_=A[,1:5] # CmTop, CmBot, AgeTop, AgeBot, Volume

## Calculates charcoal accumulation rate (CHAR, mm2.cm-2.yr-1)
CHAR=pretreatment(params=P_,serie=C_,Int=TRUE)
plot(CHAR)

## End(Not run)

---

plot.contiguous  

Plot "contiguous" object

Description
Plot an object returned by contiguous, plot contiguous cores (or sites) in green (T) and non-contiguous cores in red (F).

Usage

## S3 method for class 'contiguous'
plot(x, ylim = NULL, xlim = NULL, ...)

Arguments

x  
An object returned by contiguous

ylim  
Numeric, ylim for the graph

xlim  
Numeric, xlim for the graph

...

Value
A plot.

Author(s)
O. Blarquez
See Also

contiguous

Examples

## Not run:
x=pfSiteSel(lat>12,lat<60,long<-50,long>-140)
cont=contiguous(x)
plot(cont)

## End(Not run)

Description

Plot fire frequency calculated using the kdffreq function

Usage

## S3 method for class 'kdffreq'
plot(x,
     ylim = NULL,
     xlim = NULL,
     main = NULL,
     xlab = "Age",
     ylab = "FF (#.yr-1)",
     frame = T,
     ...)

Arguments

  x            Object returned by kdffreq
  ylim         Numeric, y axis limits
  xlim         Numeric x axis limits
  main         char, title of plot
  xlab         char, x axis legend
  ylab         char, y axis legend
  frame        frame around plot
  ...          other arguments
Description

Plot circular block bootstrap percentiles.

Usage

```r
## S3 method for class 'pfCircular'
plot(
  x,
  ylim = NULL,
  xlim = NULL,
  ylab = NULL,
  xlab = NULL,
  main = NULL,
  text = FALSE,
  ...
)
```

Arguments

- `x` A "pfCircular" object.
- `ylim` Numeric, x axis limits.
- `xlim` Numeric, y axis limits.
- `ylab` Character, y axis label.
- `xlab` Character, x axis label.
- `main` Character, title of the plot.
- `text` Logical, text options.
- `...` ...

Author(s)

O. Blarquez
Examples

## Not run:
ID=pfSiteSel(lat>49,lat<75,long>6,long<50)
TR1=pfTransform(ID, method=c("MinMax","Box-Cox","Z-Score"),BasePeriod=c(200,2000))

## Circular block bootstrapp
COMP=pfComposite(TR1, binning=TRUE, bins=seq(0,2000,100))
circ=pfCircular(COMP,conf=c(0.005,0.025,0.975,0.995),nboot=100)
plot(circ)

## End(Not run)

plot.pfComposite

Description

Plot a pfComposite object

Usage

## S3 method for class 'pfComposite'
plot(
  x,
  type = "ci",
  conf = c(0.05, 0.95),
  palette = "jet",
  add = "NONE",
  text = FALSE,
  main = NULL,
  ...
)

Arguments

x
A "pfComposite" object.

type
Character, type of plot among "ci", "prctile", "density"

conf
Numeric, confidence levels.

palette
Character, color palette used with type=c("prctile", "density") among "jet" and "BW".

add
Character, add="NONE" by default, add="sitenum" could be specified to plot the sites number in each bin along with the composite curve.

text
Logical, text options.

main
Character, title of the plot.

...
Author(s)
O. Blarquez

Examples

```r
## Not run:
# Composite charcoal record for boreal Canada:
ID=pfSiteSel(country="Canada" & l12==1)
## Transform data
res3=pfTransform(ID,method=c("MinMax","Box-Cox","Z-Score"),BasePeriod=c(200,4000))

## Composite
comp=pfComposite(res3,bins=seq(0,5000,200))
plot(comp,type="density",smoothing=TRUE,spar=0.3)

## End(Not run)
```
conf Numeric, confidence levels.
palette Character, color palette used with type=c("prctile", "density") among "jet" and "BW".
xlim Numeric, x axis limits.
ylim Numeric, y axis limits.
main Character, title of the plot.
text Logical, text options.
what Character, indicates which transformed charcoal trend is used for the plot (type="ci"), default "locfit" indicates that the trend is the locfit applied to All binned data, use "mean" or "median" to plot the mean or median of the locfit replicates given by the bootstrap procedure.

Author(s)

O. Blarquez

Examples

```r
## Not run:
ID=pfSiteSel(continent="North America", l12==1, long>=-160 & long<=-140)

TR=pfTransform(ID, method=c("MinMax","Box-Cox","MinMax","Z-Score"), BasePeriod=c(200,2000),QuantType="INFL")

COMP1=pfCompositeLF(TR, tarAge=seq(-50,4000,10), hw=200, nboot=999)

plot(COMP1, type="density")

## End(Not run)
```

Description

Plot maps presenting gridded and transformed charcoal values obtained from the `pfGridding` function.
Usage

```r
## S3 method for class 'pfGridding'
plot(
  x,  
  continuous = TRUE,  
  col_class = NULL,  
  col_lim = NULL,  
  xlim = NULL,  
  ylim = NULL,  
  empty_space = 10,  
  cpal = "YlGn",  
  anomalies = TRUE,  
  file = NULL,  
  points = FALSE,  
  add = NULL,  
  add_color = "white",  
  plot_countries = FALSE,  
  ...  
)
```

Arguments

- `x` An object returned by `pfGridding`.
- `continuous` Logical, plot continuous (TRUE) or discrete (FALSE) colors on the map.
- `col_class` Numeric, if continuous is false define here color classes (single values: `col_class=5`, or sequences `col_class=seq(-15,15,5)` are accepted.)
- `col_lim` Numeric, limits for plotting grid cells values, grid cells with values beyond `col_lim` are not plotted.
- `xlim` Numeric, map limits.
- `ylim` Numeric, map limits.
- `empty_space` Percentage, define empty space around the map.
- `cpal` String, color palette to use see `brewer.pal`.
- `anomalies` Logical, adapt output for plotting anomalies or not (color classes, etc..)
- `file` Path/Filename.tif, the function can output a GeoTiff file if desired.
- `points` Logical, plot charcoal sites on the map?
- `add` An object of the class "SpatialPolygonsDataFrame" (sp) to be ploted on the map.
- `add_color` Color of the added SpatialPolygonsDataFrame.
- `plot_countries` Logical, default FALSE (if TRUE plot countries borderlines and coastlines)
- `...` ...

Value

A ggplot2 "gg" object that could be further manipulated.
plot.pfKruskal

Author(s)
O. Blarquez

See Also
pfGridding

Examples
## Not run:
ID=pfSiteSel(continent="North America", lat==1, long>-85)
TR=pfTransform(ID, method=c("MinMax","Box-Cox","Z-Score"), BasePeriod=c(200,4000))
p=pfGridding(TR, age=1000)
plot(p, empty_space=100)
# require(ggplot2)
# pp=plot(p, empty_space=100)
# pp+ggtitle("my title..")
## End(Not run)

plot.pfKruskal  Plot a "pfKruskal" object.

Description
Plot a "pfKruskal" object using boxplots and showing significant differences between the periods using letters.

Usage
## S3 method for class 'pfKruskal'
plot(x, trend = FALSE, outliers = FALSE, xlim = NULL, ylim = NULL, ...)

Arguments
x  An object returned by pfKruskal.
trend Logical, show trend using linear regression?
outliers Logical, show outliers?
xlim Numeric, x axis limits.
ylim Numeric, y axis limits.
... ...
Details
If two periods share the same letter their rank (median) is not significantly different at the confidence level specified by alpha. If not, equality could be rejected at the confidence level specified by alpha.

Value
Return a ggplot2 "gg" object.

Author(s)
O. Blarquez

See Also
pfKruskal

Examples
```r
## Not run:
## Composite charcoal record for Western Boreal North America:
ID=pfSiteSel(continent=="North America", long<(-100) & l12==1)
plot(ID)
## Transform data
res3=pfTransform(ID,method=c("MinMax","Box-Cox","Z-Score"),BasePeriod=c(200,4000))

## Composite
comp=pfComposite(res3,bins=seq(from=-500,to=12500,by=1000))
plot(comp)

## Kruskal Wallis Anova
comparison=pfKruskal(comp)
plot(comparison)
# p=plot(comparison)
# require(ggplot2)
# p+ggtitle("my title")
## End(Not run)
```

Description
Plot an object of the class "pfSiteSel"
Usage

```r
## S3 method for class 'pfSiteSel'
plot(
x,  
add = NULL,
type = "Map",
zoom = "Sites",
pch = "|",
xlim = NULL,
ylim = NULL,
cex = 1,
plot_countries = FALSE,
main = NULL,
...
)
```

Arguments

- **x**: An object of the class "pfSiteSel".
- **add**: An object returned by pfAddData (optional).
- **type**: Character, type of plot among "Map" or "Chronology".
- **zoom**: Character, zooming factor for type="Map": “Sites" or "World"
- **pch**: Pointer type see `plot`
- **xlim**: Numeric, x axis limits.
- **ylim**: Numeric, y axis limits.
- **cex**: Numeric, size of points.
- **plot_countries**: Logical, default FALSE (if TRUE plot countries borderlines and coastlines)
- **main**: Title.
- ...

Author(s)

  O. Blarquez

Examples

```r
ID=pfSiteSel(continent=="North America", long>-100)
plot(ID,zoom="world")
```
Description

Plot "potveg" object i.e. produce a map by overlaying charcoal sites on potential vegetation maps. Uses ggplot2 syntax.

Usage

```r
## S3 method for class 'potveg'
plot(
x, size = 4, palette = NULL, alpha = 0.5, text = FALSE, points = TRUE,
    ...
)
```

Arguments

- **x**: A "potveg object."
- **size**: Size of the dots on the map.
- **palette**: A custom color palette can be specified.
- **alpha**: Transparency of charcoal sites dots
- **text**: Logical: plot sites as numbers referring to potential vegetation index (text=TRUE) or as points (text=FALSE, default).
- **points**: Logical: plot sites (TRUE, default)
- ...

Value

A ggplot2 ("gg") object that can be further modified (see example)

Author(s)

O. Blarquez

See Also

`potveg`
potveg

Examples

## Not run:
require(paleofire)
ID=pfSiteSel(c(1:10))
obj=potveg(ID, classif="l12")
plot(obj)

# Return a ggplot object
require(ggplot2)
p=plot(obj, text=TRUE, alpha=1)
p+ggtitle("My title")

## End(Not run)

potveg

<table>
<thead>
<tr>
<th>potveg</th>
</tr>
</thead>
</table>

Description

Retrieve potential vegetation types based on charcoal sites location

Usage

potveg(ID, classif = "rf99", buffer = NULL)

Arguments

ID An object of the class "pfSiteSel"
buffer Distance in m that defines a radius around each site to calculate the dominant vegetation type by kernel density estimation.

Value

An object of the class "potveg" i.e. a list containing two data frames: "site_data" for charcoal sites and associated potential vegetation type, "map" data frame used for mapping data. See plot.potveg for details.

Author(s)

O. Blarquez
pretreatment

Calculate particules accumulation rates for sediment records

Description

This is the R version of the CharAnalysis CharPretreatment.m function originally developed by P. Higuera and available at https://sites.google.com/site/charanalysis

Usage

pretreatment(
  params,
  serie,
  Int = TRUE,
  first = NULL,
  last = NULL,
  yrInterp = NULL
)
pretreatment

Arguments

params A matrix with the following columns: CmTop, CmBot, AgeTop, AgeBot, Volume, in the same order.

serie A proxy record to be transformed in accumulation rates, could be particule counts, surfaces, volumes, etc.

Int Logical specifying whether the function interpolates missing values, default TRUE (missing values specified could be specified as -999 or NA)

first, last Date of the first, last sample for accumulation rate calculation, if NULL first, last are automatically specified as the the minimum and maximum ages of the record respectively

yrInterp Temporal resolution of the interpolated accumulation rates, if NULL, yrInterp is automatically specified as the median resolution of the record

Value

Return an output structure with the following:

cmI interpolated depths

ybpI interpolated ages

accI accumulation rates

Author(s)

O. Blarquez translated from P. Higuera CharPretreatment.m function

Examples

## Not run:
# In this example we will use the charcoal record of the Lac du Loup from Blarquez et al. (2010).
# Blarquez, O., C. Carcailllet, B. Mourier, L. Bremond, and O. Radakovitch. 2010. Trees in the
# subalpine belt since 11 700 cal. BP: origin, expansion and alteration of the modern forest.
# The Holocene 20:139-146.

# Load raw charcoal data in mm2
A=read.csv("http://blarquez.com/public/code/loupchar.csv")
C_=A[,6] # charcoal areas
P_=A[,1:5] # CmTop, CmBot, AgeTop, AgeBot, Volume

# Calculates charcoal accumulation rate (CHAR, mm2.cm-2.yr-1)
CHAR=pretreatment(params=P_,serie=C_,Int=TRUE)
plot(CHAR)

## End(Not run)
**Description**

`rbind` two or more `pfAddData` objects, this enable to add charcoal series stored using multiple types, see type argument of `pfAddData` for details.

**Usage**

```r
## S3 method for class 'pfAddData'
rbind(...)  
```

**Arguments**

...

two or more objects returned by `pfAddData`

**Value**

An object of the class "pfAddData" (list)

**Author(s)**

O. Blarquez

**See Also**

`pfAddData`

**Examples**

```r
## Not run:
         "http://blarquez.com/public/data/Small.csv")
metadata=c("http://blarquez.com/public/data/metadata.csv")
mydata1=pfAddData(files=files,type="CharAnalysis")
mydata2=pfAddData(files=files,metadata=metadata,type="CharAnalysis")
mydata=rbind(mydata1,mydata2)
TR1=pfTransform(add=mydata, method=c("MinMax","Box-Cox","Z-Score"),
                BasePeriod=c(200,2000))
COMP2=pfCompositeLF(TR1, tarAge=seq(-50,8000,20), hw=500, nboot=100)
plot(COMP2)

## End(Not run)
```
Superposed Epoch Analysis

Description

The function performs a Superposed Epoch Analysis on a provided temporal serie. The function uses pfCircular function for the computation of the block bootstrap procedure. The function could be used on both dendrochronological data and other data expressed in CE ages as well on paleoecological series expressed in BP. Proxy data and ages must be spaced evenly but not necessarily using 1 yr time steps.

Usage

SEA(
  x,
  y,
  lag,
  b = NULL,
  conf = c(0.05, 0.95),
  nboot = 1000,
  center = FALSE,
  normalize = FALSE,
  age = "CE"
)

Arguments

- **x**: data frame or matrix with ages and proxy values, younger ages on top.
- **y**: events dates.
- **lag**: lag time used for calculating the SEA.
- **b**: A numeric giving block size, if NULL the optimal block size is given by: \( b = 2x(-1 /\log(p)) \), where \( p \) is the lag one autocorrelation coefficient of the serie (Adams, Mann & Ammann 2003).
- **conf**: confidence intervals for the block bootstrap procedure.
- **nboot**: number of bootstrap replicates.
- **center**: logical, center each epoch by substracting values to each epoch’s mean (default = FALSE).
- **normalize**: logical, normalize each epoch by calculating Z-Score (default = FALSE, see Adams, Mann & Ammann 2003).
- **age**: type of ages used in \( x[,1] \) either "CE" for Common Era or "BP" for Before Present.

Value

- **res**: A "pfCircular" object with estimated confidence intervals.
Author(s)

O. Blarquez

See Also

pfCircular

Examples

## Not run:
## Generate some fake data
set.seed(1)
n <- 100 # number of data points
t <- seq(0,4*pi,,100)
a <- 3
b <- 2
c.unif <- runif(n)
amp <- 4

# generate data and calculate "y"
set.seed(1)
y1 <- a*sin(b*t)+c.unif*amp # add uniform error

# SEA applied to fake dendrochronological data in CE
plot(rev(seq(1901,2000,1)), y1, t="l", ylim=range(y1)*c(1.2))
y=c(1923,1948,1972,1995)
points(y,rep(0,length(y)))
x=data.frame(rev(seq(1901,2000,1)),value=y1)
lag=10

#Perform SEA
res=SEA(x, y, lag = NULL, conf = c(0.05, 0.95), nboot = 1000, age="CE")
plot(res,xlim=c(-10,10),xlab="lag",ylab="Composite mean")

# SEA applied to fake paleoecological data in BP
plot(seq(-50,49,1), y1, t="l", ylim=range(y1)*c(1.2),xlim=c(50,-50))
points(y,rep(0,length(y)))
x=data.frame(seq(-50,49,1),value=y1)

# Perform SEA
res=SEA(x, y, lag, b = NULL, conf = c(0.05, 0.95), nboot = 1000, age="BP")
plot(res,xlim=c(-10,10),xlab="lag",ylab="Composite mean")

## End(Not run)
**triCube**

**Description**
Return a summary table for an object of the class "pfSiteSel"

**Usage**
```r
## S3 method for class 'pfSiteSel'
summary(object, ...)
```

**Arguments**
- `object` An object of the class "pfSiteSel".
- `...` ...

**Value**
Data.frame, returns the following informations: "id_site", "lat", "long" "elevation", "min_est_age", "max_est_age", "num_dating", "date_int", "num_samp", "l12", "rf99".

**Author(s)**
O. Blarquez

**Examples**
```r
ID=pfSiteSel(id_site==2)
summary(ID)
```

---

**triCube**

*Tukey's Tricube weight function*

**Description**
From the EGRET package http://usgs-r.github.io/EGRET/ Robert Hirsch and Laura De Cicco

**Usage**
```r
triCube(d, h)
```

**Arguments**
- `d` numeric vector of distances from the point of estimation to the given sample value
- `h` numeric value, the half-window width, measured in the same units as `d`
Details

Computes the tricube weight function on a vector of distance values (d), based on a half-window width of h, and returns a vector of weights that range from zero to 1.

Value

w numeric vector of weights, all 0<=w<=1

Examples

```r
h<-10
d<-c(-11,-10,-5,-1,-0.01,0,5,9.9,10,20)
triCube(d,h)
```
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