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Description This package offers different possibilities to make statistical analysis for Environmental Data.

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| | |
|-----|--|
| arw | <i>Adaptive reweighted estimator for multivariate location and scatter</i> |
|-----|--|

Description

Adaptive reweighted estimator for multivariate location and scatter with hard-rejection weights. The multivariate outliers are defined according to the supremum of the difference between the empirical distribution function of the robust Mahalanobis distance and the theoretical distribution function.

Usage

```
arw(x, m0, c0, alpha, pcrit)
```

Arguments

| | |
|-------|---|
| x | Dataset (n x p) |
| m0 | Initial location estimator (1 x p) |
| c0 | Initial scatter estimator (p x p) |
| alpha | Maximum thresholding proportion (optional scalar, default: alpha = 0.025) |
| pcrit | Critical value obtained by simulations (optional scalar, default value obtained from simulations) |

Details

At the basis of initial estimators of location and scatter, the function arw performs a reweighting step to adjust the threshold for outlier rejection. The critical value pcrit was obtained by simulations using the MCD estimator as initial robust covariance estimator. If a different estimator is used, pcrit should be changed and computed by simulations for the specific dimensions of the data x.

Value

| | |
|----|--|
| m | Adaptive location estimator (p x 1) |
| c | Adaptive scatter estimator (p x p) |
| cn | Adaptive threshold ("adjusted quantile") |
| w | Weight vector (n x 1) |

Author(s)

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 Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

P. Filzmoser, R.G. Garrett, and C. Reimann (2005). Multivariate outlier detection in exploration geochemistry. *Computers & Geosciences*, 31:579-587.

Examples

```
x <- cbind(rnorm(100), rnorm(100))
arw(x, apply(x, 2, mean), cov(x))
```

 AuNEW

Au data, new

Description

Au data from Kola C-horizon, new measurement method

Usage

```
data (AuNEW)
```

Format

The format is: num [1:606] 0.001344 0.000444 0.001607 0.000713 0.000898 ...

Details

These data of Au have much higher quality than the data AuOLD.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data (AuNEW)
data (AuOLD)
plot (log10 (AuOLD) , log10 (AuNEW) )
```

AuOLD

Au data, old

Description

Au data from Kola C-horizon, old measurement method

Usage

```
data (AuOLD)
```

Format

The format is: num [1:606] 0.001 0.001 0.002 0.001 0.007 0.006 0.001 0.001 0.001 0.001 ...

Details

These data of Au have much worse quality than the data AuNEW.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data (AuNEW)
data (AuOLD)
plot (log10 (AuOLD) , log10 (AuNEW) )
```

 bhorizon

B-horizon of the Kola Data

Description

The Kola Data were collected in the Kola Project (1993-1998, Geological Surveys of Finland (GTK) and Norway (NGU) and Central Kola Expedition (CKE), Russia). More than 600 samples in five different layers were analysed, this dataset contains the C-horizon.

Usage

```
data(bhorizon)
```

Format

A data frame with 609 observations on the following 77 variables.

ID a numeric vector

XCOO a numeric vector

YCOO a numeric vector

ELEV a numeric vector

COUN a factor with levels FIN NOR RUS

ASP a factor with levels E FLAT N NE NW NW S SE SW W

LOWDB a numeric vector

LITO a numeric vector

GENLAN a factor with levels DEEPVAL FLA PLAIN FLAT HIMO LOWMO PLAIN PLAT RIDGE
SLOPE

Ag a numeric vector

Al a numeric vector

Al_XRF a numeric vector

Al2O3 a numeric vector

As a numeric vector

Au a numeric vector

B a numeric vector

Ba a numeric vector

Be a numeric vector

Bi a numeric vector

Br_IC a numeric vector

Ca a numeric vector

Ca_XRF a numeric vector

CaO a numeric vector
Cd a numeric vector
Cl_IC a numeric vector
Co a numeric vector
Cr a numeric vector
Cu a numeric vector
EC a numeric vector
F_IC a numeric vector
Fe a numeric vector
Fe_XRF a numeric vector
Fe2O3 a numeric vector
Hg a numeric vector
K a numeric vector
K_XRF a numeric vector
K2O a numeric vector
La a numeric vector
Li a numeric vector
LOI a numeric vector
Mg a numeric vector
Mg_XRF a numeric vector
MgO a numeric vector
Mn a numeric vector
Mn_XRF a numeric vector
MnO a numeric vector
Mo a numeric vector
Na a numeric vector
Na_XRF a numeric vector
Na2O a numeric vector
Ni a numeric vector
NO3_IC a numeric vector
P a numeric vector
P_XRF a numeric vector
P2O5 a numeric vector
Pb a numeric vector
Pd a numeric vector
pH a numeric vector
PO4_IC a numeric vector

Pt a numeric vector
S a numeric vector
Sb a numeric vector
Sc a numeric vector
Se a numeric vector
Si a numeric vector
Si_XRF a numeric vector
SiO2 a numeric vector
SO4_IC a numeric vector
Sr a numeric vector
Te a numeric vector
Th a numeric vector
Ti a numeric vector
Ti_XRF a numeric vector
TiO2 a numeric vector
V a numeric vector
Y a numeric vector
Zn a numeric vector

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

Source

Kola Project (1993-1998)

References

Reimann C, Åyräs M, Chekushin V, Bogatyrev I, Boyd R, Caritat P de, Dutter R, Finne TE, Halleraker JH, Jæger Ø, Kashulina G, Lehto O, Niskavaara H, Pavlov V, Räsänen ML, Strand T, Volden T. Environmental Geochemical Atlas of the Central Barents Region. NGU-GTK-CKE Special Publication, Geological Survey of Norway, Trondheim, Norway, 1998.

Examples

```
data(bhorizon)
str(bhorizon)
```

| | |
|-------------|---|
| bordersKola | <i>Borders of the Kola Project boundary</i> |
|-------------|---|

Description

x- and y-coordinates of the Kola Project boundary.

Usage

```
data(bordersKola)
```

Format

The format is: List of 2 \$ x: num [1:64] 836200 881000 752900 743100 737500 ... \$ y: num [1:64] 7708867 7403003 7389239 7377769 7364006 ...

Details

The coordinates for the Kola Project boundary are used for the surface maps, i.e. for Krige and Smoothing maps. It is a list with two list elements x and y for the x- and y-coordinates.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data(bordersKola)
plot(bordersKola$x,bordersKola$y)
```

| | |
|-------|--------------|
| boxes | <i>Boxes</i> |
|-------|--------------|

Description

The function boxes computes boxes of multivariate data. If add=TRUE the boxes are plotted in the current plot otherwise nothing is plotted.

Usage

```
boxes(x, xA = 1, yA = 2, zA = 3, labels = dimnames(x)[[1]], locations = NULL,
      nrow = NULL, ncol = NULL, key.loc = NULL, key.labels = dimnames(x)[[2]],
      key.xpd = TRUE, xlim = NULL, ylim = NULL, flip.labels = NULL, len = 1,
      leglen = 1, axes = FALSE, frame.plot = axes, main = NULL, sub = NULL,
      xlab = "", ylab = "", cex = 0.8, lwd = 0.25, lty = par("lty"), xpd = FALSE,
      mar = pmin(par("mar"), 1.1 + c(2 * axes + (xlab != ""), 2 * axes + (ylab != "")),
      1, 0)), add = FALSE, plot = TRUE, ...)
```

Arguments

| | |
|--------------------------|---|
| <code>x</code> | multivariate data in form of matrix or data frame |
| <code>xA</code> | assignment of clusters to the coordinates of the boxes |
| <code>yA</code> | assignment of clusters to the coordinates of the boxes |
| <code>zA</code> | assignment of clusters to the coordinates of the boxes |
| <code>labels</code> | vector of character strings for labeling the plots |
| <code>locations</code> | locations for the boxes on the plot (e.g. X/Y coordinates) |
| <code>nrow</code> | integers giving the number of rows and columns to use when 'locations' is 'NULL'. By default, 'nrow == ncol', a square will be used. |
| <code>ncol</code> | integers giving the number of rows and columns to use when 'locations' is 'NULL'. By default, 'nrow == ncol', a square will be used. |
| <code>key.loc</code> | vector with x and y coordinates of the unit key. |
| <code>key.labels</code> | vector of character strings for labeling the segments of the unit key. If omitted, the second component of 'dimnames(x)' is used, if available. |
| <code>key.xpd</code> | clipping switch for the unit key (drawing and labeling), see 'par("xpd")'. |
| <code>xlim</code> | vector with the range of x coordinates to plot |
| <code>ylim</code> | vector with the range of y coordinates to plot |
| <code>flip.labels</code> | logical indicating if the label locations should flip up and down from diagram to diagram. Defaults to a somewhat smart heuristic. |
| <code>len</code> | multiplicative values for the space of the labels on the legend |
| <code>leglen</code> | multiplicative values for the space of the labels on the legend |
| <code>axes</code> | logical flag: if 'TRUE' axes are added to the plot |
| <code>frame.plot</code> | logical flag: if 'TRUE', the plot region is framed |
| <code>main</code> | a main title for the plot |
| <code>sub</code> | a sub title for the plot |
| <code>xlab</code> | a label for the x axis |
| <code>ylab</code> | a label for the y axis |
| <code>cex</code> | character expansion factor for the labels |
| <code>lwd</code> | line width used for drawing |
| <code>lty</code> | line type used for drawing |

| | |
|------|--|
| xpd | logical or NA indicating if clipping should be done, see 'par(xpd=.)' |
| mar | argument to 'par(mar=*)', typically choosing smaller margins than by default |
| add | logical, if 'TRUE' add boxes to current plot |
| plot | logical, if 'FALSE', nothing is plotted |
| ... | further arguments, passed to the first call of 'plot()' |

Details

This type of graphical approach for multivariate data is only applicable where the data can be grouped into three clusters. This means that before the plot can be made the data undergo a hierarchical cluster to get the size of each cluster. The distance measure for the hierarchical cluster is complete linkage. Each cluster represents one side of the boxes.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

See Also

[plot.default,box](#)

Examples

```
#plots the background and the boxes for the elements
data(ohorizon)
X=ohorizon[,"XCOO"]
Y=ohorizon[,"YCOO"]
el=log10(ohorizon[,c("Co","Cu","Ni","Rb","Bi","Na","Sr")])
data(kola.background)

sel <- c(3,8,22, 29, 32, 35, 43, 69, 73 ,93,109,129,130,134,168,181,183,205,211,
        218,237,242,276,292,297,298,345,346,352,372,373,386,408,419,427,441,446,490,
        516,535,551,556,558,564,577,584,601,612,617)

x=el[sel,]
xwid=diff(range(X))/12e4
ywid=diff(range(Y))/12e4
plot(X,Y,frame.plot=FALSE,xaxt="n",yaxt="n",xlab="",ylab="",type="n",
      xlim=c(360000,max(X)))
plotbg(map.col=c("gray","gray","gray","gray"),add.plot=TRUE)

boxes(x,locations=cbind(X[sel],Y[sel]),len=20000,key.loc=c(800000,7830000),leglen=25000,
      cex=0.75, add=TRUE, labels=NULL, lwd=1.1)
```

boxplotlegend *Boxplotlegend*

Description

This function plots the legend in form of a boxplot. The symbols represent the different levels (e.g. whiskers, median, ...) of the boxplot.

Usage

```
boxplotlegend(X, Y, el, boxinfo, x.shift = 40000, xf = 10000, y.shift = 0.2,
y.scale = 130000, legend.title = "Legend", cex.legtit = 1, logscale = TRUE,
symb = c(1, 1, 16, 3, 3), ssize = c(1.5, 1, 0.3, 1, 1.5), accentuate = FALSE,
cex.scale = 0.8)
```

Arguments

| | |
|--------------|---|
| X | X-coordinates |
| Y | Y-coordinates |
| el | variable considered |
| boxinfo | from boxplot(el) or boxplotlog(el) |
| x.shift | shift in x-direction |
| xf | width in x-direction |
| y.shift | shift in y-direction (from title) |
| y.scale | scale in y-direction |
| legend.title | title for legend |
| cex.legtit | cex of title for legend |
| logscale | if TRUE plot boxplot in log-scale |
| symb | symbols to be used (length 5!) |
| ssize | symbol sizes to be used (length 5!) |
| accentuate | if FALSE no symbols for the upper values (e.g. upper "hinge", upper whisker) are assigned |
| cex.scale | cex for text "log-scale" for scale |

Details

Takes the information provided by the argument boxinfo and plots a boxplot corresponding to the values. If there are no upper or/and lower outliers the symbols for the upper or/and lower whiskers will be ignored.

Value

Plots the legend with respect to the boxplot and returns the symbols, size and the quantiles used for the legend.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
#internal function, used in SymbLegend
```

```
boxplotlog
```

```
Boxplotlog
```

Description

The function boxplot plots a boxplot of the data with respect to the logarithmic transformed values of the whiskers. See also details.

Usage

```
boxplotlog(x, ..., range = 1.5, width = NULL, varwidth = FALSE, notch = FALSE,
outline = TRUE, names, plot = TRUE, border = par("fg"), col = NULL, log = "",
pars = list(boxwex = 0.8, staplewex = 0.5, outwex = 0.5), horizontal = FALSE,
add = FALSE, at = NULL)
```

Arguments

| | |
|----------|---|
| x | data |
| ... | further arguments for creating the list |
| range | this determines how far the plot "whiskers" extend from the box. If range is positive, the most extreme data point which is no more than range times the length of the box away from the box. A value of zero causes the whiskers to extend to the data extremes. |
| width | a vector giving the relative widths of the boxes making up the plot |
| varwidth | if varwidth is TRUE, the boxes are drawn with widths proportional to the square-roots of the number of observations in the groups. |
| notch | if notch is TRUE, a notch is drawn in each side of the boxes |
| outline | if outline is FALSE, the outliers are not drawn |
| names | define the names of the attributes |
| plot | if plot is TRUE the boxplot is plotted in the current plot |
| border | character or numeric (vector) which indicates the color of the box borders |

| | |
|------------|---|
| col | defines the colour |
| log | character, indicating if any axis should be drawn in logarithmic scale |
| pars | some graphical parameters can be specified |
| horizontal | logical parameter indicating if the boxplots should be horizontal; FALSE means vertical boxes |
| add | if TRUE the boxplot is added to the current plot |
| at | numeric vector giving the locations of the boxplots |

Details

Sometimes a boxplot of the original data does not identify outliers because the boxplot assumes normal distribution. Therefore the data are logarithmically transformed and values for plotting the boxplot are calculated. After that the data are backtransformed and the boxplot is plotted with respect to the logarithmic results. Now the outliers are identified.

Value

| | |
|-------|--|
| stats | a vector of length 5, containing the extreme of the lower whisker, the lower "hinge", the median, the upper "hinge" and the extreme of the upper whisker (backtransformed) |
| n | the number of non-NA observations in the sample |
| conf | the lower and upper extremes of the "notch" |
| out | the values of any data points which lie beyond the extremes of the whiskers (backtransformed) |
| group | the group |
| names | the attributes |

Returns a boxplot which is calculated with the log-transformed data.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data(chorizon)
Ba=chorizon[, "Ba"]

boxplotlog((Ba), horizontal=TRUE, xlab="Ba [mg/kg]", cex.lab=1.4, pch=3, cex=1.5)
```

 boxplotperc

Boxplot based on percentiles

Description

This function plots a boxplot of the data and the boundaries are based on percentiles.

Usage

```
boxplotperc(x, ..., quant = c(0.02, 0.98), width = NULL, varwidth = FALSE,
notch = FALSE, outline = TRUE, names, plot = TRUE, border = par("fg"),
col = NULL, log = "", pars = list(boxwex = 0.8, staplewex = 0.5, outwex = 0.5),
horizontal = FALSE, add = FALSE, at = NULL)
```

Arguments

| | |
|------------|--|
| x | data |
| ... | further arguments for creating the list |
| quant | the underlying percentages |
| width | a vector giving the relative widths of the boxes making up the plot |
| varwidth | if varwidth is TRUE, the boxes are drawn with widths proportional to the square-roots of the number of observations in the groups. |
| notch | if notch is TRUE, a notch is drawn in each side of the boxes |
| outline | if outliers is FALSE, the outliers are not drawn |
| names | define the names of the attributes |
| plot | if plot is TRUE the boxplot is plotted in the current plot |
| border | character or numeric (vector) which indicates the color of the box borders |
| col | defines the colour |
| log | character, indicating if any axis should be drawn in logarithmic scale |
| pars | some graphical parameters can be specified |
| horizontal | logical parameter indicating if the boxplots should be horizontal; FALSE means vertical boxes |
| add | if TRUE the boxplot is added to the current plot |
| at | numeric vector giving the locations of the boxplots |

Details

The default value for quant is the 2% and 98% quantile and this argument defines the percentiles for the upper and lower whiskers.

Value

| | |
|-------|--|
| stats | a vector of length 5, containing the extreme of the lower whisker, the lower "hinge", the median, the upper "hinge" and the extreme of the upper whisker (backtransformed) |
| n | the number of non-NA observations in the sample |
| conf | the lower and upper extremes of the "notch" |
| out | the values of any data points which lie beyond the extremes of the whiskers (backtransformed) |
| group | the group |
| names | the attributes |

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

See Also

[boxplotlog](#)

Examples

```
data(chorizon)
Ba=chorizon[, "Ba"]
boxplotperc(Ba, quant=c(0.05, 0.95), horizontal=TRUE, xlab="Ba [mg/kg]", cex.lab=1.2, pch=3)
```

branch-class *Class "branch"*

Description

A Composite object used to plot trees as multivariate graphics

Objects from the Class

Objects can be created by calls of the form `new("branch", ...)`.

Slots

LR: Object of class "numeric"
w: Object of class "numeric"
h: Object of class "numeric"
El: Object of class "numeric"
LeafL: Object of class "branch"
LeafR: Object of class "branch"
Bole: Object of class "numeric"

Extends

Class "[Component](#)", directly.

Methods

plot signature(x = "branch", y = "ANY"):
show signature(object = "branch"):

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
showClass("branch")
```

bubbleFIN

Bubbleplot due to Finnish method

Description

This function plots multivariate data with respect to the value. The size of the bubble represents the value of the datapoint.

Usage

```
bubbleFIN(x, y, z, radi = 10000, S = 9, s = 0.9, wa = 0, wb = 0.95, wc = 0.05,  
plottitle = "BubblePlot", legendtitle = "Legend", text.cex = 1,  
legtitle.cex = 1, backgr = "kola.background", leg = TRUE, ndigits = 1)
```

Arguments

| | |
|--------------|---|
| x | x coordinates |
| y | y coordinates |
| z | measured value at point (x,y) |
| radi | scaling for the map |
| S, s | control the size of the largest and smallest bubbles |
| wa, wb, wc | factors which defines the shape of the exponential function |
| plottitle | the titel of the plot |
| legendtitle | the titel of the legend |
| text.cex | multiplier for the size of the labels |
| legtitle.cex | multiplier for the size of the legendtitle |
| backgr | which background should be used |
| leg | if TRUE the bubbles are plotted to the legend |
| ndigits | how much digits should be plotted at the legend |

Details

The smallest bubbles represent the 10% quantile and the biggest bubbles represent the 99

Value

Plots bubbles in the existing plot.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data(kola.background)
data(ohorizon)
el=ohorizon[, "Mg"]
X=ohorizon[, "XCOO"]
Y=ohorizon[, "YCOO"]
plot(X, Y, frame.plot=FALSE, xaxt="n", yaxt="n", xlab="", ylab="", type="n") #plot bubbles with bac
plotbg(map.col=c("gray", "gray", "gray", "gray"), add.plot=TRUE)

bubbleFIN(X, Y, el, S=9, s=2, plottitle="", legendtitle="Mg [mg/kg]", text.cex=0.63, legtitle.cex=0
```

`CHorANADUP`*Analytical duplicates of the C-horizon Kola data*

Description

Analytical duplicates have been selected for quality control.

Usage

```
data(CHorANADUP)
```

Format

A data frame with 52 observations on the following 190 variables.

`A1_.Loc` a numeric vector

`A2_.Loc` a numeric vector

`A1_Ag` a numeric vector

`A1_Ag_INAA` a numeric vector

`A1_Al` a numeric vector

`A1_Al2O3` a numeric vector

`A1_As` a numeric vector

`A1_As_INAA` a numeric vector

`A1_Au_INAA` a numeric vector

`A1_B` a numeric vector

`A1_Ba` a numeric vector

`A1_Ba_INAA` a numeric vector

`A1_Be` a numeric vector

`A1_Bi` a numeric vector

`A1_Br` a numeric vector

`A1_Br_INAA` a numeric vector

`A1_Ca` a numeric vector

`A1_Ca_INAA` a numeric vector

`A1_CaO` a numeric vector

`A1_Cd` a numeric vector

`A1_Ce_INAA` a numeric vector

`A1_Cl` a numeric vector

`A1_Co` a numeric vector

`A1_Co_INAA` a numeric vector

`A1_Cond` a numeric vector

A1_Cr a numeric vector
A1_Cr_INAA a numeric vector
A1_Cs_INAA a numeric vector
A1_Cu a numeric vector
A1_Eu_INAA a numeric vector
A1_F a numeric vector
A1_F_ionselect a numeric vector
A1_Fe a numeric vector
A1_Fe_INAA a numeric vector
A1_Fe2O3 a numeric vector
A1_Hf_INAA a numeric vector
A1_Hg a numeric vector
A1_Hg_INAA a numeric vector
A1_Ir_INAA a numeric vector
A1_K a numeric vector
A1_K2O a numeric vector
A1_La a numeric vector
A1_La_INAA a numeric vector
A1_Li a numeric vector
A1_LOI a numeric vector
A1_Lu_INAA a numeric vector
A1_Mass_INAA a numeric vector
A1_Mg a numeric vector
A1_MgO a numeric vector
A1_Mn a numeric vector
A1_MnO a numeric vector
A1_Mo a numeric vector
A1_Mo_INAA a numeric vector
A1_Na a numeric vector
A1_Na_INAA a numeric vector
A1_Na2O a numeric vector
A1_Nd_INAA a numeric vector
A1_Ni a numeric vector
A1_Ni_INAA a numeric vector
A1_NO2 a numeric vector
A1_NO3 a numeric vector
A1_P a numeric vector

A1_P2O5 a numeric vector
A1_Pb a numeric vector
A1_pH a numeric vector
A1_PO4 a numeric vector
A1_Rb a numeric vector
A1_S a numeric vector
A1_Sb a numeric vector
A1_Sb_INAA a numeric vector
A1_Sc a numeric vector
A1_Sc_INAA a numeric vector
A1_Se a numeric vector
A1_Se_INAA a numeric vector
A1_Si a numeric vector
A1_SiO2 a numeric vector
A1_Sm_INAA a numeric vector
A1_Sn_INAA a numeric vector
A1_SO4 a numeric vector
A1_Sr a numeric vector
A1_Sr_INAA a numeric vector
A1_Sum a numeric vector
A1-Ta_INAA a numeric vector
A1_Tb_INAA a numeric vector
A1_Te a numeric vector
A1_Th a numeric vector
A1_Th_INAA a numeric vector
A1_Ti a numeric vector
A1_TiO2 a numeric vector
A1_U_INAA a numeric vector
A1_V a numeric vector
A1_W_INAA a numeric vector
A1_Y a numeric vector
A1_Yb_INAA a numeric vector
A1_Zn a numeric vector
A1_Zn_INAA a numeric vector
A2_Ag a numeric vector
A2_Ag_INAA a numeric vector
A2_Al a numeric vector

A2_Al2O3 a numeric vector
A2_As a numeric vector
A2_As_INAA a numeric vector
A2_Au_INAA a numeric vector
A2_B a numeric vector
A2_Ba a numeric vector
A2_Ba_INAA a numeric vector
A2_Be a numeric vector
A2_Bi a numeric vector
A2_Br a numeric vector
A2_Br_INAA a numeric vector
A2_Ca a numeric vector
A2_Ca_INAA a numeric vector
A2_CaO a numeric vector
A2_Cd a numeric vector
A2_Ce_INAA a numeric vector
A2_Cl a numeric vector
A2_Co a numeric vector
A2_Co_INAA a numeric vector
A2_Cond a numeric vector
A2_Cr a numeric vector
A2_Cr_INAA a numeric vector
A2_Cs_INAA a numeric vector
A2_Cu a numeric vector
A2_Eu_INAA a numeric vector
A2_F a numeric vector
A2_F_ionselect a numeric vector
A2_Fe a numeric vector
A2_Fe_INAA a numeric vector
A2_Fe2O3 a numeric vector
A2_Hf_INAA a numeric vector
A2_Hg a numeric vector
A2_Hg_INAA a numeric vector
A2_Ir_INAA a numeric vector
A2_K a numeric vector
A2_K2O a numeric vector
A2_La a numeric vector

A2_La_INAA a numeric vector
A2_Li a numeric vector
A2_LOI a numeric vector
A2_Lu_INAA a numeric vector
A2_Mass_INAA a numeric vector
A2_Mg a numeric vector
A2_MgO a numeric vector
A2_Mn a numeric vector
A2_MnO a numeric vector
A2_Mo a numeric vector
A2_Mo_INAA a numeric vector
A2_Na a numeric vector
A2_Na_INAA a numeric vector
A2_Na2O a numeric vector
A2_Nd_INAA a numeric vector
A2_Ni a numeric vector
A2_Ni_INAA a numeric vector
A2_NO2 a numeric vector
A2_NO3 a numeric vector
A2_P a numeric vector
A2_P2O5 a numeric vector
A2_Pb a numeric vector
A2_pH a numeric vector
A2_PO4 a numeric vector
A2_Rb a numeric vector
A2_S a numeric vector
A2_Sb a numeric vector
A2_Sb_INAA a numeric vector
A2_Sc a numeric vector
A2_Sc_INAA a numeric vector
A2_Se a numeric vector
A2_Se_INAA a numeric vector
A2_Si a numeric vector
A2_SiO2 a numeric vector
A2_Sm_INAA a numeric vector
A2_Sn_INAA a numeric vector
A2_SO4 a numeric vector

A2_Sr a numeric vector
A2_Sr_INAA a numeric vector
A2_Sum a numeric vector
A2-Ta_INAA a numeric vector
A2_Tb_INAA a numeric vector
A2_Te a numeric vector
A2_Th a numeric vector
A2_Th_INAA a numeric vector
A2_Ti a numeric vector
A2_TiO2 a numeric vector
A2_U_INAA a numeric vector
A2_V a numeric vector
A2_W_INAA a numeric vector
A2_Y a numeric vector
A2_Yb_INAA a numeric vector
A2_Zn a numeric vector
A2_Zn_INAA a numeric vector

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

Source

Kola Project (1993-1998)

References

Reimann C, Åyräs M, Chekushin V, Bogatyrev I, Boyd R, Caritat P de, Dutter R, Finne TE, Halleraker JH, Jæger Ø, Kashulina G, Lehto O, Niskavaara H, Pavlov V, Räsänen ML, Strand T, Volden T. Environmental Geochemical Atlas of the Central Barents Region. NGU-GTK-CKE Special Publication, Geological Survey of Norway, Trondheim, Norway, 1998.

Examples

```
data(CHorANADUP)  
str(CHorANADUP)
```

CHorFieldDUP *Field duplicates of the C-horizon Kola data*

Description

Field duplicates have been selected for quality control.

Usage

```
data(CHorFieldDUP)
```

Format

A data frame with 49 observations on the following 240 variables.

F1_.Loc a numeric vector

F2_.Loc a numeric vector

XCOO a numeric vector

YCOO a numeric vector

F1_Ag a numeric vector

F1_Ag_INAA a numeric vector

F1_Al a numeric vector

F1_Al2O3 a numeric vector

F1_As a numeric vector

F1_As_INAA a numeric vector

F1_Au_INAA a numeric vector

F1_B a numeric vector

F1_Ba a numeric vector

F1_Ba_INAA a numeric vector

F1_Be a numeric vector

F1_Bi a numeric vector

F1_Br a numeric vector

F1_Br_INAA a numeric vector

F1_Ca a numeric vector

F1_Ca_INAA a numeric vector

F1_CaO a numeric vector

F1_Cd a numeric vector

F1_Ce_INAA a numeric vector

F1_Cl a numeric vector

F1_Co a numeric vector

F1_Co_INAA a numeric vector
F1_Cond a numeric vector
F1_Cr a numeric vector
F1_Cr_INAA a numeric vector
F1_Cs_INAA a numeric vector
F1_Cu a numeric vector
F1_Eu_INAA a numeric vector
F1_F a numeric vector
F1_F_ionselect a numeric vector
F1_Fe a numeric vector
F1_Fe_INAA a numeric vector
F1_Fe2O3 a numeric vector
F1_Hf_INAA a numeric vector
F1_Hg a numeric vector
F1_Hg_INAA a numeric vector
F1_Ir_INAA a numeric vector
F1_K a numeric vector
F1_K2O a numeric vector
F1_La a numeric vector
F1_La_INAA a numeric vector
F1_Li a numeric vector
F1_LOI a numeric vector
F1_Lu_INAA a numeric vector
F1_Mass_INAA a numeric vector
F1_Mg a numeric vector
F1_MgO a numeric vector
F1_Mn a numeric vector
F1_MnO a numeric vector
F1_Mo a numeric vector
F1_Mo_INAA a numeric vector
F1_Na a numeric vector
F1_Na_INAA a numeric vector
F1_Na2O a numeric vector
F1_Nd_INAA a numeric vector
F1_Ni a numeric vector
F1_Ni_INAA a numeric vector
F1_NO2 a numeric vector

F1_NO3 a numeric vector
F1_P a numeric vector
F1_P2O5 a numeric vector
F1_Pb a numeric vector
F1_pH a numeric vector
F1_PO4 a numeric vector
F1_Rb a numeric vector
F1_S a numeric vector
F1_Sb a numeric vector
F1_Sb_INAA a numeric vector
F1_Sc a numeric vector
F1_Sc_INAA a numeric vector
F1_Se a numeric vector
F1_Se_INAA a numeric vector
F1_Si a numeric vector
F1_SiO2 a numeric vector
F1_Sm_INAA a numeric vector
F1_Sn_INAA a numeric vector
F1_SO4 a numeric vector
F1_Sr a numeric vector
F1_Sr_INAA a numeric vector
F1_Sum a numeric vector
F1-Ta_INAA a numeric vector
F1_Tb_INAA a numeric vector
F1_Te a numeric vector
F1_Th a numeric vector
F1_Th_INAA a numeric vector
F1_Ti a numeric vector
F1_TiO2 a numeric vector
F1_U_INAA a numeric vector
F1_V a numeric vector
F1_W_INAA a numeric vector
F1_Y a numeric vector
F1_Yb_INAA a numeric vector
F1_Zn a numeric vector
F1_Zn_INAA a numeric vector
F2_Ag a numeric vector

F2_Ag_INAA a numeric vector
F2_Al a numeric vector
F2_Al2O3 a numeric vector
F2_As a numeric vector
F2_As_INAA a numeric vector
F2_Au_INAA a numeric vector
F2_B a numeric vector
F2_Ba a numeric vector
F2_Ba_INAA a numeric vector
F2_Be a numeric vector
F2_Bi a numeric vector
F2_Br a numeric vector
F2_Br_INAA a numeric vector
F2_Ca a numeric vector
F2_Ca_INAA a numeric vector
F2_CaO a numeric vector
F2_Cd a numeric vector
F2_Ce_INAA a numeric vector
F2_Cl a numeric vector
F2_Co a numeric vector
F2_Co_INAA a numeric vector
F2_Cond a numeric vector
F2_Cr a numeric vector
F2_Cr_INAA a numeric vector
F2_Cs_INAA a numeric vector
F2_Cu a numeric vector
F2_Eu_INAA a numeric vector
F2_F a numeric vector
F2_F_ionselect a numeric vector
F2_Fe a numeric vector
F2_Fe_INAA a numeric vector
F2_Fe2O3 a numeric vector
F2_Hf_INAA a numeric vector
F2_Hg a numeric vector
F2_Hg_INAA a numeric vector
F2_Ir_INAA a numeric vector
F2_K a numeric vector

F2_K2O a numeric vector
F2_La a numeric vector
F2_La_INAA a numeric vector
F2_Li a numeric vector
F2_LOI a numeric vector
F2_Lu_INAA a numeric vector
F2_Mass_INAA a numeric vector
F2_Mg a numeric vector
F2_MgO a numeric vector
F2_Mn a numeric vector
F2_MnO a numeric vector
F2_Mo a numeric vector
F2_Mo_INAA a numeric vector
F2_Na a numeric vector
F2_Na_INAA a numeric vector
F2_Na2O a numeric vector
F2_Nd_INAA a numeric vector
F2_Ni a numeric vector
F2_Ni_INAA a numeric vector
F2_NO2 a numeric vector
F2_NO3 a numeric vector
F2_P a numeric vector
F2_P2O5 a numeric vector
F2_Pb a numeric vector
F2_pH a numeric vector
F2_PO4 a numeric vector
F2_Rb a numeric vector
F2_S a numeric vector
F2_Sb a numeric vector
F2_Sb_INAA a numeric vector
F2_Sc a numeric vector
F2_Sc_INAA a numeric vector
F2_Se a numeric vector
F2_Se_INAA a numeric vector
F2_Si a numeric vector
F2_SiO2 a numeric vector
F2_Sm_INAA a numeric vector

F2_Sn_INAA a numeric vector
 F2_SO4 a numeric vector
 F2_Sr a numeric vector
 F2_Sr_INAA a numeric vector
 F2_Sum a numeric vector
 F2_Ta_INAA a numeric vector
 F2_Tb_INAA a numeric vector
 F2_Te a numeric vector
 F2_Th a numeric vector
 F2_Th_INAA a numeric vector
 F2_Ti a numeric vector
 F2_TiO2 a numeric vector
 F2_U_INAA a numeric vector
 F2_V a numeric vector
 F2_W_INAA a numeric vector
 F2_Y a numeric vector
 F2_Yb_INAA a numeric vector
 F2_Zn a numeric vector
 F2_Zn_INAA a numeric vector
 DATE a numeric vector
 X.SAMP a factor with levels CRJHPC CRPCTF CRTF GKJHOJ GKJHTV JARR JHOJTV MÄVG
 MLRJARP MLRJSRR MLRMÄDR OJGKTV RPAV RPMLRJA RPVM Semenov Smirnov VGMÄ
 ELEV a numeric vector
 UTM a numeric vector
 X.COUN a factor with levels FIN NOR RUS
 X.ASP a factor with levels E FLAT N NE NW S SE SW
 X.GENLAN a factor with levels FLAT LOWMO PLAIN RIDGE SLOPE
 X.TOPO a factor with levels CONCLOW CONCMED CONVLOW CONVMED FLAT FLATLOW FLATTER
 LOWBRLOW LOWBRMED TER TERR TOP TOPFLAT TOPTER UPBRFLAT UPBRLOW UPBRMED
 UPBRTER
 X.FORDEN a factor with levels D MD MD NO S
 X.TREESPE a factor with levels BI BI.. BI.PBET.JUN BI..PI .BI.SP BI..SP BI.SP.
 BI.S.PJUN NO P.P.BI P.BIJUN P.BI.S.PIBI.PI.BI.PI..BI.PI.BI..PIBI.SP
 PI..SP PI..SPBI P.SBI P.S.BI P.SBI.JUN S.BI S.BI.JUN SP..BI SP.BI.
 .SPBI.PI .SPPIBI.
 TRHIGH a numeric vector
 RELAS a numeric vector
 X.BUSHDEN a factor with levels MD NO S

X.BUSHSPEC a factor with levels BET BI ..BI .BI. BI... .BI.JU BI..JU BI..PI JUN
NO ..RO ..WI ..WIBI ..WIJU ..WIRO ..WIROJU

X.GRVEGETATIO a factor with levels B..CGMLB..CHB.CO.GMB.CRCHMO.LINB.CRGRMARMO.LI
B.CRM O BJUO.MO.CR B. JUOMO.LI B.LINMAR B.MO.CRMAR .BO.ML C.. C..BGML
C.B.GML .C.BGMLO C.B.GMLO C.B.L C.BL.GM C.BM.HGL C.BML.GO C.BO.G C.BOM.L
CH.BCRLIN CH.BLIN C.L.BGM C.M.GL C..ML C.OL.MC.O.MLP CR.B.LI CR.LINMO
H..BML H.L.BCML..BMO L.BO.CML.H.BMLIN.CR.LI M.BC.GLM..BCLM.B.CLO
M.BH.CGO M.B.L M.BL.GO M.O.BCGL MO.BCR MO.BCRJUO O.B.CHMLO

X.MOSS a factor with levels -9999 HSDC HSDR HSSC HSSR PS PSDC PSDR PSRD PSSC

X.TOP a factor with levels -9999 D10 D6 D7 M10 M4 M5 M6 M7 M8

AoMEAN a numeric vector

X.AoRANGE a factor with levels 0.1_1.0 0_2.0 2_2.5 0.2_4.0 0,5_2.0,5_3.0 5_4.0
0.5_5.0 1.0_3.0 1_2 1_3 1_4 1_5 1.5_3.5 1,5_5 1_6 2_2.0_5.0 2.0_6.0
2.0_7.0 2_3 2_4 2_5 2_6 2_7 3.0_8.0 3_12 3_5 3_6 4_12 4_6 4_8 5_5_10
.5_4 -9999

HUMNO a numeric vector

HUMTHI a numeric vector

X.C_PAR a factor with levels FLUV FLUVG TILL TILLSAP TILL&SAP

X.C_grain a numeric vector

X.COLA a numeric vector

X.COLE a numeric vector

LOWDE a numeric vector

X.COLB a numeric vector

LOWDB a numeric vector

X.COLC a numeric vector

TOPC a numeric vector

X.WEATH a factor with levels DRY MIX RAIN

TEMP a numeric vector

CATLEV0 a numeric vector

CATLEV1 a numeric vector

CATLEV2 a numeric vector

LITO a numeric vector

F1_Ag.1 a numeric vector

F1_Ag.2 a numeric vector

F2_Ag.1 a numeric vector

F1_A12O3.1 a numeric vector

F1_A12O3.2 a numeric vector

F2_A12O3.1 a numeric vector

F1_Au_INAA.1 a numeric vector

F1_Au_INAA.2 a numeric vector
F2_Au_INAA.1 a numeric vector
F1_Ba_INAA.1 a numeric vector
F1_Ba_INAA.2 a numeric vector
F2_Ba_INAA.1 a numeric vector

Author(s)

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Source

Kola Project (1993-1998)

References

Reimann C, Äyräs M, Chekushin V, Bogatyrev I, Boyd R, Caritat P de, Dutter R, Finne TE, Halleraker JH, Jæger Ø, Kashulina G, Lehto O, Niskavaara H, Pavlov V, Räsänen ML, Strand T, Volden T. Environmental Geochemical Atlas of the Central Barents Region. NGU-GTK-CKE Special Publication, Geological Survey of Norway, Trondheim, Norway, 1998.

Examples

```
data(CHorFieldDUP)
str(CHorFieldDUP)
```

chorizon

C-horizon of the Kola Data

Description

The Kola Data were collected in the Kola Project (1993-1998, Geological Surveys of Finland (GTK) and Norway (NGU) and Central Kola Expedition (CKE), Russia). More than 600 samples in five different layers were analysed, this dataset contains the C-horizon.

Usage

```
data(chorizon)
```

Format

A data frame with 606 observations on the following 111 variables.

ID a numeric vector

XCOO a numeric vector

YCOO a numeric vector

ELEV a numeric vector

COUN a factor with levels FIN NOR RUS

ASP a factor with levels E FLAT N NE NW NW S SE SW W

TOPC a numeric vector

LITO a numeric vector

Ag a numeric vector

Ag_INAA a numeric vector

Al a numeric vector

Al_XRF a numeric vector

Al2O3 a numeric vector

As a numeric vector

As_INAA a numeric vector

Au a numeric vector

Au_INAA a numeric vector

B a numeric vector

Ba a numeric vector

Ba_INAA a numeric vector

Be a numeric vector

Bi a numeric vector

Br_IC a numeric vector

Br_INAA a numeric vector

Ca a numeric vector

Ca_INAA a numeric vector

Ca_XRF a numeric vector

CaO a numeric vector

Cd a numeric vector

Ce_INAA a numeric vector

Cl_IC a numeric vector

Co a numeric vector

Co_INAA a numeric vector

Cr a numeric vector

Cr_INAA a numeric vector

Cs_INAA a numeric vector
Cu a numeric vector
EC a numeric vector
Eu_INAA a numeric vector
F_IC a numeric vector
Fe a numeric vector
Fe_INAA a numeric vector
Fe_XRF a numeric vector
Fe2O3 a numeric vector
Hf_INAA a numeric vector
Hg a numeric vector
Hg_INAA a numeric vector
Ir_INAA a numeric vector
K a numeric vector
K_XRF a numeric vector
K2O a numeric vector
La a numeric vector
La_INAA a numeric vector
Li a numeric vector
LOI a numeric vector
Lu_INAA a numeric vector
Mg a numeric vector
Mg_XRF a numeric vector
MgO a numeric vector
Mn a numeric vector
Mn_XRF a numeric vector
MnO a numeric vector
Mo a numeric vector
Mo_INAA a numeric vector
Na a numeric vector
Na_INAA a numeric vector
Na_XRF a numeric vector
Na2O a numeric vector
Nd_INAA a numeric vector
Ni a numeric vector
Ni_INAA a numeric vector
NO3_IC a numeric vector

P a numeric vector
P_XRF a numeric vector
P2O5 a numeric vector
Pb a numeric vector
Pd a numeric vector
pH a numeric vector
PO4_IC a numeric vector
Pt a numeric vector
Rb a numeric vector
S a numeric vector
Sb a numeric vector
Sb_INAA a numeric vector
Sc a numeric vector
Sc_INAA a numeric vector
Se a numeric vector
Se_INAA a numeric vector
Si a numeric vector
Si_XRF a numeric vector
SiO2 a numeric vector
Sm_INAA a numeric vector
Sn_INAA a numeric vector
SO4_IC a numeric vector
Sr a numeric vector
Sr_INAA a numeric vector
Ta_INAA a numeric vector
Tb_INAA a numeric vector
Te a numeric vector
Th a numeric vector
Th_INAA a numeric vector
Ti a numeric vector
Ti_XRF a numeric vector
TiO2 a numeric vector
U_INAA a numeric vector
V a numeric vector
W_INAA a numeric vector
Y a numeric vector
Yb_INAA a numeric vector
Zn a numeric vector
Zn_INAA a numeric vector

Author(s)

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Source

Kola Project (1993-1998)

References

Reimann C, Åyräs M, Chekushin V, Bogatyrev I, Boyd R, Caritat P de, Dutter R, Finne TE, Halleraker JH, Jæger Ø, Kashulina G, Lehto O, Niskavaara H, Pavlov V, Räsänen ML, Strand T, Volden T. Environmental Geochemical Atlas of the Central Barents Region. NGU-GTK-CKE Special Publication, Geological Survey of Norway, Trondheim, Norway, 1998.

Examples

```
data(chorizon)
str(chorizon)
```

CHorSTANDARD

Standard reference material for the Kola data

Description

This is needed for quality control.

Usage

```
data(CHorSTANDARD)
```

Format

A data frame with 52 observations on the following 95 variables.

X.Loc a numeric vector
Ag a numeric vector
Ag_INAA a numeric vector
Al a numeric vector
Al2O3 a numeric vector
As a numeric vector
As_INAA a numeric vector
Au_INAA a numeric vector
B a numeric vector
Ba a numeric vector

Ba_INAA a numeric vector
Be a numeric vector
Bi a numeric vector
Br a numeric vector
Br_INAA a numeric vector
Ca a numeric vector
Ca_INAA a numeric vector
CaO a numeric vector
Cd a numeric vector
Ce_INAA a numeric vector
Cl. a numeric vector
Co a numeric vector
Co_INAA a numeric vector
Cond a numeric vector
Cr a numeric vector
Cr_INAA a numeric vector
Cs_INAA a numeric vector
Cu a numeric vector
Eu_INAA a numeric vector
F. a numeric vector
F_ionselect a numeric vector
Fe a numeric vector
Fe_INAA a numeric vector
Fe2O3 a numeric vector
Hf_INAA a numeric vector
Hg a numeric vector
Hg_INAA a numeric vector
Ir_INAA a numeric vector
K a numeric vector
K2O a numeric vector
La a numeric vector
La_INAA a numeric vector
Li a numeric vector
LOI a numeric vector
Lu_INAA a numeric vector
Mass_INAA a numeric vector
Mg a numeric vector

MgO a numeric vector
Mn a numeric vector
MnO a numeric vector
Mo a numeric vector
Mo_INAA a numeric vector
Na a numeric vector
Na_INAA a numeric vector
Na2O a numeric vector
Nd_INAA a numeric vector
Ni a numeric vector
Ni_INAA a numeric vector
NO2. a numeric vector
NO3. a numeric vector
P a numeric vector
P2O5 a numeric vector
Pb a numeric vector
pH a numeric vector
PO4... a numeric vector
Rb a numeric vector
S a numeric vector
Sb a numeric vector
Sb_INAA a numeric vector
Sc a numeric vector
Sc_INAA a numeric vector
Se a numeric vector
Se_INAA a numeric vector
Si a numeric vector
SiO2 a numeric vector
Sm_INAA a numeric vector
Sn_INAA a numeric vector
SO4.. a numeric vector
Sr a numeric vector
Sr_INAA a numeric vector
Sum a numeric vector
Ta_INAA a numeric vector
Tb_INAA a numeric vector
Te a numeric vector

Th a numeric vector
 Th_INAA a numeric vector
 Ti a numeric vector
 TiO2 a numeric vector
 U_INAA a numeric vector
 V a numeric vector
 W_INAA a numeric vector
 Y a numeric vector
 Yb_INAA a numeric vector
 Zn a numeric vector
 Zn_INAA a numeric vector

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

Source

Kola Project (1993-1998)

References

Reimann C, Äyräs M, Chekushin V, Bogatyrev I, Boyd R, Caritat P de, Dutter R, Finne TE, Halleraker JH, Jæger Ø, Kashulina G, Lehto O, Niskavaara H, Pavlov V, Räisänen ML, Strand T, Volden T. Environmental Geochemical Atlas of the Central Barents Region. NGU-GTK-CKE Special Publication, Geological Survey of Norway, Trondheim, Norway, 1998.

Examples

```
data(CHorSTANDARD)
str(CHorSTANDARD)
```

Component-class *Class "Component"*

Description

A Virtual base class for creating Composites

Objects from the Class

A virtual Class: No objects may be created from it.

Slots

LR: Object of class "numeric"
w: Object of class "numeric"
h: Object of class "numeric"
El: Object of class "numeric"
Bole: Object of class "numeric"

Extends

Class "UComponent", directly.

Methods

No methods defined with class "Component" in the signature.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
showClass("Component")
```

concarea

Plot Concentration Area

Description

Displays a concentration-area plot (see also concareaExampleKola). This function is preferable since it can be applied to non-Kola data!

Usage

```
concarea(x, y, z, zname = deparse(substitute(z)),  
caname = deparse(substitute(z)), borders=NULL, logx = FALSE, ifjit = FALSE,  
ifrev = FALSE, ngrid = 100, ncp = 0, xlim = NULL, xcoord = "Easting",  
ycoord = "Northing", ifbw = FALSE, x.logfinetick = c(2, 5, 10),  
y.logfinetick = c(2, 5, 10))
```

Arguments

| | |
|--------------|--|
| x | name of the x-axis spatial coordinate, the eastings |
| y | name of the y-axis spatial coordinate, the northings |
| z | name of the variable to be processed and plotted |
| zname | a title for the x-axes of the qp-plot and concentration area plot. |
| caname | a title for the image of interpolated data. |
| borders | either NULL or character string with the name of the list with list elements x and y for x- and y-coordinates of map borders |
| logx | if it is required to make a logarithmic data transformation for the interpolation |
| ifrev | if FALSE the empirical function is plotted from highest value to lowest |
| ngrid | default value is 100 |
| xlim | the range for the x-axis |
| xcoord | a title for the x-axis, defaults to "Easting" |
| ycoord | a title for the y-axis, defaults to "Northing" |
| ifbw | if the plot is drawn in black and white |
| x.logfintick | how fine are the tick marks on log-scale on x-axis |
| y.logfintick | how fine are the tick marks on log-scale on y-axis |
| ifjit | default value is FALSE |
| nep | default value is 0 |

Details

The function assumes that the area is proportional to the count of grid points. To be a reasonable model the data points should be 'evenly' spread over the plane. The interpolated grid size is computed as $(\max(x) - \min(x))/ngrid$, with a default value of 100 for ngrid. Akima's interpolation function is used to obtain a linear interpolation between the spatial data values.

Value

The concentration area plot, in both directions, is created.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

See Also

[caplot](#), [concareareaExampleKola](#)

Examples

```
data(ohorizon)
data(kola.background)
data(bordersKola)

Cu=ohorizon[, "Cu"]
X=ohorizon[, "XCOO"]
Y=ohorizon[, "YCOO"]

par(mfrow=c(1,2),mar=c(4,4,2,2))
concarearea(X,Y,Cu,log=TRUE,zname="Cu in O-horizon [mg/kg]",borders="bordersKola", ifrev=FALSE,
            x.logfinetick=c(2,5,10),y.logfinetick=c(10))
```

concareareaExampleKola

Concentration Area Plot for Kola data example

Description

Displays a concentration area plot example for the Kola data. This procedure is useful for determining if multiple populations that are spatially dependent are present in a data set. For a more general function see `concarearea`.

Usage

```
concareareaExampleKola(x, y, z, zname = deparse(substitute(z)),
caname = deparse(substitute(z)), borders="bordersKola", logx = FALSE, ifjit = FALSE,
ifrev = FALSE, ngrid = 100, ncp = 0, xlim = NULL, xcoord = "Easting",
ycoord = "Northing", ifbw = FALSE, x.logfinetick = c(2, 5, 10),
y.logfinetick = c(2, 5, 10))
```

Arguments

| | |
|---------|--|
| x | name of the x-axis spatial coordinate, the eastings |
| y | name of the y-axis spatial coordinate, the northings |
| z | name of the variable to be processed and plotted |
| zname | a title for the x-axes of the qp-plot and concentration area plot. |
| caname | a title for the image of interpolated data. |
| borders | either NULL or character string with the name of the list with list elements x and y for x- and y-coordinates of map borders |
| logx | if it is required to make a logarithmic data transformation for the interpolation |

| | |
|----------------------------|---|
| <code>ifrev</code> | if FALSE the empirical function is plotted from highest value to lowest |
| <code>ngrid</code> | default value is 100 |
| <code>xlim</code> | the range for the x-axis |
| <code>xcoord</code> | a title for the x-axis, defaults to "Easting" |
| <code>ycoord</code> | a title for the y-axis, defaults to "Northing" |
| <code>ifbw</code> | if the plot is drawn in black and white |
| <code>x.logfinetick</code> | how fine are the tick marks on log-scale on x-axis |
| <code>y.logfinetick</code> | how fine are the tick marks on log-scale on y-axis |
| <code>ifjit</code> | default value is FALSE |
| <code>nep</code> | default value is 0 |

Details

The function assumes that the area is proportional to the count of grid points. To be a reasonable model the data points should be 'evenly' spread over the plane. The interpolated grid size is computed as $(\max(x) - \min(x))/ngrid$, with a default value of 100 for `ngrid`. Akima's interpolation function is used to obtain a linear interpolation between the spatial data values.

Value

An example concentration area plot for Kola is created.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

See Also

[qpplot.das](#), [concareas](#), [caplot](#)

Examples

```
data(ohorizon)
data(kola.background)
data(bordersKola)

Cu=ohorizon[, "Cu"]
X=ohorizon[, "XCOO"]
Y=ohorizon[, "YCOO"]
```

```
par(mfrow=c(2,2),mar=c(1.5,1.5,1.5,1.5))
concareExampleKola(X,Y,Cu,log=TRUE,zname="Cu in 0-horizon [mg/kg]",
  x.logfinetick=c(2,5,10),y.logfinetick=c(10))
```

 cor.sign

Correlation Matrix

Description

Computes correlation matrix of x with method "pearson", "kendall" or "spearman". This function also prints the matrix with the significance levels.

Usage

```
cor.sign(x, method = c("pearson", "kendall", "spearman"))
```

Arguments

| | |
|--------|-----------------|
| x | the data |
| method | the method used |

Details

This function estimate the association between paired samples an compute a test of the value being zero. All measures of association are in the range [-1,1] with 0 indicating no association.

Value

| | |
|---------|-------------------------------|
| cor | Correlation matrix |
| p.value | p-value of the test statistic |

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

See Also

[cor.test](#)

Examples

```
data(chorizon)
x=chorizon[,c("Ca", "Cu", "Mg", "Na", "P", "Sr", "Zn")]

cor.sign(log10(x),method="spearman")
```

CorCompare *Compares Correlation Matrices*

Description

This function compares two correlation matrices numerically and graphically.

Usage

```
CorCompare(cor1, cor2, labels1, labels2, method1, method2, ndigits = 4,
lty1 = 1, lty2 = 2, col1 = 1, col2 = 2, lwd1 = 1.1, lwd2 = 1.1,
cex.label = 1.1, cex.legend = 1.2, lwd.legend = 1.2, cex.cor = 1, ...)
```

Arguments

```
cor1,cor2        two correlation matrices based on different estimation methods
labels1, labels2                      labels for the two estimation methods
method1, method2                      description of the estimation methods
ndigits         number of digits to be used for plotting the numbers
lty1, lty2, col1,col2, lwd1, lwd2, cex.label, cex.cor        other graphics parameters
cex.legend, lwd.legend                graphical parameters for the legend
...             further graphical parameters for the ellipses
```

Details

The ellipses are plotted with the function `do.ellipses`. Therefore the radius is calculated with singular value decomposition.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```

data(chorizon)
x=chorizon[,c("Ca", "Cu", "Mg", "Na", "P", "Sr", "Zn")]
par(mfrow=c(1,1),mar=c(4,4,2,0))
R=covMcd(log10(x),cor=TRUE)$cor
P=cor(log10(x))

CorCompare(R,P,labels1=dimnames(x)[[2]],labels2=dimnames(x)[[2]],
method1="Robust",method2="Pearson",ndigits=2, cex.label=1.2)

```

CorGroups

Correlation Matrix for Sub-groups

Description

The correlation matrix for sub-groups of data is computed and displayed in a graphic.

Usage

```

CorGroups(dat, grouping, labels1, labels2, legend, ndigits = 4,
method = "pearson", ...)

```

Arguments

| | |
|------------------|--|
| dat | data values (probably log10-transformed) |
| grouping | factor with levels for different groups |
| labels1, labels2 | labels for groups |
| legend | plotting legend |
| ndigits | number of digits to be used for plotting the numbers |
| method | correlation method: "pearson", "spearman" or "kendall" |
| ... | will not be used in the function |

Details

The correlation is estimated with a non robust method but it is possible to select between the method of Pearson, Spearman and Kendall. The groups must be provided by the user.

Value

Graphic with the different sub-groups.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data(chorizon)
x=chorizon[,c("Ca", "Cu", "Mg", "Na", "P", "Sr", "Zn")]

#definition of the groups
lit=chorizon["LITO"]
litolog=rep(NA, length(lit))
litolog[lit==10] <- 1
litolog[lit==52] <- 2
litolog[lit==81 | lit==82 | lit==83] <- 3
litolog[lit==7] <- 4
litolog <- litolog[!is.na(litolog)]
litolog <- factor(litolog, labels=c("AB", "PG", "AR", "LPS"))

par(mfrow=c(1,1),mar=c(0.1,0.1,0.1,0.1))
CorGroups(log10(x), grouping=litolog, labels1=dimnames(x)[[2]], labels2=dimnames(x)[[2]],
legend=c("Caledonian Sediments", "Basalts", "Alkaline Rocks", "Granites"), ndigits=2)
```

do.ellipses

Plot Ellipses

Description

This function plots ellipses according to a covariance matrix

Usage

```
do.ellipses(acov, pos, ...)
```

Arguments

| | |
|------|--|
| acov | the given covariance matrix |
| pos | the location of the ellipse |
| ... | further graphical parameter for the ellipses |

Details

The correlation matrix of the given covariance is computed and the resulting ellipse is plotted. The radi is computed with the singular value decomposition and the cos/sin is calculated for 100 different degrees.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
#internal function, used in CorCompare
```

edaplot

EDA-plot for data

Description

This function plots a histogram of the data. There is also the choice to add the density, a boxplot and a scatterplot to the histogram.

Usage

```
edaplot(data, scatter=TRUE, box=TRUE, P.plot=TRUE, D.plot=TRUE,
        P.main=paste("Histogram of", deparse(substitute(data))),
        P.sub=NULL, P.xlab=deparse(substitute(data)), P.ylab=default, P.ann=par("a"),
        P.axes=TRUE, P.frame.plot=P.axes, P.log=FALSE, P.logfine=c(2,5,10), P.xline=TRUE,
        P.cex.lab=1.4, B.range=1.5, B.notch=FALSE, B.outline=TRUE,
        B.border=par("fg"), B.col=NULL, B.pch=par("pch"), B.cex=1, B.bg=NA, H.breadth=1,
        H.freq=TRUE, H.include.lowest=TRUE, H.right=TRUE, H.density=NULL, H.angle=0,
        H.col=NULL, H.border=NULL, H.labels=FALSE, S.pch=".", S.col=par("col"), S.cex=1,
        D.lwd=1, D.lty=1)
```

Arguments

| | |
|--------------------------------------|--|
| data | data set |
| scatter | if TRUE the scatter plot is added |
| box | if TRUE a boxplot or boxplotlog is added |
| P.plot | if it is plotted or just a list is computed |
| D.plot | if TRUE the density is added |
| P.main, P.sub, P.xlab, P.ylab, P.ann | graphical parameters for the density, see plot |
| P.axes, P.frame.plot | plots the y-axis with the ticker |
| P.log | if TRUE the x-axis is in log-scale |

`P.logfine` how fine the tickers are
`P.xlim,P.cex.lab`
 further graphical parameters
`B.range, B.notch, B.outline,B.border, B.col, B.pch,B.cex, B.bg`
 parameters for boxplot and boxplotlog function, see `boxplot` and `boxplotlog`
`H.breaks, H.freq,H.include.lowest, H.right,H.density,H.angle,H.col,H.border,H.label`
 parameters for histogram, see `hist`
`S.pch, S.col,S.bg,S.cex`
 graphical parameters for the shape of the points, see `points`
`D.lwd, D.lty` parameters for the density

Details

First the histogram, boxplot/boxplotlog and density is calculate and then the plot is produced. The default is that histogram, boxplot, density trace and scatterplot is made.

Value

`H` results of the histogram
`B` results of the boxplot

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

See Also

[plot](#),[boxplot](#),[edaplotlog](#),[hist](#),[points](#)

Examples

```

data(chorizon)
Ba=chorizon[, "Ba"]
edaplot(Ba,H.freq=FALSE,box=TRUE,H.breaks=30,S.pch=3,S.cex=0.5,D.lwd=1.5,P.log=FALSE,
        P.main="",P.xlab="Ba [mg/kg]",P.ylab="Density",B.pch=3,B.cex=0.5)

```

Description

This function plots a histogram of the data. There is also the choice to add the density, a boxplot and a scatterplot to the histogram.

Usage

```
edaplotlog(data, scatter = TRUE, box = TRUE, P.plot = TRUE, D.plot = TRUE,
P.main = paste("Histogram of", deparse(substitute(data))), P.sub = NULL,
P.xlab = deparse(substitute(data)), P.ylab = default, P.ann = par("ann"),
P.axes = TRUE, P.frame.plot = P.axes, P.log = FALSE,
P.logfine = c(2, 5, 10), P.xlim = NULL, P.cex.lab = 1.4, B.range = 1.5,
B.notch = FALSE, B.outline = TRUE, B.border = par("fg"), B.col = NULL,
B.pch = par("pch"), B.cex = 1, B.bg = NA, B.log = FALSE,
H.breaks = "Sturges", H.freq = TRUE, H.include.lowest = TRUE,
H.right = TRUE, H.density = NULL, H.angle = 45, H.col = NULL,
H.border = NULL, H.labels = FALSE, S.pch = ".", S.col = par("col"),
S.bg = NA, S.cex = 1, D.lwd = 1, D.lty = 1)
```

Arguments

| | |
|--|--|
| data | data set |
| scatter | if TRUE the scatter plot is added |
| box | if TRUE a boxplot or boxplotlog is added |
| P.plot | if it is plotted or just a list is computed |
| D.plot | if TRUE the density is added |
| P.main, P.sub, P.xlab, P.ylab, P.ann | graphical parameters for the density, see plot |
| P.axes, P.frame.plot | plots the y-axis with the ticker |
| P.log | if TRUE the x-axis is in log-scale |
| P.logfine | how fine the tickers are |
| P.xlim, P.cex.lab | further graphical parameters |
| B.range, B.notch, B.outline, B.border, B.col, B.pch, B.cex, B.bg | parameters for boxplot and boxplotlog function, see boxplot and boxplotlog |
| B.log | if TRUE the function boxplotlog is used instead of boxplot |
| H.breaks, H.include.lowest, H.right, H.density, H.angle, H.col, H.border, H.labels | parameters for histogram, see hist |
| H.freq | uses the number of data points in the range |
| S.pch, S.col, S.bg, S.cex | graphical parameters for the shape of the points, see points |
| D.lwd, D.lty | parameters for the density |

Details

First the histogram, boxplot/boxplotlog and density is calculate and then the plot is produced. The default is that histogram, boxplot, density trace and scatterplot is made.

Value

| | |
|---|--------------------------|
| H | results of the histogram |
| B | results of boxplotlog |

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

See Also

[plot](#), [boxplot](#), [boxplotlog](#), [hist](#), [points](#)

Examples

```
data(chorizon)
Ba=chorizon[, "Ba"]
edaplotlog(Ba, H.freq=FALSE, box=TRUE, H.breaks=30, S.pch=3, S.cex=0.5, D.lwd=1.5, P.log=FALSE,
  P.main="", P.xlab="Ba [mg/kg]", P.ylab="Density", B.pch=3, B.cex=0.5, B.log=TRUE)
```

factanal.fit.principal

Fit a Factor Analysis

Description

Internal function for pfa.

Usage

```
factanal.fit.principal(cmat, factors, p = ncol(cmat), start = NULL,
  iter.max = 10, unique.tol = 1e-04)
```

Arguments

| | |
|------------|--|
| cmat | provided correlation matrix |
| factors | number of factors |
| p | number of observations |
| start | vector of start values |
| iter.max | maximum number of iteration used to calculate the common factor |
| unique.tol | the tolerance for a deviation of the maximum (in each row, without the diag) value of the given correlation matrix to the new calculated value |

Value

| | |
|-------------|---|
| loadings | A matrix of loadings, one column for each factor. The factors are ordered in decreasing order of sums of squares of loadings. |
| uniqueness | uniqueness |
| correlation | correlation matrix |
| criteria | The results of the optimization: the value of the negativ log-likelihood and information of the iterations used. |
| factors | the factors |
| dof | degrees of freedom |
| method | "principal" |

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

kola.background *kola.background*

Description

Coordinates of the Kola background. Seperate polygons for the project boundary, borders, lakes and coast are provided.

Usage

```
data(kola.background)
```

Format

The format is: List of 4 \$ boundary:'data.frame': 50 obs. of 2 variables: ..\$ V1: num [1:50] 388650 388160 386587 384035 383029\$ V2: num [1:50] 7892400 7881248 7847303 7790797 7769214 ... \$ coast :'data.frame': 6259 obs. of 2 variables: ..\$ V1: num [1:6259] 438431 439102 439102 439643 439643\$ V2: num [1:6259] 7895619 7896495 7896495 7895800 7895542 ... \$ borders :'data.frame': 504 obs. of 2 variables: ..\$ V1: num [1:504] 417575 417704 418890 420308 422731\$ V2: num [1:504] 7612984 7612984 7613293 7614530 7615972 ... \$ lakes :'data.frame': 6003 obs. of 2 variables: ..\$ V1: num [1:6003] 547972 546915 NA 547972 547172\$ V2: num [1:6003] 7815109 7815599 NA 7815109 7813873 ...

Details

Is used by plotbg()

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

Source

Kola Project (1993-1998)

References

Reimann C, Ayra M, Chekushin V, Bogatyrev I, Boyd R, Caritat P de, Dutter R, Finne TE, Halleraker JH, Jager O, Kashulina G, Lehto O, Niskavaara H, Pavlov V, Raisanen ML, Strand T, Volden T. Environmental Geochemical Atlas of the Central Barents Region. NGU-GTK-CKE Special Publication, Geological Survey of Norway, Trondheim, Norway, 1998.

Examples

```
data(kola.background)
plotbg()
```

KrigeLegend

Krige

Description

Plots Krige maps and Legend based on continuous or percentile scale.

Usage

```
KrigeLegend(X, Y, z, resol = 100, vario, type = "percentile",
whichcol = "gray", qutiles = c(0, 0.05, 0.25, 0.5, 0.75, 0.9, 0.95, 1), borders=NULL,
leg.xpos.min = 780000, leg.xpos.max = 8e+05, leg.ypos.min = 7760000,
leg.ypos.max = 7870000, leg.title = "mg/kg", leg.title.cex = 0.7,
leg.numb.cex = 0.7, leg.round = 2, leg.numb.xshift = 70000, leg.perc.xshift = 40000,
leg.perc.yshift = 20000, tit.xshift = 35000)
```

Arguments

| | |
|-----------------|--|
| X | X-coordinates |
| Y | Y-coordinates |
| z | values on the coordinates |
| resol | resolution of blocks for Kriging |
| vario | variogram model |
| type | "percentile" for percentile legend, "contin" for continous grey-scale or colour map |
| whichcol | type of colour scheme to use: "gray", "rainbow", "rainbow.trunc", "rainbow.inv", "terrain", "topo" |
| qutiles | considered quantiles if type="percentile" is used |
| borders | either NULL or character string with the name of the list with list elements x and y for x- and y-coordinates of map borders |
| leg.xpos.min | minimum value of x-position of the legend |
| leg.xpos.max | maximum value of x-position of the legend |
| leg.ypos.min | minimum value of y-position of the legend |
| leg.ypos.max | maximum value of y-position of the legend |
| leg.title | title for legend |
| leg.title.cex | cex for legend title |
| leg.numb.cex | cex for legend number |
| leg.round | round legend to specified digits "pretty" |
| leg.numb.xshift | x-shift of numbers in legend relative to leg.xpos.max |
| leg.perc.xshift | x-shift of "Percentile" in legend relative to leg.xpos.min |
| leg.perc.yshift | y-shift of numbers in legend relative to leg.ypos.max |
| tit.xshift | x-shift of title in legend relative to leg.xpos.max |

Details

Based on a variogram model a interpolation of the spatial data is computed. The variogram has to be provided by the user and based on this model the spatial prediction is made. To distinguish between different values every predicted value is plotted in his own scale of the choosen colour.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data(chorizon)
data(kola.background)
X=chorizon["XCOO"]
Y=chorizon["YCOO"]
el=chorizon["As"]
vario.b <- variof(coords=cbind(X,Y), data=el, lambda=0, max.dist=300000)
data(res.eyefit.As_C_m) #need the data
v5=variofit(vario.b, res.eyefit.As_C_m, cov.model="spherical", max.dist=300000)

plot(X,Y, frame.plot=FALSE, xaxt="n", yaxt="n", xlab="", ylab="", type="n")

# to increase the resolution, set e.g. resol=100
data(bordersKola) # x and y coordinates of project boundary
KrigeLegend(X,Y,el, resol=25, vario=v5, type="percentile", whichcol="gray",
  qutiles=c(0,0.05,0.25,0.50,0.75,0.90,0.95,1), borders="bordersKola",
  leg.xpos.min=7.8e5, leg.xpos.max=8.0e5, leg.ypos.min=77.6e5, leg.ypos.max=78.7e5,
  leg.title="mg/kg", leg.title.cex=0.7, leg.numb.cex=0.7, leg.round=2,
  leg.numb.xshift=0.7e5, leg.perc.xshift=0.4e5, leg.perc.yshift=0.2e5, tit.xshift=0.35e5)

plotbg(map.col=c("gray", "gray", "gray", "gray"), map.lwd=c(1,1,1,1), add.plot=TRUE)
```

loadplot

Plot the Loadings of a FA

Description

Makes a Reimann-plot of a loadings matrix.

Usage

```
loadplot(fa.object, titlepl = "Factor Analysis", crit = 0.3, length.varnames = 2)
```

Arguments

| | |
|-----------------|---|
| fa.object | the output of factor analysis class |
| titlepl | the title of the plot |
| crit | all loadings smaller than crit will be ignored in the plot |
| length.varnames | number of letters for abbreviating the variable names in the plot |

Value

Plot of the loadings of a FA therefore a object of factor analysis class must be provided.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data(moss)
var=c("Ag", "Al", "As", "B", "Ba", "Bi", "Ca", "Cd", "Co", "Cr", "Cu", "Fe", "Hg", "K", "Mg", "Mn", "Mo",
      "Na", "Ni", "P", "Pb", "Rb", "S", "Sb", "Si", "Sr", "Th", "Tl", "U", "V", "Zn")
x=log10(moss[,var])

x.mcd=covMcd(x, cor=TRUE)
x.rsc=scale(x, x.mcd$cent, sqrt(diag(x.mcd$cov)))
res5=pfa(x.rsc, factors=2, covmat=x.mcd, scores="regression", rotation="varimax",
         maxit=0, start=rep(0, ncol(x.rsc)))
loadplot(res5, titlepl="Robust FA (log-transformed)", crit=0.3)
```

monch

Boundary of the Monchegorsk area

Description

This gives x- and y-coordinates with the boundary of the area around Monchegorsk.

Usage

```
data(monch)
```

Format

The format is: List of 2 \$ x: num [1:32] 710957 734664 754666 770223 779113 ... \$ y: num [1:32] 7473981 7473143 7474818 7483191 7488215 ...

Details

This object can be used to select samples from the Kola data from the region around Monchegorsk.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data(monch)
data(kola.background)
plotbg()
lines(monch$x,monch$y,col="red")
```

moss

Moss layer of the Kola Data

Description

The Kola Data were collected in the Kola Project (1993-1998, Geological Surveys of Finland (GTK) and Norway (NGU) and Central Kola Expedition (CKE), Russia). More than 600 samples in five different layers were analysed, this dataset contains the C-horizon.

Usage

```
data(moss)
```

Format

A data frame with 594 observations on the following 58 variables.

ID a numeric vector

XCOO a numeric vector

YCOO a numeric vector

ELEV a numeric vector

COUN a factor with levels FIN NOR RUS

ASP a factor with levels E FLAT N NE NW NW S SE SW W

GENLAN a factor with levels DEEPVAL FLA PLAIN FLAT HIMO LOWMO PLAIN PLAT RIDGE SLOPE

TOPO a factor with levels BRUP BRUPLow BRUPSTEE CONC CONCFLAT CONCLOW CONC MED CONCRUG CONCTERR CONV CONVLO CONVLOW CONVMED CONVTER FLAT FLATLOW FLATRUG FLATTER FLATTERR LOBRUG LOW LOWBR LOWBRFLAT LOWBRLO LOWBRLOW LOWBRMED RUG RUGLOW TER TERLOW TERR TERRLOW TOHIFLAT TOP TOPFLAT TOPHILO TOPLOW TOPTER TOPUPBR UPBR UPBRFLAT UPBRLOW UPBRMED UPBRTER UPBRTERR UPTER

GROUNDVEG a factor with levels BLUEBERRY CARLIN_HEATHER EMPETRUM GRASS LICHEN
MOSS SHRUBS WHITE_LICHEN

TREELAY a factor with levels BIPI BIPISPR BIRCH BIRCHdense BISPR BISPRPI MIX
PIBI PIBISPRPINE PISPR PISPRBI SHRUBS SPARCEBI SPARCEPI SPRBI SPRBIP I
SPRPI SPRPIBI SPRUCE WILLOW

VEG_ZONE a factor with levels BOREAL_FOREST DWARF_SHRUB_TUNDRA FOREST_TUNDRA
SHRUB_TUNDRA TUNDRA

Date a numeric vector

SAMP a factor with levels ALL ATMLRMA CRGKPCTF CRJHOJTV CRJHPC CRJHTF CROJTV
CRPCTF CRPCTV CRTF DRMLRKK DRMLRKK GKJHOJ GKJHTV GKOJPCTV GKOJTF GKOJTV
GKPCTF HARR JA JAMAMRL JAMLRMA JAMLRRR JARKP JARP JARPMA JARPMLR JARR
JARRMLR JCPCTF JHGKTV JHOJGK JHOJTV JHPCTF JHRBTV Katanaev MAKKVG
MARP MARPMLR MARPMRL MAVG MLR MLRJA MLRJARP MLRJARR MLRJSRR MLRMADR
MLRMAJA MLRMARP MLRMAVG MLRMÖVG MLRRPJA MLRRPMA MRLMAJA OJGKTV OJTF
Pavlov RPAV RPEM RPMA RPMLRJA RPMLRMA RPVM Semenov Smirnov TFOJ VGHNMA
VGMMA VGMMAHN VGMARS VGMASR VGRSMA VMRP VMRPMA

SPECIES a factor with levels HSDC HSDR HSRC HSSC HSSR PS PSDC PSDR PSRC PSRD
PSSC PSSR SFDR

LITO a numeric vector

C_PAR a factor with levels BEDR FLUV FLUVG MAR SAP SEA STRAT TILL TILLSA TILLSAP
TILL&SAP

TOPC a numeric vector

WEATH a factor with levels DRY DRY MIX MIX RAIN SNOW

TEMP a numeric vector

Ag a numeric vector

Al a numeric vector

As a numeric vector

Au a numeric vector

B a numeric vector

Ba a numeric vector

Be a numeric vector

Bi a numeric vector

Ca a numeric vector

Cd a numeric vector

Co a numeric vector

Cr a numeric vector

Cu a numeric vector

Fe a numeric vector

Hg a numeric vector

K a numeric vector

La a numeric vector
Mg a numeric vector
Mn a numeric vector
Mo a numeric vector
Na a numeric vector
Ni a numeric vector
P a numeric vector
Pb a numeric vector
Pd a numeric vector
Pt a numeric vector
Rb a numeric vector
S a numeric vector
Sb a numeric vector
Sc a numeric vector
Se a numeric vector
Si a numeric vector
Sr a numeric vector
Th a numeric vector
Tl a numeric vector
U a numeric vector
V a numeric vector
Y a numeric vector
Zn a numeric vector

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

Source

Kola Project (1993-1998)

References

Reimann C, Äyräs M, Chekushin V, Bogatyrev I, Boyd R, Caritat P de, Dutter R, Finne TE, Halleraker JH, Jæger Ø, Kashulina G, Lehto O, Niskavaara H, Pavlov V, Räisänen ML, Strand T, Volden T. Environmental Geochemical Atlas of the Central Barents Region. NGU-GTK-CKE Special Publication, Geological Survey of Norway, Trondheim, Norway, 1998.

Examples

```
data(moss)
str(moss)
```

`nizap`*Boundary of the area Nikel-Zapoljarnij*

Description

This gives x- and y-coordinates with the boundary of the area around Nikel-Zapoljarnij.

Usage

```
data(nizap)
```

Format

The format is: List of 2 \$ x: num [1:36] 699104 693918 681324 662062 645023 ... \$ y: num [1:36] 7739416 7746115 7751139 7756163 7757000 ...

Details

This object can be used to select samples from the Kola data from the region around Nikel-Zapoljarnij.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data(nizap)
data(kola.background)
plotbg()
lines(nizap$x, nizap$y, col="red")
```

`Northarrow`*Northarrow*

Description

Add a North Arrow to a map.

Usage

```
Northarrow(Xbottom, Ybottom, Xtop, Ytop, Xtext, Ytext, Alength, Aangle, Alwd, Tcex)
```

Arguments

| | |
|----------------------|---|
| <code>Xbottom</code> | x coordinate of the first point |
| <code>Ybottom</code> | y coordinate of the first point |
| <code>Xtop</code> | x coordinate of the second point |
| <code>Ytop</code> | y coordinate of the second point |
| <code>Xtext</code> | x coordinate of the label |
| <code>Ytext</code> | y coordinate of the label |
| <code>Alength</code> | length of the edges of the arrow head (in inches) |
| <code>Aangle</code> | angle from the shaft of the arrow to the edge of the arrow head |
| <code>Alwd</code> | The line width, a positive number |
| <code>Tcex</code> | numeric character expansion factor |

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
plot.new()  
Northarrow(0.5, 0, 0.5, 1, 0.5, 0.5, Alength=0.15, Aangle=15, Alwd=2, Tcex=2)
```

ohorizon

O-horizon of the Kola Data

Description

The Kola Data were collected in the Kola Project (1993-1998, Geological Surveys of Finland (GTK) and Norway (NGU) and Central Kola Expedition (CKE), Russia). More than 600 samples in five different layers were analysed, this dataset contains the O-horizon.

Usage

```
data(ohorizon)
```

Format

A data frame with 617 observations on the following 85 variables.

ID a numeric vector

XCOO a numeric vector

YCOO a numeric vector

ELEV a numeric vector

COUN a factor with levels FIN NOR RUS

X.ASP a factor with levels -9999 E FLAT N NE NW NW S SE SW W

AoMEAN a numeric vector

HUMNO a numeric vector

HUMTHI a numeric vector

GROUNDVEG a factor with levels BLUEBERRY CARLIN_HEATHER EMPETRUM GRASS LICHEN
MOSS SHRUBS WHITE_LICHEN

TREELAY a factor with levels BIPI BIPISPR BIRCH BIRCHdense BISPR BISPRPI MIX
PIBI PIBISPR PINE PISPR PISPRBI SHRUBS SPARCEBI SPARCEPI SPRBI SPRBIPI
SPRPI SPRPIBI SPRUCE WILLOW

VEG_ZONE a factor with levels BOREAL_FOREST DWARF_SHRUB_TUNDRA FOREST_TUNDRA
SHRUB_TUNDRA TUNDRA

LITO a numeric vector

Ag a numeric vector

Al a numeric vector

Al_AA a numeric vector

As a numeric vector

Au a numeric vector

B a numeric vector

Ba a numeric vector

Ba_AA a numeric vector
Be a numeric vector
Bi a numeric vector
Br a numeric vector
C a numeric vector
Ca a numeric vector
Ca_AA a numeric vector
Cd a numeric vector
Cd_AA a numeric vector
Cl a numeric vector
Co a numeric vector
Co_AA a numeric vector
Cond a numeric vector
Cr a numeric vector
Cr_AA a numeric vector
Cu a numeric vector
Cu_AA a numeric vector
F a numeric vector
Fe a numeric vector
Fe_AA a numeric vector
H a numeric vector
Hg a numeric vector
K a numeric vector
K_AA a numeric vector
La a numeric vector
LOI a numeric vector
Mg a numeric vector
Mg_AA a numeric vector
Mn a numeric vector
Mn_AA a numeric vector
Mo a numeric vector
N a numeric vector
Na a numeric vector
Na_AA a numeric vector
Ni a numeric vector
Ni_AA a numeric vector
NO3 a numeric vector

P a numeric vector
P_AA a numeric vector
Pb a numeric vector
Pb_AA a numeric vector
Pd a numeric vector
pH a numeric vector
PO4 a numeric vector
Pt a numeric vector
Rb a numeric vector
S a numeric vector
S_AA a numeric vector
Sb a numeric vector
Sc a numeric vector
Se a numeric vector
Si a numeric vector
Si_AA a numeric vector
SO4 a numeric vector
Sr a numeric vector
Sr_AA a numeric vector
Th a numeric vector
Ti_AA a numeric vector
Tl a numeric vector
U a numeric vector
V a numeric vector
V_AA a numeric vector
Y a numeric vector
Zn a numeric vector
Zn_AA a numeric vector

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

Source

Kola Project (1993-1998)

References

Reimann C, Äyräs M, Chekushin V, Bogatyrev I, Boyd R, Caritat P de, Dutter R, Finne TE, Halleraker JH, Jæger Ø, Kashulina G, Lehto O, Niskavaara H, Pavlov V, Räsänen ML, Strand T, Volden T. Environmental Geochemical Atlas of the Central Barents Region. NGU-GTK-CKE Special Publication, Geological Survey of Norway, Trondheim, Norway, 1998.

Examples

```
data(ohorizon)
str(ohorizon)
```

pfa

Principal Factor Analysis

Description

Computes the principal factor analysis of the input data.

Usage

```
pfa(x, factors, data = NULL, covmat = NULL, n.obs = NA, subset, na.action,
start = NULL, scores = c("none", "regression", "Bartlett"),
rotation = "varimax", maxiter = 5, control = NULL, ...)
```

Arguments

| | |
|-----------|--|
| x | (robustly) scaled input data |
| factors | number of factors |
| data | default value is NULL |
| covmat | (robustly) computed covariance or correlation matrix |
| n.obs | number of observations |
| subset | if a subset is used |
| start | starting values |
| scores | which method should be used to calculate the scores |
| rotation | if a rotation should be made |
| maxiter | maximum number of iterations |
| control | default value is NULL |
| na.action | what to do with NA values |
| ... | arguments for creating a list |

Value

| | |
|-----------------|---|
| loadings | A matrix of loadings, one column for each factor. The factors are ordered in decreasing order of sums of squares of loadings. |
| uniqueness | uniqueness |
| correlation | correlation matrix |
| criteria | The results of the optimization: the value of the negativ log-likelihood and information of the iterations used. |
| factors | the factors |
| dof | degrees of freedom |
| method | "principal" |
| n.obs | number of observations if available, or NA |
| call | The matched call. |
| STATISTIC, PVAL | The significance-test statistic and p-value, if can be computed |

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data(moss)
var=c("Ni", "Cu", "Mg", "Rb", "Mn")
x=log10(moss[,var])

x.mcd=covMcd(x, cor=TRUE)
x.rsc=scale(x, x.mcd$cent, sqrt(diag(x.mcd$cov)))
pfa(x.rsc, factors=2, covmat=x.mcd, scores="regression", rotation="varimax",
    maxit=0, start=rep(0, ncol(x.rsc)))
```

plotbg

Kola background Plot

Description

Plots the Kola background

Usage

```
plotbg(map = "kola.background", which.map = c(1, 2, 3, 4),
map.col = c(5, 1, 3, 4), map.lwd = c(2, 1, 2, 1), add.plot = FALSE, ...)
```

Arguments

| | |
|-----------|---|
| map | List of coordinates. For the correct format see also <code>help(kola.background)</code> |
| which.map | which==1 ... plot project boundary \# which==2 ... plot coast line \# which==3 ... plot country borders \# which==4 ... plot lakes and rivers |
| map.col | Map colors to be used |
| map.lwd | Defines linestyle of the background |
| add.plot | logical. if true background is added to an existing plot |
| ... | additional plot parameters, see <code>help(par)</code> |

Details

Plots the background map of Kola

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

Reimann C, Åyräs M, Chekushin V, Bogatyrev I, Boyd R, Caritat P de, Dutter R, Finne TE, Halleraker JH, Jæger Ø, Kashulina G, Lehto O, Niskavaara H, Pavlov V, Räsänen ML, Strand T, Volden T. Environmental Geochemical Atlas of the Central Barents Region. NGU-GTK-CKE Special Publication, Geological Survey of Norway, Trondheim, Norway, 1998.

Examples

```
data(kola.background)
plotbg()
```

plotelement

Plot Elements of a Discriminant Analysis

Description

Plot the elements for the discriminant analysis. The plot is ordered in the different groups.

Usage

```
plotelement(da.object)
```

Arguments

`da.object` a object of the `lda` class

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data(iris3)
Iris <- data.frame(rbind(iris3[,1], iris3[,2], iris3[,3]), Sp = rep(c("s","c","v"), rep(50,3)))
train <- sample(1:150, 75)
z <- lda(Sp ~ ., Iris, prior = c(1,1,1)/3, subset = train)

plotelement(z)
```

plotellipse

Plot Ellipse

Description

Plots an ellipse with percentage tolerance and a certain location and covariance.

Usage

```
plotellipse(x.loc, x.cov, perc = 0.98, col = NULL, lty = NULL)
```

Arguments

`x.loc` the location vector
`x.cov` the covariance
`perc` defines the percentage and should be a (vector of) number(s) between 0 and 1
`col, lty` graphical parameters

Details

First the radius of the covariance is calculated and then the ellipses for the provided percentages are plotted at the certain location.

Value

Plot with ellipse.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data(moss)
Ba=log10(moss[, "Ba"])
Ca=log10(moss[, "Ca"])
plot.new()
plot.window(xlim=range(Ba), ylim=c(min(Ca)-1, max(Ca)))

x=cbind(Ba, Ca)
plotellipse(apply(x, 2, mean), cov(x), perc=c(0.5, 0.75, 0.9, 0.98))
```

plotmvoutlier *Multivariate outlier plot*

Description

This function plots multivariate outliers. One possibility is to distinguish between outlier and no outlier. The alternative is to distinguish between the different percentils (e.g. <25%, 25%<x<50%,...).

Usage

```
plotmvoutlier(coord, data, quan = 1/2, alpha = 0.025, symb = FALSE, bw = FALSE,
plotmap = TRUE, map = "kola.background", which.map = c(1, 2, 3, 4),
map.col = c(5, 1, 3, 4), map.lwd = c(2, 1, 2, 1), pch2 = c(3, 21),
cex2 = c(0.7, 0.2), col2 = c(1, 1), lcex.fac = 1, ...)
```

Arguments

| | |
|---------|--|
| coord | the coordinates for the points |
| data | the value for the different coordinates |
| quan | Number of subsets used for the robust estimation of the covariance matrix. Allowed are values between 0.5 and 1., see covMcd |
| alpha | Maximum thresholding proportion |
| symb | if FALSE, only two different symbols (outlier and no outlier) will be used |
| bw | if TRUE, symbols are in gray-scale (only if symb=TRUE) |
| plotmap | if TRUE, the map is plotted |

map the name of the background map
 which.map, map.col, map.lwd parameters for the background plot, see plotbg
 pch2, cex2, col2 graphical parameters for the points
 lcex.fac factor for multiplication of symbol size (only if symb=TRUE)
 ... further parameters for the plot

Details

The function computes a robust estimation of the covariance and then the Mahalanobis distances are calculated. With this distances the data set is divided into outliers and non outliers. If symb=FALSE only two different symbols are used otherwise different grey scales are used to distinguish the different types of outliers.

Value

o returns the outliers
 md the square root of the Mahalanobis distance
 euclidean the Euclidean distance of the scaled data

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

See Also

[plotbg](#), [covMcd](#), [arw](#)

Examples

```

data(moss)
X=moss[, "XCOO"]
Y=moss[, "YCOO"]
el=c("Ag", "As", "Bi", "Cd", "Co", "Cu", "Ni")
x=log10(moss[,el])

data(kola.background)
plotmvoutlier(cbind(X,Y), x, symb=FALSE, map.col=c("grey", "grey", "grey", "grey"),
  map.lwd=c(1,1,1,1),
  xlab="", ylab="", frame.plot=FALSE, xaxt="n", yaxt="n")

```

plotuniout *Multivariate outlier plot for each dimension*

Description

A multivariate outlier plot for each dimension is produced.

Usage

```
plotuniout(x, symb = FALSE, quan = 1/2, alpha = 0.025, bw = FALSE,
pch2 = c(3, 1), cex2 = c(0.7, 0.4), col2 = c(1, 1), lcex.fac = 1, ...)
```

Arguments

| | |
|------------------|--|
| x | dataset |
| symb | if FALSE, only two different symbols (outlier and no outlier) will be used |
| quan | Number of subsets used for the robust estimation of the covariance matrix. Allowed are values between 0.5 and 1., see covMcd |
| alpha | Maximum thresholding proportion, see arw |
| bw | if TRUE, symbols are in gray-scale (only if symb=TRUE) |
| pch2, cex2, col2 | graphical parameters for the points |
| lcex.fac | factor for multiplication of symbol size (only if symb=TRUE) |
| ... | further graphical parameters for the plot |

Value

| | |
|-----------|---|
| o | returns the outliers |
| md | the square root of the Mahalanobis distance |
| euclidean | the Euclidean distance of the scaled data |

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

See Also

[arw](#), [covMcd](#)

Examples

```
data(moss)
el=c("Ag", "As", "Bi", "Cd", "Co", "Cu", "Ni")
dat=log10(moss[,el])

ans<-plotuniout(dat, symb=FALSE, cex2=c(0.9, 0.1), pch2=c(3, 21))
```

plotvario

*Plot Empirical Variogram***Description**

Plot sample (empirical) variogram computed using the function variog.

Usage

```
plotvario(x, max.dist, vario.col = "all",
scaled = FALSE, var.lines = FALSE, envelope.obj = NULL,
pts.range.cex, bin.cloud = FALSE, ...)
```

Arguments

| | |
|----------------------------|---|
| <code>x</code> | an object of the class "variogram", typically an output of the function variog |
| <code>max.dist</code> | maximum distance for the x-axis. The default is the maximum distance for which the sample variogram was computed |
| <code>vario.col</code> | only used if <code>obj</code> has information on more than one empirical variogram. The default "all" indicates that variograms of all variables should be plotted. Alternatively a numerical vector can be used to select variables. |
| <code>scaled</code> | If TRUE the variogram values are divided by the sample variance. This allows comparison of variograms of variables measured in different scales. |
| <code>var.lines</code> | If TRUE a horizontal line is drawn at the value of the variance of the data (if <code>scaled=FALSE</code>) or at 1 (if <code>scaled=TRUE</code>) |
| <code>envelope.obj</code> | adds a variogram envelope |
| <code>pts.range.cex</code> | optional. A two elements vector with maximum and minimum values for the character expansion factor <code>cex</code> . If provided the point sizes in binned variogram are proportional to the number of pairs of points used to compute each bin. |
| <code>bin.cloud</code> | logical. If TRUE and the sample variogram was computed with the option <code>keep.cloud=TRUE</code> , boxplots of values at each bin are plotted instead of the empirical variograms. |
| <code>...</code> | other arguments to be passed to the function plot or matplot. |

Details

Computes the same as the function plot.variogram from the library geoR.

Value

Variogram plot.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

See Also

[plot.variogram](#)

Examples

```
data(chorizon)
X=chorizon["XCOO"]/1000
Y=chorizon["YCOO"]/1000
el=chorizon["As"]
vario.b <- variog(coords=cbind(X,Y), data=el, lambda=0, max.dist=300)
plotvario(vario.b,xlab="Distance [km]",ylab="Semivariogram",
cex.lab=1.2,max.dist=300,pch=1,cex=1)
```

polys

Connect the Values with a Polygon

Description

Connect the values for the elements with a polygon. Every "point" has his own shape and this demonstrates the characteristic of the point.

Usage

```
polys(x, scale = TRUE, labels = dimnames(x)[[1]], locations = NULL,
nrow = NULL, ncol = NULL, key.loc = NULL, key.labels = dimnames(x)[[2]],
key.xpd = TRUE, xlim = NULL, ylim = NULL, flip.labels = NULL, factx = 1,
facty = 1, col.stars = NA, axes = FALSE, frame.plot = axes, main = NULL,
sub = NULL, xlab = "", ylab = "", cex = 0.8, lwd = 1.1, lty = par("lty"),
xpd = FALSE,
mar = pmin(par("mar"), 1.1 + c(2 * axes + (xlab != ""), 2 * axes +
(ylab != ""), 1, 0)),
add = FALSE, plot = TRUE, ...)
```

Arguments

| | |
|--|--|
| <code>x</code> | a matrix or a data frame |
| <code>scale</code> | if TRUE, the data will be scaled |
| <code>labels</code> | the labels for the polygons inside the map |
| <code>locations</code> | the locations for the polygons inside the map |
| <code>nrow, ncol</code> | integers giving the number of rows and columns to use when <code>locations=NULL</code> . By default, <code>'nrow==ncol'</code> , a square layout will be used. |
| <code>key.loc</code> | the location for the legend |
| <code>key.labels</code> | the labels in the legend |
| <code>key.xpd</code> | A logical value or NA. If FALSE, all plotting is clipped to the plot region, if TRUE, all plotting is clipped to the figure region, and if NA, all plotting is clipped to the device region. |
| <code>flip.labels</code> | logical indicating if the label locations should flip up and down from diagram to diagram. |
| <code>factx</code> | additive factor for the x-coordinate |
| <code>facty</code> | magnification for the influence of the x-coordinate on the y-coordinate |
| <code>main, sub, xlab, ylab, xlim, ylim, col.stars, cex, lwd, lty, xpd, mar</code> | graphical parameters and labels for the plot |
| <code>axes</code> | if FALSE, no axes will be drawn |
| <code>frame.plot</code> | if TRUE, a box will be made around the plot |
| <code>add</code> | if TRUE, it will be added to the plot |
| <code>plot</code> | nothing is plotted |
| <code>...</code> | further graphical parameters |

Details

Each polygon represents one row of the input `x`. For the variables the values are computed and then those values are connected with a polygon. The location of the polygons can be defined by the user.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```

data(ohorizon)
X=ohorizon[, "XCOO"]
Y=ohorizon[, "YCOO"]
el=log10(ohorizon[, c("Cu", "Ni", "Na", "Sr")])
sel <- c(3,8,22, 29, 32, 35, 43, 69, 73, 93,109,129,130,134,168,181,183,205,211,
        218,237,242,276,292,297,298,345,346,352,372,373,386,408,419,427,441,446,490,
        516,535,551,556,558,564,577,584,601,612,617)
x=el[sel,]
plot(X,Y,frame.plot=FALSE,xaxt="n",yaxt="n",xlab="",ylab="",type="n",
      xlim=c(360000,max(X)))
polys(x,ncol=8,key.loc=c(15,1),factx=0.30,facty=2.0,cex=0.75,lwd=1.1)

```

ppplot.das

*PP plot***Description**

This function computes a PP (Probability-Probability) plot for the given dataset.

Usage

```
ppplot.das(x, pdist = pnorm, xlab = NULL, ylab = "Probability", line = TRUE, lwd =
```

Arguments

| | |
|------------------------------------|---|
| x | dataset |
| pdist | the distribution function |
| xlab, ylab, lwd, pch, cex, cex.lab | graphical parameters |
| line | if a regression line should be added |
| ... | further parameters for the probability function |

Details

The empirical probability is calculated and compared with the comparison distribution.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data (AuNEW)
ppplot.das (AuNEW, pdist=plnorm, xlab="Probability of Au", ylab="Probabilities of lognormal dist
```

qpplot.das *QP plot*

Description

This function produces a QP (Quantile-Probability) plot of the data.

Usage

```
qpplot.das(x, qdist = qnorm, probs = NULL, logx = FALSE, cex.lab = 1,
xlab = NULL, ylab = "Probability [%]", line = TRUE, lwd = 2, pch = 3,
logfinetick = c(10), logfinelab = c(10), cex = 0.7, xlim = NULL,
ylim = NULL, gridy = TRUE, add.plot = FALSE, col = 1, ...)
```

Arguments

| | |
|---------------|--|
| x | data |
| qdist | The probability function with which the data should be compared. |
| probs | The selected probabilities, see details |
| logx | if TRUE, then log scale on x-axis is used |
| cex.lab | The size of the label |
| xlab | title for x-axis |
| ylab | title for y-axis |
| line | if TRUE the line will be drawn |
| lwd | the width of the line |
| pch, cex, col | graphical parameter |
| logfinetick | how fine are the tick marks on log-scale on x-axis |
| logfinelab | how fine are the labels on log-scale on x-axis |
| xlim | the range for the x-axis |
| ylim | the range for the y-axis |
| gridy | if grid along y-axis should be drawn |
| add.plot | if TRUE the new plot is added to an old one |
| ... | further arguments for the probability function |

Details

First the probability of the sorted input x is computed and then the selected quantiles are calculated and after that plot is produced. If probs=NULL then the 1%, 5%, 10%, 20%,..., 90%, 95% and 99% quantile is taken.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

See Also

[plot](#), [par](#), [plot.default](#)

Examples

```
data (AuNEW)
qqplot.das (AuNEW, qdist=qlnorm, xlab="Au",
ylab="Probabilities of lognormal distribution", pch=3, cex=0.7)
```

qqplot.das

QQ plot

Description

A QQ (Quantile-Quantile) plot is produced.

Usage

```
qqplot.das(x, distribution = "norm", ylab = deparse(substitute(x)), xlab = paste(di
```

Arguments

| | |
|---------------------------------------|---|
| <code>x</code> | numeric vector |
| <code>distribution</code> | name of the comparison distribution |
| <code>ylab</code> | label for the y axis (empirical quantiles) |
| <code>xlab</code> | label for the x axis (comparison quantiles) |
| <code>main</code> | title for the plot |
| <code>las</code> | if 0, ticks labels are drawn parallel to the axis |
| <code>datax</code> | if TRUE, x and y axis are exchanged |
| <code>envelope</code> | confidence level for point-wise confidence envelope, or FALSE for no envelope |
| <code>labels</code> | vector of point labels for interactive point identification, or FALSE for no labels |
| <code>col, lwd, pch, cex, xaxt</code> | graphical parameter, see <code>par</code> |
| <code>line</code> | "quartiles" to pass a line through the quartile-pairs, or "robust" for a robust-regression line. "none" suppresses the line |

| | |
|----------|--|
| add.plot | if TRUE the new plot is added to an old one |
| xlim | the range for the x-axis |
| ylim | the range for the y-axis |
| ... | further arguments for the probability function |

Details

The probability of the input data is computed and with this result the quantiles of the comparison distribution are calculated. If line="quartiles" a line based on quartiles is plotted and if line="robust" a robust LM model is calculated.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

See Also

[par](#)

Examples

```
data(AuNEW)
qqplot.das(AuNEW, distribution="lnorm", col=1, envelope=FALSE, datax=TRUE, ylab="Au",
xlab="Quantiles of lognormal distribution", main="", line="none", pch=3, cex=0.7)
```

res.eyefit.As_C *Result of the function eyefit for variogram estimation.*

Description

This result could also be directly computed using the function eyefit.

Usage

```
data(res.eyefit.As_C)
```

Format

The format is: List of 1 \$:List of 7 ..\$ cov.model: chr "spherical" ..\$ cov.pars : num [1:2] 0.8 160.3 ..\$ nugget : num 0.49 ..\$ kappa : num 0.5 ..\$ lambda : num 0 ..\$ trend : chr "cte" ..\$ max.dist : num 288 ..- attr(*, "class")= chr "variomodel" - attr(*, "class")= chr "eyefit"

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data(res.eyefit.As_C)
str(res.eyefit.As_C)
```

res.eyefit.As_C_m *Result of the function eyefit for variogram estimation.*

Description

This result could also be directly computed using the function eyefit.

Usage

```
data(res.eyefit.As_C_m)
```

Format

The format is: List of 1 \$:List of 7 ..\$ cov.model: chr "spherical" ..\$ cov.pars : num [1:2] 0.8 160255.8 ..\$ nugget : num 0.49 ..\$ kappa : num 0.5 ..\$ lambda : num 0 ..\$ trend : chr "cte" ..\$ max.dist : num 288460 ..- attr(*, "class")= chr "variomodel" - attr(*, "class")= chr "eyefit"

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data(res.eyefit.As_C_m)
str(res.eyefit.As_C_m)
```

```
res.eyefit.AuNEW
```

Result of the function eyefit for variogram estimation.

Description

This result could also be directly computed using the function eyefit.

Usage

```
data(res.eyefit.AuNEW)
```

Format

The format is: List of 1 \$:List of 7 ..\$ cov.model: chr "exponential" ..\$ cov.pars : num [1:2] 0.31 53418.46 ..\$ nugget : num 0.44 ..\$ kappa : num 0.5 ..\$ lambda : num 0 ..\$ trend : chr "cte" ..\$ max.dist : num 192306 ..- attr(*, "class")= chr "variomodel" - attr(*, "class")= chr "eyefit"

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data(res.eyefit.AuNEW)
str(res.eyefit.AuNEW)
```

```
res.eyefit.Ca_C
```

Result of the function eyefit for variogram estimation.

Description

This result could also be directly computed using the function eyefit.

Usage

```
data(res.eyefit.Ca_C)
```

Format

The format is: List of 1 \$:List of 7 ..\$ cov.model: chr "spherical" ..\$ cov.pars : num [1:2] 3.80e-01 1.92e+05 ..\$ nugget : num 0.21 ..\$ kappa : num 0.5 ..\$ lambda : num 0 ..\$ trend : chr "cte" ..\$ max.dist : num 192306 ..- attr(*, "class")= chr "variomodel" - attr(*, "class")= chr "eyefit"

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data(res.eyefit.Ca_C)
str(res.eyefit.Ca_C)
```

res.eyefit.Ca_O *Result of the function eyefit for variogram estimation.*

Description

This result could also be directly computed using the function eyefit.

Usage

```
data(res.eyefit.Ca_O)
```

Format

The format is: List of 1 \$:List of 7 ..\$ cov.model: chr "spherical" ..\$ cov.pars : num [1:2] 0.01 5341.85 ..\$ nugget : num 0.12 ..\$ kappa : num 0.5 ..\$ lambda : num 0 ..\$ trend : chr "cte" ..\$ max.dist : num 192306 ..- attr(*, "class")= chr "variomodel" - attr(*, "class")= chr "eyefit"

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data(res.eyefit.Ca_O)
str(res.eyefit.Ca_O)
```

```
res.eyefit.Hg_O
```

Result of the function eyefit for variogram estimation.

Description

This result could also be directly computed using the function eyefit.

Usage

```
data(res.eyefit.Hg_O)
```

Format

The format is: List of 1 \$:List of 7 ..\$ cov.model: chr "exponential" ..\$ cov.pars : num [1:2] 1.50e-02 3.21e+04 ..\$ nugget : num 0.04 ..\$ kappa : num 0.5 ..\$ lambda : num 0 ..\$ trend : chr "cte" ..\$ max.dist : num 288460 ..- attr(*, "class")= chr "variomodel" - attr(*, "class")= chr "eyefit"

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data(res.eyefit.Hg_O)
str(res.eyefit.Hg_O)
```

res.eyefit.Pb_01 *Result of the function eyefit for variogram estimation.*

Description

This result could also be directly computed using the function eyefit.

Usage

```
data(res.eyefit.Pb_01)
```

Format

The format is: List of 1 \$:List of 7 ..\$ cov.model: chr "spherical" ..\$ cov.pars : num [1:2] 1.90e-01 5.13e+05 ..\$ nugget : num 0.11 ..\$ kappa : num 0.5 ..\$ lambda : num 0 ..\$ trend : chr "cte" ..\$ max.dist : num 288460 ..- attr(*, "class")= chr "variomodel" - attr(*, "class")= chr "eyefit"

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data(res.eyefit.Pb_01)
str(res.eyefit.Pb_01)
```

res.eyefit.Pb_02 *Result of the function eyefit for variogram estimation.*

Description

This result could also be directly computed using the function eyefit.

Usage

```
data(res.eyefit.Pb_02)
```

Format

The format is: List of 1 \$:List of 7 ..\$ cov.model: chr "spherical" ..\$ cov.pars : num [1:2] 0.03 48076.64 ..\$ nugget : num 0.11 ..\$ kappa : num 0.5 ..\$ lambda : num 0 ..\$ trend : chr "cte" ..\$ max.dist : num 288460 ..- attr(*, "class")= chr "variomodel" - attr(*, "class")= chr "eyefit"

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data(res.eyefit.Pb_02)
str(res.eyefit.Pb_02)
```

rg.boxplot

Plot a Boxplot

Description

Plot a single horizontal boxplot, the default is a Tukey boxplot.

Usage

```
rg.boxplot(xx, xlab = deparse(substitute(xx)), log = FALSE, ifbw = FALSE,
wend = 0.05, xlim = NULL, main = " ", colr = 5, ...)
```

Arguments

| | |
|------|--|
| xx | data |
| xlab | label for the x-axis |
| log | if TRUE, a log-scaled plot and a logtransformation of the data |
| ifbw | if TRUE, a IDEAS style box-and-whisker plot is produced |
| wend | defines the end of the whisker, default is 5% and 95% quantile |
| xlim | setting xlim results in outliers not being plotted as the x-axis is shortened. |
| main | main title of the plot |
| colr | the box is infilled with a yellow ochre; if no colour is required set colr=0 |
| ... | further graphical parameters for the plot |

Details

As the x-axis is shortened by setting `xlim`, however, the statistics used to define the boxplot, or box-and-whisker plot, are still based on the total data set. To plot a truncated data set create a subset first, or use the `x[x<some.value]` construct in the call.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data(chorizon)
Ba=chorizon[, "Ba"]
rg.boxplot(Ba, ifbw=TRUE, colr=0, xlab="Ba [mg/kg]", cex.lab=1.2)
```

 rg.mva

Non-robust Multivariate Data Analysis

Description

Procedure to undertake non-robust multivariate data analysis. The saved list may be passed to other rotation and display functions

Usage

```
rg.mva(x, main = deparse(substitute(x)))
```

Arguments

| | |
|-------------------|-------------------|
| <code>x</code> | data |
| <code>main</code> | used for the list |

Details

Procedure to undertake non-robust multivariate data analyses; the object generated is identical to that of `rg.robmva` so that the saved list may be passed to other rotation and display functions. Thus weights are set to 1, and other variables are set to appropriate defaults. The estimation of Mahalanobis distances is only undertaken if `x` is nonsingular, i.e. the lowest eigenvalue is $> 10e-4$.

Value

| | |
|--------------|---|
| n | number of rows |
| p | number of columns |
| wts | the weights for the covariance matrix |
| mean | the mean of the data |
| cov | the covariance |
| sd | the standard deviation |
| r | correlation matrix |
| eigenvalues | eigenvalues of the SVD |
| econtrib | proportion of eigenvalues in % |
| eigenvectors | eigenvectors of the SVD |
| rload | loadings matrix |
| rchr | standardised loadings matrix |
| vcontrib | scores variance |
| pvcontrib | proportion of scores variance in % |
| cpvcontrib | cummulative proportion of scores variance |
| md | Mahalanbois distance |
| ppm | probability for outliegness using F-distribution |
| epm | probability for outliegness using Chisquared-distribution |

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
#input data
data(ohorizon)
vegzn=ohorizon[, "VEG_ZONE"]
veg=rep(NA,nrow(ohorizon))
veg[vegzn=="BOREAL_FOREST"] <- 1
veg[vegzn=="FOREST_TUNDRA"] <- 2
veg[vegzn=="SHRUB_TUNDRA"] <- 3
veg[vegzn=="DWARF_SHRUB_TUNDRA"] <- 3
veg[vegzn=="TUNDRA"] <- 3
el=c("Ag", "Al", "As", "B", "Ba", "Bi", "Ca", "Cd", "Co", "Cu", "Fe", "K", "Mg", "Mn",
      "Na", "Ni", "P", "Pb", "Rb", "S", "Sb", "Sr", "Th", "Tl", "V", "Y", "Zn")
x <- log10(ohorizon[!is.na(veg),el])
```

```
v <- veg[!is.na(veg)]
rg.mva(as.matrix(x[v==1,]))
```

 rg.mvalloc

Robust Multivariate Allocation Procedure

Description

Function to allocate an individual to one of several populations.

Usage

```
rg.mvalloc(pcrit = 0.05, x, ...)
```

Arguments

| | |
|-------|---|
| pcrit | When the probability of group membership is less than pcrit it is allocated to group 0. |
| x | contains the individuals to be allocated |
| ... | arguments for creating a list of groups |

Details

m objects are the reference populations generated by md.gait, rg.robmva or rg.mva to estimate Mahalanobis distances and predicted probabilities of group membership for individuals in matrix x. Note that the log |determinant| of the appropriate covariance matrix is added to the Mahalanobis distance on the assumption that the covariance matrices are inhomogeneous. If the data require transformation this must be undertaken before calling this function. This implies that a similar transformation must have been used for all the reference data subsets.

Value

| | |
|--------|--|
| groups | the groups |
| m | number of groups |
| n | number of individuals to be allocated |
| p | number of columns |
| pgm | number of individuals to be allocated multiplied with the groups |
| pcrit | critical probability |
| xalloc | number of individuals as integer |

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
#input data
data(ohorizon)
vegzn=ohorizon[, "VEG_ZONE"]
veg=rep(NA, nrow(ohorizon))
veg[vegzn=="BOREAL_FOREST"] <- 1
veg[vegzn=="FOREST_TUNDRA"] <- 2
veg[vegzn=="SHRUB_TUNDRA"] <- 3
veg[vegzn=="DWARF_SHRUB_TUNDRA"] <- 3
veg[vegzn=="TUNDRA"] <- 3
el=c("Ag", "Al", "As", "B", "Ba", "Bi", "Ca", "Cd", "Co", "Cu", "Fe", "K", "Mg", "Mn",
      "Na", "Ni", "P", "Pb", "Rb", "S", "Sb", "Sr", "Th", "Tl", "V", "Y", "Zn")
x <- log10(ohorizon[!is.na(veg), el])
v <- veg[!is.na(veg)]

res.zone1=rg.mva(as.matrix(x[v==1,]))
res.zone2=rg.mva(as.matrix(x[v==2,]))
res.zone3=rg.mva(as.matrix(x[v==3,]))
res=rg.mvalloc(pcrit=0.01, x, res.zone1, res.zone2, res.zone3)
```

rg.remove.na

Remove NA

Description

Function to remove NAs from a vector and inform the user of how many.

Usage

```
rg.remove.na(xx)
```

Arguments

xx vector

Details

The function counts the NAs in a vector and returns the number of NAs and the "new" vector.

Value

x vector without the NAs
 nna number of NAs removed

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
x<-rep(NA,10)
x[c(1,3,5,7,9)]<-10
rg.remove.na(x)
```

rg.robmva

Robust Multivariate Analysis

Description

Procedure for multivariate analysis using the minimum volume ellipsoid (MVE), minimum covariance determinant (MCD) or a supplied set of 0-1 weights.

Usage

```
rg.robmva(x, proc = "mcd", wts = NULL, main = deparse(substitute(x)))
```

Arguments

| | |
|------|--|
| x | data |
| proc | procedure for the estimation (MVE or MCD) |
| wts | if proc=NULL, the supplied weights for the calculation |
| main | input for the list |

Details

cov.mcd is limited to a maximum of 50 variables. Both of these procedures lead to a vector of 0-1 weights and mcd is the default. A set of weights can be generated by using Graphical Adaptive Interactive Trimming (GAIT) procedure available through `rg.md.gait()`. Using 0-1 weights the parameters of the background distribution are estimated by `cov.wt()`. A robust estimation of the Mahalanobis distances is made for the total data set but is only undertaken if x is non-singular (lowest eigenvalue is >10e-4).

Value

| | |
|--------------|---|
| n | number of rows |
| p | number of columns |
| wts | the weights for the covariance matrix |
| mean | the mean of the data |
| cov | the covariance |
| sd | the standard deviation |
| r | correlation matrix |
| eigenvalues | eigenvalues of the SVD |
| econtrib | proportion of eigenvalues in % |
| eigenvectors | eigenvectors of the SVD |
| rload | loadings matrix |
| rchr | standardised loadings matrix |
| vcontrib | scores variance |
| pvcontrib | proportion of scores variance in % |
| cpvcontrib | cummulative proportion of scores variance |
| md | Mahalanbois distance |
| ppm | probability for outlierness using F-distribution |
| epm | probability for outlierness using Chisquared-distribution |

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
#input data
data(ohorizon)
vegzn=ohorizon[, "VEG_ZONE"]
veg=rep(NA,nrow(ohorizon))
veg[vegzn=="BOREAL_FOREST"] <- 1
veg[vegzn=="FOREST_TUNDRA"] <- 2
veg[vegzn=="SHRUB_TUNDRA"] <- 3
veg[vegzn=="DWARF_SHRUB_TUNDRA"] <- 3
veg[vegzn=="TUNDRA"] <- 3
el=c("Ag", "Al", "As", "B", "Ba", "Bi", "Ca", "Cd", "Co", "Cu", "Fe", "K", "Mg", "Mn",
      "Na", "Ni", "P", "Pb", "Rb", "S", "Sb", "Sr", "Th", "Tl", "V", "Y", "Zn")
x <- log10(ohorizon[!is.na(veg),el])
```

```
v <- veg[!is.na(veg)]
subvar=c("Ag", "B", "Bi", "Mg", "Mn", "Na", "Pb", "Rb", "S", "Sb", "Tl")
set.seed(100)

rg.robmva(as.matrix(x[v==1, subvar]))
```

 rg.wtdsums

Calculate Weighted Sums for a Matrix

Description

This function computes a weighted sum for a matrix based on computed quantiles and user defined relative importance.

Usage

```
rg.wtdsums(x, ri, xcentr = NULL, xdisp = NULL)
```

Arguments

| | |
|--------|--|
| x | matrix |
| ri | vector for the relative importance, length(ri)=length(x[1,]) |
| xcentr | the provided center |
| xdisp | the provided variance |

Details

It is not necessary to provide the center and the variance. If those values are not supplied the center is the 50% quantile and the variance is calculated from the 25% and 75% quantile.

Value

| | |
|-------|---|
| input | input parameter |
| centr | the center |
| disp | the variance |
| ri | relative importance |
| w | weights |
| a | normalized weights |
| ws | normalized weights times standardized x |

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data(chorizon)
var=c("Si_XRF", "Al_XRF", "K_XRF", "LOI", "P", "Mn")
ri=c(-2.0, 1.5, 2.0, 2.0, 3.0, 2.0)
x=chorizon[,var]
rg.wtdsums(x,ri)
```

RobCor.plot

Compares the Robust Estimation with the Classical

Description

This function compares a robust covariance (correlation) estimation (MCD is used) with the classical approach. A plot with the two ellipses will be produced and the correlation coefficients are quoted.

Usage

```
RobCor.plot(x, y, quan = 1/2, alpha = 0.025, colC = 1, colR = 1, ltyC = 2,
ltyR = 1, ...)
```

Arguments

| | |
|-------------------------|---|
| <code>x, y</code> | two data vectors where the correlation should be computed |
| <code>quan</code> | fraction of tolerated outliers (at most 0.5) |
| <code>alpha</code> | quantile of chisquare distribution for outlier cutoff |
| <code>colC, colR</code> | colour for both ellipses |
| <code>ltyC, ltyR</code> | line type for both ellipses |
| <code>...</code> | other graphical parameters |

Details

The covariance matrix is estimated in a robust (MCD) and non robust way and then both ellipses are plotted. The radii is calculated from the singular value decomposition and a breakpoint (specified quantile) for outlier cutoff.

Value

| | |
|----------------------|---|
| <code>cor.cla</code> | correlation of the classical estimation |
| <code>cor.rob</code> | correlation of the robust estimation |

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data(chorizon)
Be=chorizon["Be"]
Sr=chorizon["Sr"]
RobCor.plot(log10(Be),log10(Sr),xlab="Be in C-horizon [mg/kg]",
ylab="Sr in C-horizon [mg/kg]",cex.lab=1.2, pch=3, cex=0.7,
xaxt="n", yaxt="n",colC=1,colR=1,ltyC=2,ltyR=1)
```

roundpretty

Roundpretty

Description

Round a value in a pretty way.

Usage

```
roundpretty(kvec, maxdig)
```

Arguments

| | |
|--------|---|
| kvec | the variable to be rounded |
| maxdig | maximum number of digits after the coma |

Value

| | |
|--------|---------------|
| result | rounded value |
|--------|---------------|

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

See Also

[roundpretty.sub](#)

Examples

```
roundpretty(0.873463029, 5)
roundpretty(0.073463029, 5)
roundpretty(0.003463029, 5)
roundpretty(0.000463029, 5)
```

roundpretty.sub *Subfunction for Roundpretty*

Description

This function rounds the number in pretty way.

Usage

```
roundpretty.sub(k, maxdig)
```

Arguments

| | |
|--------|---|
| k | number to be rounded pretty |
| maxdig | maximum number of digits after the coma |

Details

When maxdig is larger than 8 and the number is smaller than 0.00001, the number is rounded to 8 numbers after the coma. When the number is smaller than 0.0001 the maximum numbers after the coma is 7, and so on.

Value

| | |
|----|---------------|
| kr | rounded value |
|----|---------------|

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

See Also

[roundpretty](#)

scalebar

Scalebar

Description

This function plots the unit at a specified location.

Usage

```
scalebar(Xlowerleft, Ylowerleft, Xupperright, Yupperright, shifttext, shiftkm,
sizetext)
```

Arguments

| | |
|---|---|
| <code>Xlowerleft</code> , <code>Ylowerleft</code> | x and y coordinate of the lower left corner |
| <code>Xupperright</code> , <code>Yupperright</code> | x and y coordinate of the upper corner |
| <code>shifttext</code> | on which margin line, starting at 0 counting outwards |
| <code>shiftkm</code> | how far from the last point the label should be written |
| <code>sizetext</code> | expansion factor for the text |

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
plot.new()
scalebar(0, 0.25, 1, 0.5, shifttext=-0.05, shiftkm=4e4, sizetext=0.8)
```

scatter3dPETER *3D plot of a Regression Model*

Description

This function makes a 3D plot of the data and the regression function. The user has the choice between different methods to calculate the coefficients for the regression model.

Usage

```
scatter3dPETER(x, y, z, xlab = deparse(substitute(x)),
ylab = deparse(substitute(y)), zlab = deparse(substitute(z)),
revolutions = 0, bg.col = c("white", "black"),
axis.col = if (bg.col == "white") "black" else "white",
surface.col = c("blue", "green", "orange", "magenta", "cyan", "red",
"yellow", "gray"), neg.res.col = "red",
pos.res.col = "green", point.col = "yellow", text.col = axis.col,
grid.col = if (bg.col == "white") "black" else "gray",
fogtype = c("exp2", "linear", "exp", "none"),
residuals = (length(fit) == 1), surface = TRUE, grid = TRUE,
grid.lines = 26, df.smooth = NULL, df.additive = NULL, sphere.size = 1,
threshold = 0.01, speed = 1, fov = 60, fit = "linear", groups = NULL,
parallel = TRUE, model.summary = FALSE)
```

Arguments

| | |
|---|--|
| <code>x, y, z</code> | the coordinates for the points |
| <code>xlab, ylab, zlab</code> | the labels for the axis |
| <code>revolutions</code> | if the plot should be viewed from different angles |
| <code>bg.col, axis.col, surface.col, point.col, text.col, grid.col</code> | define the colour for the background, axis,... |
| <code>pos.res.col, neg.res.col</code> | colour for positive and negativ residuals |
| <code>fogtype</code> | describes the fogtype, see <code>rgl.bg</code> |
| <code>residuals</code> | if the residuals should be plotted |
| <code>surface</code> | if the regression function should be plotted or just the points |
| <code>grid</code> | if TRUE, the grid is plotted |
| <code>grid.lines</code> | number of lines in the grid |
| <code>df.smooth</code> | if <code>fit=smooth</code> , the number of degrees of freedom |
| <code>df.additive</code> | if <code>fit=additive</code> , the number of degrees of freedom |
| <code>sphere.size</code> | a value for calibrating the size of the sphere |
| <code>threshold</code> | the minimum size of the sphere, if the size is smaller than the threshold a point is plotted |

| | |
|---------------|--|
| speed | if revolutions>0, how fast you make a 360 degree turn |
| fov | field-of-view angle, see rgl.viewpoint |
| fit | which method should be used for the model; "linear", "quadratic", "smooth" or "additive" |
| groups | define groups for the points |
| parallel | if groups is not NULL, a parallel shift in the model is made |
| model.summary | if the summary should be returned |

Details

The user can choose between a linear, quadratic, smoothed or additive model to calculate the coefficients.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
#required library
#require(IPSUR)
data(chorizon)
lit=1
# This example needs additional libraries:
#scatter3dPETER(x=log10(chorizon[chorizon$LITO==lit,"Cr"]),
#               z=log10(chorizon[chorizon$LITO==lit,"Cr_INAA"]),
#               y=log10(chorizon[chorizon$LITO==lit,"Co"]),
#               xlab="",ylab="",zlab="",
#               neg.res.col=gray(0.6), pos.res.col=gray(0.1), point.col=1, fov=30,
#               surface.col="black",grid.col="gray",sphere.size=0.8)
```

Description

Plots smoothing maps and legend based on continuous or percentile scale.

Usage

```
SmoothLegend(X, Y, z, resol = 200, type = "percentile", whichcol = "gray",
  qutiles = c(0, 0.05, 0.25, 0.5, 0.75, 0.9, 0.95, 1), borders=NULL, leg.xpos.min = 7
  leg.xpos.max = 8e+05, leg.ypos.min = 7760000, leg.ypos.max = 7870000,
  leg.title = "mg/kg", leg.title.cex = 0.7, leg.numb.cex = 0.7, leg.round = 2,
  leg.wid = 4, leg.numb.xshift = 70000, leg.perc.xshift = 40000,
  leg.perc.yshift = 20000, tit.xshift = 35000)
```

Arguments

| | |
|-----------------|--|
| X | X-coordinates |
| Y | Y-coordinates |
| z | values on the coordinates |
| resol | resolution of smoothing |
| type | "percentile" for percentile legend; "contin" for continuous grey-scale or colour map |
| whichcol | type of color scheme to use: "grey", "rainbow", "rainbow.trunc", "rainbow.inv", "terrain" or "topo" |
| qutiles | considered quantiles if type="percentile" is used |
| borders | either NULL or character string with the name of the list with list elements x and y for x- and y-coordinates of map borders |
| leg.xpos.min | minimum value of x-position of the legend |
| leg.xpos.max | maximum value of x-position of the legend |
| leg.ypos.min | minimum value of y-position of the legend |
| leg.ypos.max | maximum value of y-position of the legend |
| leg.title | title for legend |
| leg.title.cex | cex for legend title |
| leg.numb.cex | cex for legend numbers |
| leg.round | round legend to specified digits "pretty" |
| leg.wid | width (space in numbers) for legend |
| leg.numb.xshift | x-shift of numbers in legend relative to leg.xpos.max |
| leg.perc.xshift | x-shift of "Percentile" in legend relative to leg.xpos.min |
| leg.perc.yshift | y-shift of "Percentile" in legend relative to leg.ypos.max |
| tit.xshift | x-shift of title in legend relative to leg.xpos.max |

Details

First a interpolation is applied using different versions of algorithms from Akima and then all points a distinguished into inside an outside the polygonal region. Now the empirical quantiles for points inside the polygon are computed and then the values are plotted in different scales of the choosen colour. ATTENTION: here borders were defined for the smoothing region

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data(chorizon)
X=chorizon[, "XCOO"]
Y=chorizon[, "YCOO"]
el=log10(chorizon[, "As"])

# generate plot
plot(X,Y,frame.plot=FALSE,xaxt="n",yaxt="n",xlab="",ylab="",type="n")

data(bordersKola) # list with list elements x and y for x- and y-coordinates of map borders
SmoothLegend(X,Y,el,resol=200,type="contin",whichcol="gray",
  qutiles=c(0,0.05,0.25,0.50,0.75,0.90,0.95,1), borders="bordersKola",
  leg.xpos.min=7.8e5,leg.xpos.max=8.0e5,leg.ypos.min=77.6e5,leg.ypos.max=78.7e5,
  leg.title="mg/kg", leg.title.cex=0.7, leg.numb.cex=0.7, leg.round=2,leg.wid=4,
  leg.numb.xshift=0.7e5,leg.perc.xshift=0.4e5,leg.perc.yshift=0.2e5,tit.xshift=0.35e5)

# plot background
data(kola.background)
plotbg(map.col=c("gray","gray","gray","gray"),map.lwd=c(1,1,1,1),add.plot=TRUE)
```

suns

Plot Suns

Description

This function makes a graphical diagram of multivariate data. Every element represents one line in the sun and the length of the line indicates the concentration of the element.

Usage

```
suns(x, full = TRUE, scale = TRUE, radius = TRUE, labels = dimnames(x)[[1]],
  locations = NULL, nrow = NULL, ncol = NULL, len = 1, key.loc = NULL,
  key.labels = dimnames(x)[[2]], key.xpd = TRUE, xlim = NULL, ylim = NULL,
  flip.labels = NULL, col.stars = NA, axes = FALSE, frame.plot = axes, main = NULL,
  sub = NULL, xlab = "", ylab = "", cex = 0.8, lwd = 0.25, lty = par("lty"),
  xpd = FALSE,
  mar = pmin(par("mar"), 1.1 + c(2 * axes + (xlab != ""), 2 * axes + (ylab != ""), 1,
  add = FALSE, plot = TRUE, ...)
```

Arguments

| | |
|--|--|
| <code>x</code> | a matrix or a data frame |
| <code>full</code> | if TRUE, a whole circle will be made |
| <code>scale</code> | if TRUE, the data will be scaled |
| <code>radius</code> | should be TRUE, otherwise the lines in the sun will not be plotted |
| <code>labels</code> | the labels for the suns inside the map |
| <code>locations</code> | the locations for the suns inside the map |
| <code>nrow, ncol</code> | integers giving the number of rows and columns to use when locations=NULL |
| <code>len</code> | scaling factor for the length of the lines (according to the size of the map) |
| <code>key.loc</code> | the location for the legend |
| <code>key.labels</code> | the labels in the legend |
| <code>key.xpd</code> | A logical value or NA. If FALSE, all plotting is clipped to the plot region, if TRUE, all plotting is clipped to the figure region, and if NA, all plotting is clipped to the device region. |
| <code>flip.labels</code> | logical indication if the label locations should flip up and down from diagram to diagram. |
| <code>axes</code> | if FALSE, no axes will be drawn |
| <code>frame.plot</code> | if TRUE, a box will be made around the plot |
| <code>main, sub, xlab, xlim, ylim, col.stars, ylab, cex, lwd, lty, xpd, mar</code> | graphical parameters and labels for the plot |
| <code>add</code> | if TRUE, it will be added to the plot |
| <code>plot</code> | nothing is plotted |
| <code>...</code> | graphical parameters for plotting the box |

Details

Each sun represents one row of the input `x`. Each line of the sun represents one chosen element. The distance from the center of the sun to the point shows the size of the value of the (scaled) column.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```

data(ohorizon)
X=ohorizon[, "XCOO"]
Y=ohorizon[, "YCOO"]
el=log10(ohorizon[, c("Co", "Cu", "Ni", "Rb", "Bi", "Na", "Sr")])

sel <- c(3,8,22, 29, 32, 35, 43, 69, 73 ,93,109,129,130,134,168,181,183,205,211,
        218,237,242,276,292,297,298,345,346,352,372,373,386,408,419,427,441,446,490,
        516,535,551,556,558,564,577,584,601,612,617)
x=el[sel,]
suns(x, ncol=8, key.loc=c(15,0.5), lwd=1.3)

```

SymbLegend

*Plot Legend***Description**

Plots symbols and Legend on a map. There are two different methods (percentile symbols or boxplot symbols) to display the legend.

Usage

```

SymbLegend(X, Y, z, type = "percentile", qtiles = c(0, 0.05, 0.25, 0.75, 0.95, 1),
q = NULL, symbtype = "EDA", symbmagn = 0.8, leg.position = "topright",
leg.title = "", leg.title.cex = 0.8, leg.round = 2, leg.wid = 4, leg.just = "right",
cex.scale = 0.8, xf = 9000, logscale = TRUE, accentuate = FALSE)

```

Arguments

| | |
|---------------|--|
| X | X-coordinates |
| Y | Y-coordinates |
| z | values on the coordinates |
| type | "percentile" for percentile legend, "boxplot" for boxplot legend |
| qtiles | considered quantiles if type="percentile" is used |
| q | if not NULL, provide manually data points where to break |
| symbtype | type of symbols to be used; "EDA", "EDAacc", "EDAacc2", "EDAext", "GSC" or "arbit" |
| symbmagn | magnification factor for symbols |
| leg.position | position of the legend, either character like "topright" or coordinates |
| leg.title | title for legend |
| leg.title.cex | cex for legend |
| leg.round | round legend to specified digits "pretty" |
| leg.wid | width (space in numbers) for legend |

| | |
|-------------------------|---|
| <code>leg.just</code> | how to justify the legend |
| <code>cex.scale</code> | cex for text "log-scale" and for boxplot legend - only for type="boxplot" |
| <code>xf</code> | x-distance from boxplot to number for legend |
| <code>logscale</code> | if TRUE a log scale is used (for boxplot scale) and the log-boxplot is computed |
| <code>accentuate</code> | if TRUE, accentuated symbols are used (here only EDA accentuated!) |

Details

It is possible to choose between different methods for calculating the range of the values for the different symbols.

If type="percentile" the pre-determined quantiles of the data are computed and are used to plot the symbols. If type="boxplot" a boxplot is computed and the values were taken to group the values for the plot and the legend. In the case that a log scale is used the function boxplotlog is used instead of boxplot.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data(chorizon)
data(kola.background)
el=chorizon[, "As"]
X=chorizon[, "XCOO"]
Y=chorizon[, "YCOO"]

plot(X,Y,frame.plot=FALSE,xaxt="n",yaxt="n",xlab="",ylab="",type="n")
plotbg(map.col=c("gray","gray","gray","gray"),add.plot=TRUE)

SymbLegend(X,Y,el,type="percentile",quiles<-c(0,0.05,0.25,0.75,0.95,1),symbtype="EDA",
symbmagn=0.8,leg.position="topright",leg.title="As [mg/kg]",leg.title.cex=0.8,leg.round=2,
leg.wid=4,leg.just="right")
```

ternary

Ternary plot

Description

This plot shows the relative proportions of three variables in one diagramm. It is important that the proportion sum up to 100% and if the values of the variables are very different it is important to scale them to the same data range.

Usage

```
ternary(x, nam = NULL, grid = FALSE, ...)
```

Arguments

| | |
|------|---------------------------------------|
| x | matrix with 3 columns |
| nam | names of the variables |
| grid | if TRUE the grid should be plotted |
| ... | further graphical parameters, see par |

Details

The relative proportion of each variable is computed and those points are plotted into the graphic.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data(moss)
x=moss[,c("Ni", "Cu", "Pb")]
ternary(x, grid=TRUE, pch=3, cex=0.7, col=1)
```

timetrend

Data for computing time trends

Description

These are time trends from the Kola Project data.

Usage

```
data(timetrend)
```

Format

A data frame with 96 observations on the following 47 variables.

DD a numeric vector

MM a numeric vector

YY a numeric vector

Year a numeric vector

Catch a numeric vector

X.ID a numeric vector

Ag a numeric vector

Al a numeric vector

As a numeric vector

B a numeric vector

Ba a numeric vector

Be a numeric vector

Bi a numeric vector

Cd a numeric vector

Co a numeric vector

Cr a numeric vector

Cu a numeric vector

Fe a numeric vector

K a numeric vector

Li a numeric vector

Mn a numeric vector

Mo a numeric vector

Ni a numeric vector

Pb a numeric vector

Rb a numeric vector

Sb a numeric vector

Se a numeric vector

Sr a numeric vector

Th a numeric vector

Tl a numeric vector

U a numeric vector

V a numeric vector

Zn a numeric vector

Ca a numeric vector

Mg a numeric vector

Na a numeric vector
P a numeric vector
S a numeric vector
Si a numeric vector
PO4 a numeric vector
Br a numeric vector
Cl a numeric vector
F a numeric vector
NO3 a numeric vector
SO4 a numeric vector
pH a numeric vector
EC a numeric vector

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

Source

Kola Project (1993-1998)

References

Reimann C, Äyräs M, Chekushin V, Bogatyrev I, Boyd R, Caritat P de, Dutter R, Finne TE, Halleraker JH, Jæger Ø, Kashulina G, Lehto O, Niskavaara H, Pavlov V, Räisänen ML, Strand T, Volden T. Environmental Geochemical Atlas of the Central Barents Region. NGU-GTK-CKE Special Publication, Geological Survey of Norway, Trondheim, Norway, 1998.

Examples

```
data(timetrend)
str(timetrend)
```

topsoil

topsoil layer of the Kola Data

Description

The Kola Data were collected in the Kola Project (1993-1998, Geological Surveys of Finland (GTK) and Norway (NGU) and Central Kola Expedition (CKE), Russia). More than 600 samples in five different layers were analysed, this dataset contains the C-horizon.

Usage

```
data(topsoil)
```

Format

A data frame with 607 observations on the following 45 variables.

ID a numeric vector

XCOO a numeric vector

YCOO a numeric vector

ELEV a numeric vector

COUN a factor with levels FIN NOR RUS

ASP a factor with levels E FLAT N NE NW NW S SE SW W

TOPC a numeric vector

LITO a numeric vector

Ac_228 a numeric vector

As a numeric vector

Au a numeric vector

Ba a numeric vector

Bi_214 a numeric vector

Br a numeric vector

Ca a numeric vector

Ce a numeric vector

Co a numeric vector

Cr a numeric vector

Cs a numeric vector

Cs_137 a numeric vector

EC a numeric vector

Eu a numeric vector

Fe a numeric vector

Hf a numeric vector

Hg a numeric vector

K_40 a numeric vector

La a numeric vector

LOI a numeric vector

Lu a numeric vector

Mo a numeric vector

Na a numeric vector

Nd a numeric vector

Ni a numeric vector
pH a numeric vector
Rb a numeric vector
Sb a numeric vector
Sc a numeric vector
Sm a numeric vector
Sr a numeric vector
Tb a numeric vector
Th a numeric vector
U a numeric vector
W a numeric vector
Yb a numeric vector
Zn a numeric vector

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

Source

Kola Project (1993-1998)

References

Reimann C, Åyräs M, Chekushin V, Bogatyrev I, Boyd R, Caritat P de, Dutter R, Finne TE, Halleraker JH, Jæger Ø, Kashulina G, Lehto O, Niskavaara H, Pavlov V, Räsänen ML, Strand T, Volden T. Environmental Geochemical Atlas of the Central Barents Region. NGU-GTK-CKE Special Publication, Geological Survey of Norway, Trondheim, Norway, 1998.

Examples

```
data(topsoil)  
str(topsoil)
```

tree

*Plot Trees***Description**

This function makes a graphical diagram of multivariate data. Every element represents one branch of the tree and the length of the branch indicates the concentration of the element.

Usage

```
tree(x, wmax = 0, wmin = 0, lh = 1, labels = dimnames(x)[[1]], locations = NULL,
     nrow = NULL, ncol = NULL, key.loc = NULL, key.labels = dimnames(x)[[2]],
     key.xpd = TRUE, xlim = NULL, ylim = NULL, flip.labels = NULL, len = 1,
     leglen = 1, leglh = 1, axes = FALSE, frame.plot = axes, main = NULL, sub = NULL,
     xlab = "", ylab = "", cex = 0.8, lwd = 0.25, lty = par("lty"), xpd = FALSE,
     mar = pmin(par("mar"), 1.1 + c(2 * axes + (xlab != ""), 2 * axes + (ylab != "")),
     1, 0)), add = FALSE, plot = TRUE, ...)
```

Arguments

| | |
|---------------------------------|---|
| <code>x</code> | multivariate data in form of matrix or data frame |
| <code>wmax, wmin</code> | maximum and minimum angle for the leaves of the tree |
| <code>lh</code> | multiplier for height |
| <code>labels</code> | vector of character strings for labeling the plots |
| <code>locations</code> | locations for the boxes on the plot (e.g. X/Y coordinates) |
| <code>nrow, ncol</code> | integers giving the numbers of rows and columns to use when location=NULL. By default, 'nrow==ncol', a square layout will be used. |
| <code>key.loc</code> | vector with x and y coordinates of the unit key. |
| <code>key.labels</code> | vector of character strings for labeling the segments of the unit key. If omitted, the second component of 'dimnames(x)' is used, if available. |
| <code>key.xpd</code> | clipping switch for the unit key (drawing and labelin), see 'par("xpd")' |
| <code>xlim</code> | vector with the range of x coordinates to plot |
| <code>ylim</code> | vector with the range of y coordinates to plot |
| <code>flip.labels</code> | logical indication if the label locations should flip up and down from diagram to diagram. Defaults to a somewhat smart heuristic. |
| <code>len, leglen, leglh</code> | multiplicative values for the space of the labels on the legend |
| <code>axes</code> | logical, if TRUE axes are added to the plot |
| <code>frame.plot</code> | if TRUE the plot region is framed |
| <code>main</code> | a main title for the plot |
| <code>sub</code> | a sub title for the plot |
| <code>xlab</code> | a label for the x-axis |

| | |
|------|---|
| ylab | a label for the y-axis |
| cex | character expansion factor for the labels |
| lwd | line width used for drawing |
| lty | line type used for drawing |
| xpd | logical or NA indicating if clipping should be done, see 'par(mar=*)' |
| mar | argument to 'par(mar=*)', typically choosing smaller margins than by default. |
| add | if TRUE add boxes to current plot |
| plot | if FALSE nothing is plotted |
| ... | further arguments, passed to the first call of 'plot()', see 'plot.default' |

Details

Each tree represents one row of the input x. Each branch of the tree represents one chosen element and the length of the branches shows the value of the variable. The different concentrations of each row in x is displayed by the shape of the tree.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
data(ohorizon)
X=ohorizon[, "XCOO"]
Y=ohorizon[, "YCOO"]
el=log10(ohorizon[,c("Co", "Cu", "Ni", "Rb", "Bi", "Na", "Sr")])
sel <- c(3,8,22, 29, 32, 35, 43, 69, 73 ,93,109,129,130,134,168,181,183,205,211,
        218,237,242,276,292,297,298,345,346,352,372,373,386,408,419,427,441,446,490,
        516,535,551,556,558,564,577,584,601,612,617)
x=el[sel,]

tree(x, key.loc=c(15,0), len=0.022, lh=30, leglh=4,
      wmax=120, wmin=30, leglen=0.05, ncol=8, cex=0.75)
```

UComponent-class *Class "UComponent"*

Description

To allow Component slots be also NULL

Objects from the Class

A virtual Class: No objects may be created from it.

Methods

No methods defined with class "UComponent" in the signature.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
showClass("UComponent")
```

varcomp *Variance Components*

Description

This function estimates the variance components for ANOVA.

Usage

```
varcomp(a1, a2, f1, f2)
```

Arguments

a1, a2 analytical duplicates
f1, f2 field duplicates

Value

pct.regional percentage of regional variability
pct.site percentage at site variability
pct.analytical percentage of analytical variability
pval p-value

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

Examples

```
# field duplicates:
data(CHorFieldDUP)
xfield1=CHorFieldDUP[,5:98]
xfield2=CHorFieldDUP[,99:192]

# analytical duplicates:
data(CHorANADUP)
xanal1=CHorANADUP[,3:96]
xanal2=CHorANADUP[,97:190]

varcomp(xanal1[,1],xanal2[,1],xfield1[,1],xfield2[,1])
```

varioCalc

Variogram Calculation

Description

This function calculates (and plots) a variogram.

Usage

```
varioCalc(X, Y, el, max.dist = 300, title = "", km = TRUE, plot = TRUE)
```

Arguments

| | |
|----------|---|
| X | X-coordinate |
| Y | Y-coordinate |
| el | vector or matrix with data values |
| max.dist | a numerical value defining the maximum distance for the variogram. All pairs of locations separated for a distance larger than this value are ignored in the variogram calculation. |
| title | title for the plot |
| km | if TRUE the distances are given in km, otherwise the unit is m |
| plot | if TRUE the variogram is plotted, otherwise only the parameters are returned |

Details

A omnivariogram, E-W and N-S variogram is calculated and then the results are plotted.

Value

vario.b a omnidirectional variogram

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> <http://www.statistik.tuwien.ac.at/public/filz/>

References

C. Reimann, P. Filzmoser, R.G. Garrett, and R. Dutter: Statistical Data Analysis Explained. Applied Environmental Statistics with R. John Wiley and Sons, Chichester, 2008.

See Also

[variog](#)

Examples

```
data(ohorizon)
X=ohorizon[, "XCOO"]
Y=ohorizon[, "YCOO"]
vario.b=varioCalc(X, Y, el=ohorizon[, "Hg"], max.dist=300000, title=paste("Hg", "in O-horizon"),
km=FALSE)
```

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