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Depends R (>= 2.10), methods, sgeostat

Imports cluster, e1071, MASS, MBA, mgcv, rgl, robustbase, xtable, sp, geoR

Suggests mclust

Description Several tools are provided for the statistical analysis of environmental data.

License GPL (>= 3)

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NeedsCompilation no

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R topics documented:

`arw` *Adaptive reweighted estimator for multivariate location and scatter*

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://cstat.tuwien.ac.at/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://cstat.tuwien.ac.at/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://cstat.tuwien.ac.at/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 B-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://cstat.tuwien.ac.at/filz/

Source

Kola Project (1993-1998)

References

Reimann C, ?yr?s M, Chekushin V, Bogatyrev I, Boyd R, Caritat P de, Dutter R, Finne TE, Halleraker JH, J?ger ?, Kashulina G, Lehto O, Niskavaara H, Pavlov V, R?is?nen 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` *Borders of the Kola Project boundary*

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 corrdinates 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://cstat.tuwien.ac.at/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 *Boxes*

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

x	multivariate data in form of matrix or data frame
xA	assignment of clusters to the coordinates of the boxes
yA	assignment of clusters to the coordinates of the boxes
zA	assignment of clusters to the coordinates of the boxes
labels	vector of character strings for labeling the plots
locations	locations for the boxes on the plot (e.g. X/Y coordinates)
nrow	integers giving the number of rows ands columns to use when 'locations' is 'NULL'. By default, 'nrow == ncol', a square will be used.
ncol	integers giving the number of rows and columns to use when 'locations' is 'NULL'. By default, 'nrow == ncol', a square will be used.
key.loc	vector with x and y coordinates of the unit key.
key.labels	vector of character strings for labeling the segments of the unit key. If omitted, the second component of 'dimnames(x)' ist used, if available.
key.xpd	clipping switch for the unit key (drawing and labeling), see 'par("xpd")'.
xlim	vector with the range of x coordinates to plot
ylim	vector with the range of y coordinates to plot
flip.labels	logical indicating if the label locations should flip up and down from diagram to diagram. Defaults to a somewhat smart heuristic.
len	multiplicative values for the space used in the plot window

leglen	multiplicative values for the space of the labels on the legend
axes	logical flag: if 'TRUE' axes are added to the plot
frame.plot	logical flag: if 'TRUE', the plot region ist framed
main	a main title for the plot
sub	a sub title for the plot
xlab	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 indicationg if clipping should be done, see 'par(xpd=.)'
mar	argument to 'par(mar=*)', rypically choosing smaller margings 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 hierarchicla cluster is complete linkage. Each cluster represents one side of the boxes.

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> http://cstat.tuwien.ac.at/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://cstat.tuwien.ac.at/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://cstat.tuwien.ac.at/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://cstat.tuwien.ac.at/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)
```

`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://cstat.tuwien.ac.at/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 background
```

```
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=0.80)
```

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://cstat.tuwien.ac.at/filz/

Source

Kola Project (1993-1998)

References

Reimann C, ?yr?s M, Chekushin V, Bogatyrev I, Boyd R, Caritat P de, Dutter R, Finne TE, Halleraker JH, J?ger ?, Kashulina G, Lehto O, Niskavaara H, Pavlov V, R?is?nen 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 M?VG MLRJARP MLRJSRR MLRM?DR OJGKTV RPAV RPMLRJA RPVM Semenov Smirnov VGM?

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. 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..CGML B..CH B.CO.GM B.CRCHMO.LIN B.CRGRMARMO.LI B.CRMO 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.M C.O.MLP CR.B.LI CR.LINMO H..BML H.L.BCM L..BMO L.BO.CM L.H.BM LIN.CR.LI M.BC.GL M..BCL M.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_Al2O3.1 a numeric vector

F1_Al2O3.2 a numeric vector

F2_Al2O3.1 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)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> http://cstat.tuwien.ac.at/filz/

Source

Kola Project (1993-1998)

References

Reimann C, ?yr?s M, Chekushin V, Bogatyrev I, Boyd R, Caritat P de, Dutter R, Finne TE, Halleraker JH, J?ger ?, Kashulina G, Lehto O, Niskavaara H, Pavlov V, R?is?nen 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)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> http://cstat.tuwien.ac.at/filz/

Source

Kola Project (1993-1998)

References

Reimann C, ?yr?s M, Chekushin V, Bogatyrev I, Boyd R, Caritat P de, Dutter R, Finne TE, Halleraker JH, J?ger ?, Kashulina G, Lehto O, Niskavaara H, Pavlov V, R?is?nen 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://cstat.tuwien.ac.at/filz/

Source

Kola Project (1993-1998)

References

Reimann C, ?yr?s M, Chekushin V, Bogatyrev I, Boyd R, Caritat P de, Dutter R, Finne TE, Halleraker JH, J?ger ?, Kashulina G, Lehto O, Niskavaara H, Pavlov V, R?is?nen 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)
```

---

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 logarithmis data transformation for the interpolation

ifrev	if FALSE the empirical function ist 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.logfinetick	how fine are the tick marks on log-scale on x-axis
y.logfinetick	how fine are the tick marks on log-scale on y-axis
ifjit	default value is FALSE
ncp	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 ist 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://cstat.tuwien.ac.at/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, concareaExampleKola

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))
concarea(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))
```

concareaExampleKola *Concentration Area Plot for Kola data example*

Description

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

Usage

```
concareaExampleKola(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 logarithmis data transformation for the interpolation
ifrev	if FALSE the empirical function ist 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.logfinetick	how fine are the tick marks on log-scale on x-axis
y.logfinetick	how fine are the tick marks on log-scale on y-axis
ifjit	default value is FALSE
ncp	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 ist 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://cstat.tuwien.ac.at/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, concarea, 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))
concareaExampleKola(X,Y,Cu,log=TRUE,zname="Cu in O-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://cstat.tuwien.ac.at/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://cstat.tuwien.ac.at/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=robustbase::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 corralation 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://cstat.tuwien.ac.at/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://cstat.tuwien.ac.at/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("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,
         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
`H.breaks, H.freq,H.include.lowest, H.right,H.density,H.angle,H.col,H.border,H.labels`	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://cstat.tuwien.ac.at/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)
```

---

edaplotlog *Edaplot for logtransformed 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

```
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://cstat.tuwien.ac.at/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.
uniquness	uniquness
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://cstat.tuwien.ac.at/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://cstat.tuwien.ac.at/filz/

Source

Kola Project (1993-1998)

References

Reimann C, Ayras 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://cstat.tuwien.ac.at/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 <- variog(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 inclrease 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://cstat.tuwien.ac.at/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=robustbase::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://cstat.tuwien.ac.at/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 moss layer.

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 CONCMED CONCRUG CONCTERR CONV CONVLO CONVLOW CONVMED CONVTER FLAT FLATLOW FLATRUG FLATTER FLATTERR LOBRRUG 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 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

Date a numeric vector

SAMP a factor with levels ALL ATMLRMA CRGKPCTF CRJHOJTV CRJHPC CRJHTF CROJTV CRPCTF CRPCTV CRTF DRMLRKK DRMRLKK 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 MLRM?VG MLRRPJA MLRRPMA MRLMAJA OJGKTV OJTF Pavlov RPAV RPEM RPMA RPMLRJA RPMLRMA RPVM Semenov Smirnov TFOJ VGHNMA VGMA VGMAHN 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://cstat.tuwien.ac.at/filz/

Source

Kola Project (1993-1998)

References

Reimann C, ?yr?s M, Chekushin V, Bogatyrev I, Boyd R, Caritat P de, Dutter R, Finne TE, Halleraker JH, J?ger ?, Kashulina G, Lehto O, Niskavaara H, Pavlov V, R?is?nen 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://cstat.tuwien.ac.at/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

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

Author(s)

Peter Filzmoser <`P.Filzmoser@tuwien.ac.at`> http://cstat.tuwien.ac.at/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://cstat.tuwien.ac.at/filz/

Source

Kola Project (1993-1998)

References

Reimann C, ?yr?s M, Chekushin V, Bogatyrev I, Boyd R, Caritat P de, Dutter R, Finne TE, Halleraker JH, J?ger ?, Kashulina G, Lehto O, Niskavaara H, Pavlov V, R?is?nen 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.
`uniquness`	uniquness
`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://cstat.tuwien.ac.at/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=robustbase::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 help(kola.background)
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 help(par)

Details

Plots the background map of Kola

Author(s)

Peter Filzmoser <<P.Filzmoser@tuwien.ac.at>> http://cstat.tuwien.ac.at/filz/

References

Reimann C, ?yr?s M, Chekushin V, Bogatyrev I, Boyd R, Caritat P de, Dutter R, Finne TE, Halleraker JH, J?ger ?, Kashulina G, Lehto O, Niskavaara H, Pavlov V, R?is?nen 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://cstat.tuwien.ac.at/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 <- MASS::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://cstat.tuwien.ac.at/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://cstat.tuwien.ac.at/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://cstat.tuwien.ac.at/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))
```

`polygrid` *Coordinates of Points Inside a Polygon*

Description

This function builds a rectangular grid and extracts points which are inside of an internal polygonal region.

Usage

```
polygrid(xgrid, ygrid, borders, vec.inout = FALSE, ...)
```

Arguments

`xgrid`	grid values in the x-direction.
`ygrid`	grid values in the y-direction.
`borders`	a matrix with polygon coordinates defining the borders of the region.
`vec.inout`	logical. If `TRUE` a logical vector is included in the output indicating whether each point of the grid is inside the polygon. Defaults to `FALSE`.
`...`	currently not used (kept for back compatibility).

Details

The function works as follows: First it creates a grid using the R function `expand.grid` and then it uses the geoR' internal function `.geoR_inout()` which wraps usage of `SpatialPoints` and `over` from the package **sp** to extract the points of the grid which are inside the polygon.

Value

A list with components:

`xypoly`	an $n \times 2$ matrix with the coordinates of the points inside the polygon.
`vec.inout`	logical, a vector indicating whether each point of the rectangular grid is inside the polygon. Only returned if `vec.inout = TRUE`.

Author(s)

Paulo Justiniano Ribeiro Jr. <paulojus@leg.ufpr.br>,
Peter J. Diggle <p.diggle@lancaster.ac.uk>.

References

Further information on the package **geoR** can be found at:
http://www.leg.ufpr.br/geoR.

See Also

expand.grid, over, SpatialPoints.

Examples

```
poly <- matrix(c(.2, .8, .7, .1, .2, .1, .2, .7, .7, .1), ncol=2)
plot(0:1, 0:1, type="n")
lines(poly)
poly.in <- polygrid(seq(0,1,l=11), seq(0,1,l=11), poly, vec=TRUE)
points(poly.in$xy)
```

---

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

x	a matrix or a data frame
scale	if TRUE, the data will be scaled
labels	the labels for the polygons inside the map
locations	the locations for the polygons inside the map
nrow,ncol	integers giving the number of rows and columns to use when locations=NULL. By default, 'nrow==ncol', a square layout will be used.
key.loc	the location for the legend
key.labels	the labels in the legend
key.xpd	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.

flip.labels — logical indicating if the label locations should flip up and down from diagram to diagram.

factx — additive factor for the x-coordinate

facty — magnification for the influence of the x-coordinate on the y-coordinate

main, sub, xlab, ylab, xlim, ylim, col.stars,cex, lwd, lty, xpd, mar — graphical parameters and labels for the plot

axes — if FALSE, no axes will be drawn

frame.plot — if TRUE, a box will be made around the plot

add — if TRUE, it will be added to the plot

plot — nothing is plotted

... — 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://cstat.tuwien.ac.at/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 = 2, pch = 3, cex = 0.7, cex.lab = 1, ...)
```

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://cstat.tuwien.ac.at/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 distribution", pch=3,cex=0.7)
```

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
`...`	futher arguments for the probability function

Details

First the probability of the sorted input x is computed and than 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://cstat.tuwien.ac.at/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)
qpplot.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(distribution, "quantiles"), main = "", las = par("las"),
     datax = FALSE, envelope = 0.95, labels = FALSE, col = palette()[2],
     lwd = 2, pch = 1, line = c("quartiles", "robust", "none"), cex = 1,
     xaxt = "s", add.plot=FALSE,xlim=NULL,ylim=NULL,...)
```

Arguments

`x`	numeric vector
`distribution`	name of the comparison distribution
`ylab`	label for the y axis (empirical quantiles)
`xlab`	label for the x axis (comparison quantiles)
`main`	title for the plot
`las`	if 0, ticks labels are drawn parallel to the axis
`datax`	if TRUE, x and y axis are exchanged
`envelope`	confidence level for point-wise confidence envelope, or FALSE for no envelope
`labels`	vector of point labels for interactive point identification, or FALSE for no labels
`col, lwd, pch, cex, xaxt`	graphical parameter, see par
`line`	"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://cstat.tuwien.ac.at/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://cstat.tuwien.ac.at/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://cstat.tuwien.ac.at/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://cstat.tuwien.ac.at/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://cstat.tuwien.ac.at/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://cstat.tuwien.ac.at/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://cstat.tuwien.ac.at/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_O1 *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_O1)
```

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://cstat.tuwien.ac.at/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_O1)
str(res.eyefit.Pb_O1)
```

---

res.eyefit.Pb_O2 — *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_O2)
```

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://cstat.tuwien.ac.at/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_O2)
str(res.eyefit.Pb_O2)
```

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 shortend 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://cstat.tuwien.ac.at/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

`x`	data
`main`	used for the list

Details

Procesure to undertake non-robust multivariate data analyses; the object generated is identical to that of rg.robmva so that the savedlist 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
`rcr`	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://cstat.tuwien.ac.at/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 distancesand 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://cstat.tuwien.ac.at/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://cstat.tuwien.ac.at/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 though 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
rcr	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://cstat.tuwien.ac.at/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://cstat.tuwien.ac.at/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

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

Details

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

Value

`cor.cla`	correlation of the classical estimation
`cor.rob`	correlation of the robust estimation

Author(s)

Peter Filzmoser <`<P.Filzmoser@tuwien.ac.at>`> http://cstat.tuwien.ac.at/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://cstat.tuwien.ac.at/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 ist 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://cstat.tuwien.ac.at/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

`Xlowerleft, Ylowerleft`
: x and y coordinate of the lower left corner

`Xupperright, Yupperright`
: x and y coordinate of the upper corner

`shifttext`
: on which margin line, starting at 0 counting outwards

`shiftkm`
: how far from the last point the label should be written

`sizetext`
: expansion factor for the text

Author(s)

Peter Filzmoser <`<P.Filzmoser@tuwien.ac.at>`> `http://cstat.tuwien.ac.at/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

`x, y, z` the coordinates for the points

`xlab, ylab, zlab`
the labels for the axis

`revolutions` if the plot should be viewed from different angles

`bg.col, axis.col, surface.col, point.col, text.col, grid.col`
define the colour for the background, axis,...

`pos.res.col, neg.res.col`
colour for positive and negativ residuals

`fogtype` describes the fogtype, see rgl.bg

`residuals` if the residuals should be plotted

`surface` if the regression function should be plotted or just the points

`grid` if TRUE, the grid is plotted

`grid.lines` number of lines in the grid

`df.smooth` if fit=smooth, the number of degrees of freedom

`df.additive` if fit=additive, the number of degrees of freedom

`sphere.size` a value for calibrating the size of the sphere

`threshold` 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 additve model to calculate the coefficients.

Author(s)

Peter Filzmoser <<`P.Filzmoser@tuwien.ac.at`>> `http://cstat.tuwien.ac.at/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)
```

`SmoothLegend` *Plots Smoothing Maps and a Legend*

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 = 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.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://cstat.tuwien.ac.at/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-corrdinates 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, 0)),
add = FALSE, plot = TRUE, ...)
```

Arguments

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

Details

Each sun represents one row of the input x. Each line of the sun represents one choosen 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://cstat.tuwien.ac.at/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", qutiles = 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
qutiles	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

`leg.just`	how to justify the legend
`cex.scale`	cex for text "log-scale" and for boxplot legend - only for type="boxplot"
`xf`	x-distance from boxplot to number for legend
`logscale`	if TRUE a log scale is used (for boxplot scale) and the log-boxplot is computed
`accentuate`	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 fot 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://cstat.tuwien.ac.at/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",qutiles<-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://cstat.tuwien.ac.at/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://cstat.tuwien.ac.at/filz/

Source

Kola Project (1993-1998)

References

Reimann C, ?yr?s M, Chekushin V, Bogatyrev I, Boyd R, Caritat P de, Dutter R, Finne TE, Halleraker JH, J?ger ?, Kashulina G, Lehto O, Niskavaara H, Pavlov V, R?is?nen 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://cstat.tuwien.ac.at/filz/

Source

Kola Project (1993-1998)

References

Reimann C, ?yr?s M, Chekushin V, Bogatyrev I, Boyd R, Caritat P de, Dutter R, Finne TE, Halleraker JH, J?ger ?, Kashulina G, Lehto O, Niskavaara H, Pavlov V, R?is?nen 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)
```

---

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://cstat.tuwien.ac.at/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]

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

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

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