

# Package ‘OSMscale’

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**Title** Add a Scale Bar to 'OpenStreetMap' Plots

**Version** 0.5.20

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**Description**

Functionality to handle and project lat-long coordinates, easily download background maps and add a correct scale bar to 'OpenStreetMap' plots in any map projection.

**Imports** OpenStreetMap, berryFunctions (>= 1.15.0), sf, pbapply

**URL** <https://github.com/brry/OSMscale>

**License** GPL (>= 2)

**Encoding** UTF-8

**RoxygenNote** 7.2.3

**Suggests** testthat

**BugReports** <https://github.com/brry/OSMscale/issues>

**NeedsCompilation** no

**Repository** CRAN

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OSMscale-package	<i>Add a Scalebar to OpenStreetMap Plots</i>
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## Description

Functionality to handle and project lat-long coordinates, easily download background maps and add a correct scale bar to 'OpenStreetMap' plots in any map projection. There are some other spatially related miscellaneous functions as well.

## Note

Get the most recent code updates at <https://github.com/brry/OSMscale>

## Author(s)

Berry Boessenkool, <brry-b@gmx.de>, June 2016

## See Also

[scaleBar](#), [pointsMap](#), [projectPoints](#), mapmisc article at <https://journal.r-project.org/archive/2016-1/brown.pdf>

## Examples

```
if(FALSE){ # Not tested on CRAN to avoid download time
d <- read.table(sep="," , header=TRUE, text=
"lat, long
55.685143, 12.580008
52.514464, 13.350137
50.106452, 14.419989
48.847003, 2.337213
51.505364, -0.164752")

# zoom set to 3 to speed up tests. automatic zoom determination is better.
map <- pointsMap(lat, long, data=d, type="esri",
                proj=utm(d$long), scale=FALSE, zoom=3, pch=16, col=2)
scaleBar(map, abslen=500, y=0.8, cex=0.8)
lines(projectPoints(d$lat, d$long), col="blue", lwd=2)
}
```

---

biketrack	<i>GPS recorded bike track</i>
-----------	--------------------------------

---

**Description**

My daily bike route, recorded with the app OSMtracker on my Samsung Galaxy S5

**Format**

```
'data.frame': 254 obs. of 4 variables:
 $ lon : num 13 13 13 13 13 ...
 $ lat : num 52.4 52.4 52.4 52.4 52.4 ...
 $ time: POSIXct, format: "2016-05-18 07:53:22" "2016-05-18 07:53:23" ...
 $ ele : num 66 66 66 67 67 67 68 69 69 69 ....
```

**Source**

GPS track export from OSMtracker App

**Examples**

```
data(biketrack)
plot(biketrack[,1:2])
# see equidistPoints
```

---

checkLL	<i>lat-long coordinate check</i>
---------	----------------------------------

---

**Description**

check lat-long coordinates for plausibility

**Usage**

```
checkLL(lat, long, data, fun = stop, quiet = FALSE, ...)
```

**Arguments**

lat, long	Latitude (North/South) and longitude (East/West) coordinates in decimal degrees
data	Optional: data.frame with the columns lat and long
fun	One of the functions <a href="#">stop</a> , <a href="#">warning</a> , or <a href="#">message</a> . DEFAULT: stop
quiet	Logical: suppress non-df warning in <a href="#">getColumn?</a> DEFAULT: FALSE
...	Further arguments passed to fun

**Value**

Invisible T/F vector showing which of the coordinates is violated in the order: minlat, maxlat, minlong, maxlong. Only returned if check is passed or fun != stop

**Author(s)**

Berry Boessenkool, <berry-b@gmx.de>, Aug 2016

**See Also**

[pointsMap](#), [putm](#), [berryFunctions::checkFile](#)

**Examples**

```
checkLL(lat=52, long=130)
checkLL(130, 52, fun=message)
checkLL(85:95, 0, fun=message)

d <- data.frame(x=0, y=0)
checkLL(y,x, d)

# informative errors:
library("berryFunctions")
is.error( checkLL(85:95, 0, fun="message"), tell=TRUE)
is.error( checkLL(170,35), tell=TRUE)

mustfail <- function(expr) stopifnot(berryFunctions::is.error(expr))
mustfail( checkLL(100) )
mustfail( checkLL(100, 200) )
mustfail( checkLL(-100, 200) )
mustfail( checkLL(90.000001, 0) )
```

---

degree

*decimal degree coordinate conversion*

---

**Description**

Convert latitude-longitude coordinates between decimal representation and degree-minute-second notation

**Usage**

```
degree(
  lat,
  long,
  data,
  todms = !is.character(lat),
```

```

  digits = 1,
  drop = FALSE,
  quiet = FALSE
)

```

### Arguments

lat, long	Latitude (North/South) and longitude (East/West) coordinates in decimal degrees
data	Optional: data.frame with the columns lat and long
todms	Logical specifying direction of conversion. If FALSE, converts to decimal degree notation, splitting coordinates at the symbols for degree, minute and second (\\U00B0, ', "). DEFAULT: !is.character(lat)
digits	Number of digits the seconds are rounded to. DEFAULT: 1
drop	Drop to lowest dimension? DEFAULT: FALSE
quiet	Logical: suppress non-df warning in getColumn? DEFAULT: FALSE

### Value

data.frame with x and y as character strings or numerical values, depending on conversion direction

### Author(s)

Berry Boessenkool, <berry-b@gmx.de>, Aug 2016

### See Also

[earthDist](#), [projectPoints](#) for geographical reprojection

### Examples

```

# DECIMAL to DMS notation: -----
degree(52.366360, 13.024181)
degree(c(52.366360, -32.599203), c(13.024181,-55.809601))
degree(52.366360, 13.024181, drop=TRUE) # vector
degree(47.001, -13.325731, digits=5)

# Use table with values instead of single vectors:
d <- read.table(header=TRUE, sep=",", text="
lat, long
 52.366360, 13.024181
-32.599203, -55.809601")
degree(lat, long, data=d)

# DMS to DECIMAL notation: -----
# You can use the degree symbol and escaped quotation mark (\\") as well.
degree("52'21'58.9"N", "13'1'27.1"E")
print(degree("52'21'58.9"N", "13'1'27.1"E"), digits=15)

d2 <- read.table(header=TRUE, stringsAsFactors=FALSE, text="

```

```

lat long
52'21'58.9"N 13'01'27.1"E
32'35'57.1"S 55'48'34.6"W") # columns cannot be comma-separated!
degree(lat, long, data=d2)

# Rounding error checks: -----
oo <- options(digits=15)
d
degree(lat, long, data=degree(lat, long, d))
degree(lat, long, data=degree(lat, long, d, digits=3))
options(oo)
stopifnot(all(degree(lat, long, data=degree(lat, long, d, digits=3))==d))

```

---

earthDist

*distance between lat-long coordinates*

---

### Description

Great-circle distance between points at lat-long coordinates. (The shortest distance over the earth's surface). The distance of all the entries is computed relative to the *i*th one.

### Usage

```
earthDist(lat, long, data, r = 6371, i = 1L, along = FALSE, quiet = FALSE)
```

### Arguments

lat, long	Latitude (North/South) and longitude (East/West) coordinates in decimal degrees
data	Optional: data.frame with the columns lat and long
r	radius of the earth. Could be given in miles. DEFAULT: 6371 (km)
i	Integer: Index element against which all coordinate pairs are computed. DEFAULT: 1
along	Logical: Should distances be computed along vector of points? If TRUE, i is ignored. DEFAULT: FALSE
quiet	Logical: suppress non-df warning in <code>getColumn</code> ? DEFAULT: FALSE

### Value

Vector with distance(s) in km (or units of *r*, if *r* is changed)

### Author(s)

Berry Boessenkool, <berry-b@gmx.de>, Aug 2016 + Jan 2017. Angle formula from Diercke Weltatlas 1996, Page 245

**See Also**

`maxEarthDist`, `degree` for pre-formatting, <http://www.movable-type.co.uk/scripts/latlong.html>

**Examples**

```
d <- read.table(header=TRUE, sep=",", text="
lat, long
52.514687, 13.350012 # Berlin
51.503162, -0.131082 # London
35.685024, 139.753365") # Tokio
earthDist(lat, long, d) # from Berlin to L and T: 928 and 8922 km
earthDist(lat, long, d, i=2) # from London to B and T: 928 and 9562 km

# slightly different with other formulas:
# install.packages("geosphere")
# geosphere::distHaversine(as.matrix(d[1,2:1]), as.matrix(d[2,2:1])) / 1000

# Distance along vector of points:
d <- data.frame(lat=21:50, long=1:30)
pointsMap(lat,long,d, zoom=2, proj=utm(1:30) )
along1 <- earthDist(lat,long,d, along=TRUE)
along2 <- c(0, sapply(2:nrow(d), function(i) earthDist(lat,long,data=d[i-1:0,])[2]))
along1-along2 # all zero, but second version is MUCH slower for large datasets

# compare with UTM distance
set.seed(42)
d <- data.frame(lat=runif(100, 47,54), long=runif(100, 6, 15))
d2 <- projectPoints(d$lat, d$long)
d_utm <- berryFunctions::distance(d2$x[-1],d2$y[-1], d2$x[1],d2$y[1])/1000
d_earth <- earthDist(lat,long, d)[-1]
plot(d_utm, d_earth) # distances in km
hist(d_utm-d_earth) # UTM distance slightly larger than earth distance
plot(d_earth, d_utm-d_earth) # correlates with distance
berryFunctions::colPoints(d2$x[-1], d2$y[-1], d_utm-d_earth, add=FALSE)
points(d2$x[1],d2$y[1], pch=3, cex=2, lwd=2)
```

---

equidistPoints

*Evenly spaced points along path*

---

**Description**

Compute waypoints with equal distance to each other along a (curved) path or track given by coordinates

**Usage**

```
equidistPoints(x, y, z, data, n, nint = 30, mid = FALSE, quiet = FALSE, ...)
```

**Arguments**

x, y, z	Vectors with coordinates. z is optional and can be left empty
data	Optional: data.frame with the column names as given by x,y (and z)
n	Number of segments to create along the path (=number of points-1)
nint	Number of points to interpolate between original coordinates (with <a href="#">approx2</a> ). Larger numbers give more precisely equidistant points, but increase computing time. int=1 to not do any interpolation. DEFAULT: 30
mid	Logical: Should centers of segments be returned instead of their ends?
quiet	Logical: suppress non-df warning in <a href="#">getColumn</a> ? DEFAULT: FALSE
...	Further arguments passed to <a href="#">approx</a>

**Value**

Dataframe with the coordinates of the final points. ATTENTION: The columns are named x,y,z, not with the original names from the function call.

**Author(s)**

Berry Boessenkool, <berry-b@gmx.de>, May 2016

**See Also**

berryFunctions::[distance](#) and [approx2](#)

**Examples**

```
library(berryFunctions) # distance, colPoints etc
x <- c(2.7, 5, 7.8, 10.8, 13.7, 15.8, 17.4, 17.7, 16.2, 15.8, 15.1, 13.1, 9.3, 4.8, 6.8, 12.2)
y <- c(2.3, 2.1, 2.6, 3.3, 3.7, 4.7, 7.6, 11.7, 12.4, 12.3, 12.3, 12.3, 12, 12.1, 17.5, 19.6)
eP <- equidistPoints(x,y, n=10) ; eP
plot(x,y, type="o", pch=4)
points(equidistPoints(x,y, n=10), col=4, pch=16)
points(equidistPoints(x,y, n=10, nint=1), col=2) # from original point set
round(distance(eP$x, eP$y), 2) # the 2.69 instead of 4.50 is in the sharp curve
# These points are quidistant along the original track

plot(x,y, type="o", pch=16, col=2)
round(sort(distance(x,y)), 2)
xn <- equidistPoints(x,y, n=10)$x
yn <- equidistPoints(x,y, n=10)$y
lines(xn,yn, type="o", pch=16)
round(sort(distance(xn,yn)), 2)
for(i in 1:8)
{
  xn <- equidistPoints(xn,yn, n=10)$x
```



```

yn <- equidistPoints(xn,yn, n=10)$y
lines(xn,yn, type="o", pch=16)
print(round(sort(distance(xn,yn)), 2))
} # We may recursively get closer to equidistant along track _and_ air,
# but never actually reach it.

# Real dataset:
data(biketrack)
colPoints("lon","lat","ele",data=biketrack, add=FALSE,asp=1,pch=4,lines=TRUE)
points(equidistPoints(lon, lat, data=biketrack, n=25), pch=3, lwd=3, col=2)
bt2 <- equidistPoints(lon, lat, ele, data=biketrack, n=25)
bt2$dist <- distance(bt2$x, bt2$y)*1000
colPoints("x", "y", "z", data=bt2, legend=FALSE)
# in curves, crow-distance is shorter sometimes
plot(lat~lon, data=biketrack, asp=1, type="l")
colPoints("x","y","dist",data=bt2, Range=c(2.5,4),add=TRUE,asp=1,pch=3,lwd=5)
lines(lat~lon, data=biketrack)

```

---

mapComp

*Compare map tiles*


---

## Description

Compare map tiles

## Usage

```

mapComp(
  lat,
  long,
  data,
  types = NA,
  progress = TRUE,
  file = "mapComp.pdf",
  overwrite = FALSE,
  pargs = NULL,
  quiet = FALSE,
  ...
)

```

## Arguments

lat, long, data	Coordinates as in <a href="#">pointsMap</a>
types	Character string vector, types for OpenStreetMap:: <a href="#">openmap</a> DEFAULT: NA (all current types)
progress	Display progress bar? DEFAULT: TRUE
file	PDF filename. Will not be overwritten. DEFAULT: "mapComp.pdf"

overwrite	Overwrite pdf file? DEFAULT: FALSE
pargs	List of arguments passed to <a href="#">pdf</a> . DEFAULT:NULL
quiet	Logical: suppress non-df warning in <a href="#">getColumn?</a> DEFAULT: FALSE
...	Further arguments passed to <a href="#">pointsMap</a>

**Value**

List of maps, writes to a pdf

**Author(s)**

Berry Boessenkool, <berry-b@gmx.de>, Jul 2017

**See Also**

[pointsMap](#)

**Examples**

```
## Not run: # Exclude from CRAN checks because of download time
maps <- mapComp(c(52.39,52.46), c(12.99,13.06),
               pargs=list(width=8.27, height=11.96), overwrite=TRUE)

# still need to suppress output to console:
https://stackoverflow.com/questions/45041762/suppress-rjava-error-output-in-console

unlink("mapComp.pdf")

## End(Not run)
```

---

maxEarthDist

*maximum distance between set of points*

---

**Description**

Maximum great-circle distance between points at lat-long coordinates. This is not computationally efficient. For large datasets, consider pages like <https://stackoverflow.com/a/16870359>.

**Usage**

```
maxEarthDist(
  lat,
  long,
  data,
  r = 6371,
  fun = max,
  each = TRUE,
```

```

    quiet = FALSE,
    ...
  )

```

### Arguments

lat, long, data	Coordinates for <a href="#">earthDist</a>
r	Earth Radius for <a href="#">earthDist</a>
fun	Function to be applied. DEFAULT: <a href="#">max</a>
each	Logical: give max dist to all other points for each point separately? If FALSE, will return the maximum of the complete distance matrix, as if <code>max(maxEarthDist(y,x))</code> . DEFAULT: TRUE
quiet	Logical: suppress non-df warning in <a href="#">getColumn</a> ? DEFAULT: FALSE
...	Further arguments passed to fun, like <code>na.rm=TRUE</code>

### Value

Single number

### Author(s)

Berry Boessenkool, <berry-b@gmx.de>, Jan 2017

### See Also

[earthDist](#)

### Examples

```

d <- read.table(header=TRUE, text="
  x     y
14.9 53.73
 1.12 53.12
 6.55 58.13
 7.71 71.44
")

plot(d, asp=1, pch=as.character(1:4), xlab="lon", ylab="lat")
for(i in 1:4) segments(d$x[-i], d$y[-i], d$x[i], d$y[i], col=2)
text(x=c(7,10,11), y=c(53,56,64), round(earthDist(y,x,d)[-1]), col=2)
text(x=c(4,4), y=c(56,61), round(earthDist(y,x,d,i=2)[3:4]), col=2)
text(x=7, y=64, round(earthDist(y,x,d,i=4)[3]), col=2)

round( earthDist(y,x,d, i=2) )
round( earthDist(y,x,d, i=3) )

round( maxEarthDist(y,x,d) )
round( maxEarthDist(y,x,d, each=FALSE) )
round( maxEarthDist(y,x,d, fun=min) )

```

```
maxEarthDist(y,x, d[1:2,] )
```

---

```
pointsMap          Get map for lat-long points
```

---

### Description

Download and plot map with the extend of a dataset with lat-long coordinates.

### Usage

```
pointsMap(
  lat,
  long,
  data,
  ext = 0.07,
  fx = 0.05,
  fy = fx,
  type = "osm",
  zoom = NULL,
  minNumTiles = 9L,
  mergeTiles = TRUE,
  map = NULL,
  proj = NA,
  plot = TRUE,
  mar = c(0, 0, 0, 0),
  add = FALSE,
  scale = TRUE,
  quiet = FALSE,
  pch = 3,
  col = "red",
  cex = 1,
  bg = NA,
  pargs = NULL,
  titleargs = NULL,
  ...
)
```

### Arguments

lat, long	Latitude (North/South) and longitude (East/West) coordinates in decimal degrees
data	Optional: data.frame with the columns lat and long
ext	Extension added in each direction if a single coordinate is given. DEFAULT: 0.07

fx, fy	Extend factors (additional map space around actual points) passed to custom version of <code>extendrange</code> . DEFAULT: 0.05
type	Tile server in <code>OpenStreetMap::openmap</code> . For an overview, see <a href="https://blog.fellstat.com/?p=356">https://blog.fellstat.com/?p=356</a> and <code>mapComp</code> . DEFAULT: "osm"
zoom, minNumTiles, mergeTiles	Arguments passed to <code>openmap</code>
map	Optional map object. If given, it is not downloaded again. Useful to project maps in a second step. DEFAULT: NULL
proj	If you want to reproject the map (Consumes some extra time), the proj4 character string or CRS object to project to, e.g. <code>putm(long=long)</code> . DEFAULT: NA (no conversion)
plot	Logical: Should map be plotted and points added? Plotting happens with <code>OpenStreetMap::plot.OpenSt</code> . DEFAULT: TRUE
mar	Margins to be set first (and left unchanged). DEFAULT: <code>c(0,0,0,0)</code>
add	Logical: add points to existing map? DEFAULT: FALSE
scale	Logical: should <code>scaleBar</code> be added? DEFAULT: TRUE
quiet	Logical: suppress progress messages and non-df warning in <code>getColumn</code> ? DEFAULT: FALSE
pch, col, cex, bg	Arguments passed to <code>points</code> , see <code>pargs</code> for more. DEFAULT: <code>pch=3, col="red", cex=1, bg=NA</code>
pargs	List of arguments passed to <code>points</code> like <code>lwd</code> , <code>type</code> , <code>cex</code> , ...
titleargs	List of arguments passed to <code>title</code> (if not NULL). DEFAULT: NULL
...	Further arguments passed to <code>scaleBar</code> like <code>abslen</code> , <code>ndiv</code> , ...

**Value**

Map returned by `OpenStreetMap::openmap`

**Author(s)**

Berry Boessenkool, <[berry-b@gmx.de](mailto:berry-b@gmx.de)>, Jun 2016

**See Also**

[projectPoints](#), `OpenStreetMap::openmap`

**Examples**

```
if(interactive()){
d <- read.table(sep="," , header=TRUE, text=
"lat, long # could e.g. be copied from googleMaps, rightclick on What's here?
43.221028, -123.382998
43.215348, -123.353804
43.227785, -123.368694
43.232649, -123.355895")
```

```

map <- pointsMap(lat, long, data=d)
axis(1, line=-2); axis(2, line=-2) # in whatever unit
map_utm <- pointsMap(lat, long, d, map=map, proj=putm(d$long))
axis(1, line=-2); axis(2, line=-2) # now in meters
projectPoints(d$lat, d$long)
scaleBar(map_utm, x=0.2, y=0.8, unit="mi", type="line", col="red", length=0.25)
pointsMap(lat, long, d[1:2,], map=map_utm, add=TRUE, col="red", pch=3, pargs=list(lwd=3))

d <- data.frame(long=c(12.95, 12.98, 13.22, 13.11), lat=c(52.40,52.52, 52.36, 52.45))
map <- pointsMap(lat,long,d, type="bing") # aerial map
}

```

---

proj *CRS of various PROJ.4 projections*

---

### Description

coordinate reference system (CRS) Object for several proj4 character strings. posm and pll are taken directly from OpenStreetMap: [osm](#) and [longlat](#).

pmap gets the projection string from map objects as returned by [pointsMap](#).

### Usage

```
putm(long, zone = mean(long, na.rm = TRUE)%/%6 + 31)
```

```
posm()
```

```
pll()
```

```
pmap(map)
```

### Arguments

long	Vector of decimal longitude coordinates (East/West values). Not needed if zone is given.
zone	UTM (Universal Transverse Mercator) zone, see e.g. <a href="https://upload.wikimedia.org/wikipedia/commons/e/ed/Utm-zones.jpg">https://upload.wikimedia.org/wikipedia/commons/e/ed/Utm-zones.jpg</a> . DEFAULT: UTM zone at <a href="#">mean</a> of long
map	for pmap: map object as returned by <a href="#">pointsMap</a>

### Value

sf::st\_crs objects for one of:

- UTM projection with given zone
- Open street map (and google) mercator projection
- Latitude Longitude projection

**Author(s)**

Berry Boessenkool, <berry-b@gmx.de>, Aug 2016

**See Also**

[projectPoints](#), [degree](#)

**Examples**

```
posm()
str(posm())
pll()
putm(5:14) # Germany
putm(zone=33) # Berlin

map <- list(tiles=list(dummy=list(projection=pll())),
           bbox=list(p1=par("usr")[c(1,4)], p2=par("usr")[2:3]) )
pmap(map)
```

---

projectPoints

*Project lat-lon points*

---

**Description**

Project long lat points to e.g. UTM projection. Basics copied from OpenStreetMap: [projectMercator](#)

**Usage**

```
projectPoints(
  lat,
  long,
  data,
  from = pll(),
  to = putm(long = long),
  dfout = TRUE,
  drop = FALSE,
  quiet = FALSE
)
```

**Arguments**

lat, long	Latitude (North/South) and longitude (East/West) coordinates in decimal degrees
data	Optional: data.frame with the columns lat and long
from	Original Projection CRS (do not change for latlong-coordinates). DEFAULT: <code>pll()</code> = <code>sf::st_crs("+proj=longlat +datum=WGS84")</code>

to	target projection CRS (Coordinate Reference System) Object. Other projections can be specified as <code>sf::st_crs("your_proj4_character_string")</code> . DEFAULT: <code>utm(long=long)</code>
dfout	Convert output to data.frame to allow easier indexing? DEFAULT: TRUE
drop	Drop to lowest dimension? DEFAULT: FALSE (unlike <code>projectMercator</code> )
quiet	Suppress warning about NA coordinates and non-df warning in <code>getColumn?</code> DEFAULT: FALSE

**Value**

data.frame (or matrix, if `dfout=FALSE`) with points in new projection

**Author(s)**

Berry Boessenkool, <berry-b@gmx.de>, Jun 2016

**See Also**

`scaleBar`, `OpenStreetMap::projectMercator`, <https://gis.stackexchange.com/a/74723>, <https://spatialreference.org> on proj4strings

**Examples**

```
library("OpenStreetMap")
lat <- runif(100, 6, 12)
lon <- runif(100, 48, 58)
plot(lat,lon, main="flat earth unprojected")
plot(projectMercator(lat,lon), main="Mercator")
plot(projectPoints(lat,lon), main="UTM32")
stopifnot(all( projectPoints(lat,lon, to=posm()) == projectMercator(lat,lon) ))

projectPoints(c(52.4,NA),      c(13.6,12.9))
projectPoints(c(52.4,NA),      c(13.6,12.9), quiet=TRUE)
projectPoints(c(52.4,52.3,NA), c(13.6,12.9,13.1))
projectPoints(c(52.4,52.3,NA), c(13.6,NA  ,13.1))
projectPoints(c(52.4,52.3,NA), c(NA   ,12.9,13.1))

# Reference system ETRS89 with GRS80-Ellipsoid (common in Germany)
set.seed(42)
d <- data.frame(N=runif(50,5734000,6115000), E=runif(50, 33189000,33458000))
d$VALUES <- berryFunctions::rescale(d$N, 20,40) + rnorm(50, sd=5)
head(d)
c1 <- projectPoints(lat=d$N, long=d$E-33e6, to=p11(),
                    from=sf::st_crs("+proj=utm +zone=33 +ellps=GRS80 +units=m +no_defs") )
c2 <- projectPoints(y, x, data=c1, to=posm() )
head(c1)
head(c2)

## Not run: # not checked on CRAN because of file opening
map <- pointsMap(y,x, c1, plot=FALSE)
pdf("ETRS89.pdf")
```



```

par(mar=c(0,0,0,0))
plot(map)
rect(par("usr")[1], par("usr")[3], par("usr")[2], par("usr")[4],
      col=berryFunctions::addAlpha("white", 0.7))
scaleBar(map, y=0.2, abslen=100)
points(c2)
berryFunctions::colPoints(c2$x, c2$y, d$VALUE )
dev.off()
berryFunctions::openFile("ETRS89.pdf")
#unlink("ETRS89.pdf")

## End(Not run)

```

---

randomPoints	<i>Distanced random points</i>
--------------	--------------------------------

---

### Description

Arranges points in square randomly, but with certain minimal distance to each other

### Usage

```
randomPoints(xmin, xmax, ymin, ymax, number, mindist, plot = TRUE, ...)
```

### Arguments

xmin	Minimum x coordinate
xmax	Upper limit x values
ymin	Ditto for y
ymax	And yet again: Ditto.
number	How many points should be randomly + uniformly distributed
mindist	Minimum DIstance each point should have to others
plot	Plot the result? DEFAULT: TRUE
...	Further arguments passed to plot

### Value

data.frame with x and y coordinates.

### Author(s)

Berry Boessenkool, <berry-b@gmx.de>, 2011/2012

### See Also

[distance](https://cran.r-project.org/package=RandomFields), the package RandomFields (<https://cran.r-project.org/package=RandomFields>)

**Examples**

```

P <- randomPoints(xmin=200,xmax=700, ymin=300,ymax=680, number=60,mindist=10, asp=1)
rect(xleft=200, ybottom=300, xright=700, ytop=680, col=NA, border=1)

format( round(P,4), trim=FALSE)

for(i in 1:10)
{
rp <- randomPoints(xmin=0,xmax=20, ymin=0,ymax=20, number=20, mindist=3, plot=FALSE)
plot(rp, las=1, asp=1, pch=16)
abline(h=0:30*2, v=0:30*2, col=8); box()
for(i in 1:nrow(rp))
  berryFunctions::circle(rp$x[i],rp$y[i], r=3, col=rgb(1,0,0,alpha=0.2), border=NA)
}

```

---

scaleBar

*scalebar for OSM plots*


---

**Description**

Add a scalebar to default or (UTM)-projected OpenStreetMap plots

**Usage**

```

scaleBar(
  map,
  x = 0.1,
  y = 0.9,
  length = 0.4,
  abslen = NA,
  unit = c("km", "m", "mi", "ft", "yd"),
  label = unit,
  type = c("bar", "line"),
  ndiv = NA,
  field = "rect",
  fill = NA,
  adj = c(0.5, 1.5),
  cex = par("cex"),
  col = c("black", "white"),
  targs = NULL,
  lwd = 7,
  lend = 1,
  bg = "transparent",
  mar = c(2, 0.7, 0.2, 3),
  ...
)

```

**Arguments**

map	Map object with map\$tiles[[1]]\$projection to get the projection from.
x, y	Relative position of left end of scalebar. DEFAULT: 0.1, 0.9
length	Approximate relative length of bar. DEFAULT: 0.4
abslen	Absolute length in units. DEFAULT: NA (computed internally from length)
unit	Unit for computation and label. Possible: kilometer, meter, miles, feet, yards. DEFAULT: "km"
label	Unit label in plot. DEFAULT: unit
type	Scalebar type: simple 'line' or classical black & white 'bar'. DEFAULT: "bar"
ndiv	Number of divisions if type="bar". DEFAULT: NA (computed internally) Internal selection of ndiv is based on divisibility of abslen (modulo) with 1:6. For ties, preferation order is 5>4>3>2>6>1.
field, fill, adj, cex	Arguments passed to <a href="#">textField</a>
col	Vector of (possibly alternating) colors passed to <a href="#">segments</a> or <a href="#">rect</a> . DEFAULT: c("black","white")
targs	List of further arguments passed to <a href="#">textField</a> like font, col (to differ from bar color), etc. DEFAULT: NULL
lwd, lend	Line width and end style passed to <a href="#">segments</a> . DEFAULT: 5,1, which works well in pdf graphics.
bg	Background color, e.g. <a href="#">addAlpha</a> (White). DEFAULT: "transparent" to suppress background.
mar	Background margins approximately in letter width/height. DEFAULT: c(2,0.7,0.2,3)
...	Further arguments passed to <a href="#">segments</a> like lty. (Color for segments is the first value of col). Passed to <a href="#">rect</a> if type="bar", like lwd.

**Details**

scaleBar gets the right distance in the default mercator projected maps. There, the axes are not in meters, but rather ca 0.7m units (for NW Germany area maps with 20km across). Accordingly, other packages plot wrong bars, see the last example section.

**Value**

invisible: coordinates of scalebar and label

**Author(s)**

Berry Boessenkool, <berry-b@gmx.de>, Jun 2016

**See Also**

[pointsMap](#), [projectPoints](#)

## Examples

```

plot(0:10, 40:50, type="n", asp=1) # Western Europe in lat-long
map <- list(tiles=list(dummy=list(projection=pll())),
           bbox=list(p1=par("usr")[c(1,4)], p2=par("usr")[2:3]) )
scaleBar(map)

if(interactive()){
d <- data.frame(long=c(12.95, 12.98, 13.22, 13.11), lat=c(52.40,52.52, 52.36, 52.45))
map <- pointsMap(lat,long,d, scale=FALSE, zoom=9)
coord <- scaleBar(map) ; coord
scaleBar(map, bg=berryFunctions::addAlpha("white", 0.7))
scaleBar(map, 0.3, 0.05, unit="m", length=0.45, type="line")
scaleBar(map, 0.3, 0.5, unit="km", abslen=5, col=4:5, lwd=3)
scaleBar(map, 0.3, 0.8, unit="mi", col="red", targ=list(col="blue", font=2), type="line")

# I don't like subdivisions, but if you wanted them, you could use:
sb <- scaleBar(map, 0.12, 0.28, abslen=10, adj=c(0.5, -1.5) )
scaleBar(map, 0.12, 0.28, abslen=4, adj=c(0.5, -1.5),
         targ=list(col="transparent"), label="" )

# more lines for exact measurements in scalebar:
segments(x0=seq(sb["x1"], sb["x2"], len=21), y0=sb["y1"], y1=sb["y2"], col=8)
rect(xleft=sb["x1"], xright=sb["x2"], ybottom=sb["y1"], ytop=sb["y2"])
}

## Not run: # don't download too many maps in R CMD check
d <- read.table(header=TRUE, sep=",", text="
lat, long
52.514687, 13.350012 # Berlin
51.503162, -0.131082 # London
35.685024, 139.753365") # Tokio
map <- pointsMap(lat, long, d, zoom=2, abslen=5000, y=0.7)
scaleBar(map, y=0.5, abslen=5000) # in mercator projections, scale bars are not
scaleBar(map, y=0.3, abslen=5000) # transferable to other latitudes

map_utm <- pointsMap(lat, long, d[1:2,], proj=putm(long=d$long[1:2]),
                    zoom=4, y=0.7, abslen=500)
scaleBar(map_utm, y=0.5, abslen=500) # transferable in UTM projection
scaleBar(map_utm, y=0.3, abslen=500)

## End(Not run)

## Not run: ## Too much downloading time, too error-prone
# Tests around the world
par(mfrow=c(1,2), mar=rep(1,4))
long <- runif(2, -180, 180) ; lat <- runif(2, -90, 90)
long <- 0:50 ; lat <- 0:50
map <- pointsMap(lat, long)
map2 <- pointsMap(lat, long, map=map, proj=putm(long=long))

## End(Not run)

```

```
## Not run: ## excluded from tests to avoid package dependencies
berryFunctions::require2("SDMTools")
berryFunctions::require2("raster")
berryFunctions::require2("mapmisc")
par(mar=c(0,0,0,0))
map <- OSMscale::pointsMap(long=c(12.95, 13.22), lat=c(52.52, 52.36))
SDMTools::Scalebar(x=1443391,y=6889679,distance=10000)
raster::scalebar(d=10000, xy=c(1443391,6884254))
OSMscale::scaleBar(map, x=0.35, y=0.45, abslen=5)
library(mapmisc) # otherwise rbind for SpatialPoints is not found
mapmisc::scaleBar(pmap(map)@projargs, seg.len=10, pos="center", bg="transparent")

## End(Not run)
```

---

triangleArea	<i>Area of a triangle</i>
--------------	---------------------------

---

### Description

calculate Area of a planar triangle

### Usage

```
triangleArea(x, y, digits = 3)
```

### Arguments

x	Vector with 3 values (x coordinates of triangle corners)
y	Ditto for y.
digits	Number of digits the result is rounded to. DEFAULT: 3)

### Value

Numeric

### Author(s)

Berry Boessenkool, <berry-b@gmx.de>, 2011

### See Also

berryFunctions::distance

**Examples**

```
a <- c(1,5.387965,9); b <- c(1,1,5)
plot(a[c(1:3,1)], b[c(1:3,1)], type="l", asp=1)#; grid()

triangleArea(a,b)
#triangleArea(a,b[1:2])
```

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