

# Package ‘RgoogleMaps’

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**Type** Package

**Title** Overlays on Google map tiles in R

**Version** 1.2.0.7

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**Depends** R (>= 2.10)

**Imports** graphics, stats, utils, png, RJSONIO

**Suggests** PBSmapping, maptools, sp, rgdal, loa, RColorBrewer

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**Description** This package serves two purposes: (i) Provide a comfortable R interface to query the Google server for static maps, and (ii) Use the map as a background image to overlay plots within R. This requires proper coordinate scaling.

**License** GPL

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RgoogleMaps-package      *Overlays on Google map tiles in R*

---

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License:	GPL
LazyLoad:	yes

**Author(s)**

Markus Loecher

---

AddAlpha	<i>add alpha level to color that lacks one</i>
----------	--

---

**Description**

add alpha level to color that lacks one

**Usage**`AddAlpha(plotclr, alpha = 0.5, verbose = 0)`**Arguments**

<code>plotclr</code>	color to be modified
<code>alpha</code>	alpha level
<code>verbose</code>	level of verbosity

**Value**

modified color with alpha value

**Author(s)**

Markus Loecher

**Examples**

```
#example:

#require(RColorBrewer)

if (requireNamespace("RColorBrewer", quietly = TRUE)) {

  plotclr <- RColorBrewer::brewer.pal(8, "YlOrRd")
```

```
plotclr = AddAlpha(plotclr,0.5)

} else {

  print("package RColorBrewer must be installed for this example")

}
```

---

**bubbleMap***Create a bubble plot of spatial data on Google Maps*

---

**Description**

This function creates a bubble plot of spatial data, with options for bicolour residual plots.

**Usage**

```
bubbleMap(SP, coords = c("x", "y"), crs = sp::CRS("+proj=longlat +datum=WGS84"),

  map, filename = "", zcol = 1, max.radius = 100, key.entries,

  do.sqrt = TRUE, colPalette = NULL, strokeColor = "#FFAA00",

  alpha = 0.7, strokeWeight = 1, LEGEND = TRUE, legendLoc = "topleft",

  verbose = 0)
```

**Arguments**

SP	object of class <code>data.frame</code> or <a href="#">SpatialPointsDataFrame-class</a> with associated coordinate reference systems
coords	names of coordinate columns
crs	coordinate reference systems

map	map object; if missing map is downloaded from server
filename	filename to save the map under, IF map object not given
zcol	variable column name, or column number after removing spatial coordinates from x@data: 1 refers to the first non-coordinate column
max.radius	value for largest circle (the plotting symbols) in metre, circumcircle of triangle or quadrangle (square)
key.entries	value for largest circle (the plotting symbols) in metre, circumcircle of triangle or quadrangle (square)
do.sqrt	logical; if TRUE the plotting symbol area (sqrt(diameter)) is proportional to the value of the z-variable; if FALSE, the symbol size (diameter) is proportional to the z-variable
colPalette	colours to be used to fill plotting symbols; numeric vector of same size like key.entries colours to be used to fill features depending on attribute
strokeColor	the color to draw the border of circle (the plotting symbols)
alpha	the fill opacity between 0.0 and 1.0
strokeWeight	the stroke width in pixels
LEGEND	logical; if TRUE add bubbleLegend
legendLoc	the x and y co-ordinates to be used to position the legend. They can be specified by keyword or in any way which is accepted by legend
verbose	level of verbosity

**Value**

#####  
map structure or URL used to download the tile.

**Author(s)**

Markus Loecher

**Examples**

```
data(lat.lon.meuse, package="loa", envir = environment())
```

```
map <- GetMap(center=c(lat=50.97494,lon=5.743606), zoom=13,
              size=c(480,480),destfile = file.path(tempdir(),"meuse.png"),
```

```

maptype="mobile", SCALE = 1);

par(cex=1.5)

bubbleMap(lat.lon.meuse, coords = c("longitude","latitude"), map=map,

zcol='zinc', key.entries = 100+ 100 * 2^(0:4));

```

---

ColorMap

*Plot Levels of a Variable in a Colour-Coded Map*


---

### Description

Plot Levels of a Variable in a Colour-Coded Map

### Usage

```

ColorMap(values, map = NULL, polys = NULL, log = FALSE, nclr = 7,

include.legend = list(TRUE), round = 3, brks = NULL, legend = NULL,

location = "topright", rev = FALSE, alpha = 0.5, GRAY = FALSE,

palette = c("YlOrRd", "RdYlGn", "Spectral")[1], textInPolys = NULL,

... )

```

### Arguments

values	variable to plot
map	map object
polys	an object of class <code>SpatialPolygons</code> (See <a href="#">SpatialPolygons-class</a> )

log	boolean of whether to plot values on log scale
nclr	number of colour-levels to use
include.legend	boolean of whether to include legend
round	number of digits to round to in legend
brks	if desired, pre-specified breaks for legend
legend	if desired, a pre-specified legend
location	location of legend
rev	boolean of whether to reverse colour scheme (darker colours for smaller values)
alpha	alpha value of colors
GRAY	boolean: if TRUE, use gray scale instead
palette	palette to choose from RColorBrewer
textInPolys	text to be displayed inside polygons. This can be a column names for values
...	extra args to pass to PlotPolysOnStaticMap

**Author(s)**

Markus Loecher

**Examples**

```

if (interactive()){

data("NYleukemia", envir = environment())

population <- NYleukemia$data$population

cases <- NYleukemia$data$cases

mapNY <- GetMap(center=c(lat=42.67456,lon=-76.00365), destfile = "NYstate.png",

               maptype = "mobile", zoom=9)

ColorMap(100*cases/population, mapNY, NYleukemia$spatial.polygon, add = FALSE,

         alpha = 0.35, log = TRUE, location = "topleft")

}

```

```
#ColorMap(100*cases/population, map=NULL, NYleukemia$spatial.polygon)
```

---

columbus

*Columbus OH spatial analysis data set*

---

### Description

The columbus data frame has 49 rows and 22 columns. Unit of analysis: 49 neighbourhoods in Columbus, OH, 1980 data. In addition the data set includes a polylist object polys with the boundaries of the neighbourhoods, a matrix of polygon centroids coords, and col.gal.nb, the neighbours list from an original GAL-format file. The matrix bbs is DEPRECATED, but retained for other packages using this data set.

### Usage

```
data(columbus)
```

### Format

This data frame contains the following columns:

**AREA** computed by ArcView

**PERIMETER** computed by ArcView

**COLUMBUS\\_** internal polygon ID (ignore)

**COLUMBUS\\_I** another internal polygon ID (ignore)

**POLYID** yet another polygon ID

**NEIG** neighborhood id value (1-49); conforms to id value used in Spatial Econometrics book.

**HOVAL** housing value (in \\$1,000)

**INC** household income (in \\$1,000)

**CRIME** residential burglaries and vehicle thefts per thousand households in the neighborhood

**OPEN** open space in neighborhood

**PLUMB** percentage housing units without plumbing

**DISCBD** distance to CBD

**X** x coordinate (in arbitrary digitizing units, not polygon coordinates)

**Y** y coordinate (in arbitrary digitizing units, not polygon coordinates)

**NSA** north-south dummy (North=1)

**NSB** north-south dummy (North=1)  
**EW** east-west dummy (East=1)  
**CP** core-periphery dummy (Core=1)  
**THOUS** constant=1,000  
**NEIGNO** NEIG+1,000, alternative neighborhood id value

### Details

The row names of `columbus` and the `region.id` attribute of `polys` are set to `columbus$NEIGNO`.

### Note

All source data files prepared by Luc Anselin, Spatial Analysis Laboratory, Department of Agricultural and Consumer Economics, University of Illinois, Urbana-Champaign, <http://sal.agecon.uiuc.edu/datasets/columbus.zip>.

### Source

Anselin, Luc. 1988. Spatial econometrics: methods and models. Dordrecht: Kluwer Academic, Table 12.1 p. 189.

### Examples

```
#library(maptools)
#columbus <- readShapePoly(system.file("etc/shapes/columbus.shp",
# package="spdep")[1])
#col.gal.nb <- read.gal(system.file("etc/weights/columbus.gal",
# package="spdep")[1])
```

---

degreeAxis	<i>axis with degrees</i>
------------	--------------------------

---

### Description

add an axis with degree labels

### Usage

```
degreeAxis(side, at, labels, MyMap, ...)
```

### Arguments

<code>side</code>	integer; see <a href="#">axis</a>
<code>at</code>	numeric; if missing, <a href="#">axTicks</a> is called for nice values; see <a href="#">axis</a>
<code>labels</code>	character; if omitted labels are constructed with degree symbols, ending in N/S/E/W; in case of negative degrees, sign is reversed and S or W is added; see <a href="#">axis</a>
<code>MyMap</code>	optional map object to be passed
<code>...</code>	optional arguments to <a href="#">axis</a>

**Value**

axis is plotted on current graph

**Note**

decimal degrees are used if variation is small, instead of minutes and seconds

**Author(s)**

Markus Loecher

**Examples**

```
xy = cbind(x = 2 * runif(100) - 1, y = 2 * runif(100) - 1)
```

```
plot(xy, xlim=c(-1,1), ylim=c(-1,1))
```

```
degreeAxis(1)
```

```
degreeAxis(2, at = c(-1,-0.5,0,0.5,1))
```

---

DF2SpatialPointsDataFrame

*change data.frame to SpatialPointsDataFrame*

---

**Description**

This function modifies an object of class `data.frame` to one of class `SpatialPointsDataFrame`

**Usage**

```
DF2SpatialPointsDataFrame(x, coords = c("x", "y"), crs = sp::CRS("+init=epsg:28992"))
```

**Arguments**

<code>x</code>	data frame to be converted
<code>coords</code>	which columns are coordinates
<code>crs</code>	projection scheme

**Value**

the new object of class `SpatialPointsDataFrame`

**Author(s)**

Markus Loecher

**Examples**

```
if (requireNamespace("sp", quietly = TRUE)) {  
  
  data("meuse", package = "sp", envir = environment())  
  
  meuseSP = DF2SpatialPointsDataFrame(meuse)  
  
  sp::plot(meuseSP, asp = 1, cex = 4 * meuse$zinc/max(meuse$zinc),  
           pch = 1, col = as.numeric(meuse$ffreq)+1 )  
  
  data("meuse.riv", package = "sp", envir = environment())  
  
  lines(meuse.riv)  
  
} else {  
  
  print("package sp must be installed for this example")  
  
}
```

---

getGeoCode	<i>geocoding utility</i>
------------	--------------------------

---

**Description**

Geocode your data using, R, JSON and Google Maps' Geocoding APIs  
see <http://allthingsr.blogspot.de/2012/01/geocode-your-data-using-r-json-and.html>  
and

**Usage**

```
getGeoCode(gcStr, verbose = 0)
```

**Arguments**

gcStr	address to geocode
verbose	level of verbosity

**Value**

returns lat/lon for address

**Author(s)**

Markus Loecher

**Examples**

```
getGeoCode("Brooklyn")
```

```
#You can run this on the entire column of a data frame or a data table:
```

```
DF = cbind.data.frame(address=c("Berlin,Germany", "Princeton,NJ",  
                               "cadillac+mountain+acadia+national+park"), lat = NA, lon = NA)  
  
DF <- with(DF, data.frame(address, t(sapply(DF$address, getGeoCode))))
```

---

GetMap	<i>download a static map from the Google server</i>
--------	---

---

### Description

Query the Google server for a static map tile, defined primarily by its center and zoom. Many additional arguments allow the user to customize the map tile.

### Usage

```
GetMap(center = c(lat = 42, lon = -76), size = c(640, 640), destfile,

       zoom = 12, markers, path = "", span, frame, hl, sensor = "true",

       maptype = c("roadmap", "mobile", "satellite", "terrain",

                  "hybrid", "mapmaker-roadmap", "mapmaker-hybrid")[2],

       format = c("gif", "jpg", "jpg-baseline", "png8", "png32")[5],

       RETURNIMAGE = TRUE, GRAYSCALE = FALSE, NEWMAP = TRUE, SCALE = 1,

       API_console_key = NULL, verbose = 0)
```

### Arguments

center	optional center (lat first,lon second )
size	desired size of the map tile image. defaults to maximum size returned by the Gogle server, which is 640x640 pixels
destfile	File to load the map image from or save to, depending on NEWMAP.
zoom	Google maps zoom level.
markers	(optional) defines one or more markers to attach to the image at specified locations. This parameter takes a string of marker definitions separated by the pipe character ( )
path	(optional) defines a single path of two or more connected points to overlay on the image at specified locations. This parameter takes a string of point definitions separated by the pipe character ( )

span	(optional) defines a minimum viewport for the map image expressed as a latitude and longitude pair. The static map service takes this value and produces a map of the proper zoom level to include the entire provided span value from the map's center point. Note that the resulting map may include larger bounds for either latitude or longitude depending on the rectangular dimensions of the map. If zoom is specified, span is ignored
frame	(optional) specifies that the resulting image should be framed with a colored blue border. The frame consists of a 5 pixel, 55 % opacity blue border.
hl	(optional) defines the language to use for display of labels on map tiles. Note that this parameter is only supported for some country tiles; if the specific language requested is not supported for the tile set, then the default language for that tile set will be used.
sensor	specifies whether the application requesting the static map is using a sensor to determine the user's location. This parameter is now required for all static map requests.
maptype	defines the type of map to construct. There are several possible maptype values, including satellite, terrain, hybrid, and mobile.
format	(optional) defines the format of the resulting image. By default, the Static Maps API creates GIF images. There are several possible formats including GIF, JPEG and PNG types. Which format you use depends on how you intend to present the image. JPEG typically provides greater compression, while GIF and PNG provide greater detail. This version supports only PNG.
RETURNIMAGE	return image yes/no default: TRUE
GRAYSCALE	Boolean toggle; if TRUE the colored map tile is rendered into a black & white image, see <a href="#">RGB2GRAY</a>
NEWMAP	if TRUE, query the Google server and save to destfile, if FALSE load from destfile.
SCALE	use the API's scale parameter to return higher-resolution map images. The scale value is multiplied with the size to determine the actual output size of the image in pixels, without changing the coverage area of the map
API_console_key	optional API key (allows for higher rate of downloads)
verbose	level of verbosity

**Value**

map structure or URL used to download the tile.

**Note**

Note that size is in order (lon, lat)

**Author(s)**

Markus Loecher

**See Also**[GetMap.bbox](#)**Examples**

```
lat = c(40.702147,40.718217,40.711614);

lon = c(-74.012318,-74.015794,-73.998284);

center = c(mean(lat), mean(lon));

zoom <- min(MaxZoom(range(lat), range(lon)));

#this overhead is taken care of implicitly by GetMap.bbox();

markers = paste0("&markers=color:blue|label:S|40.702147,-74.015794&markers=color:",

                 "green|label:G|40.711614,-74.012318&markers=color:red|color:red|",

                 "label:C|40.718217,-73.998284")

MyMap <- GetMap(center=center, zoom=zoom,markers=markers,destfile = "MyTile1.png");

#Note that in the presence of markers one often needs to add some extra padding to the

#latitude range to accomodate the extent of the top most marker

#add a path, i.e. polyline:

MyMap <- GetMap(center=center, zoom=zoom,destfile = "MyTile3.png",

path = paste0("&path=color:0x0000ff|weight:5|40.737102,-73.990318|",
```

```
"40.749825,-73.987963|40.752946,-73.987384|40.755823,-73.986397"));

#use implicit geo coding

BrooklynMap <- GetMap(center="Brooklyn", zoom=13)

PlotOnStaticMap(BrooklynMap)

#use implicit geo coding and display labels in Korean:

BrooklynMap <- GetMap(center="Brooklyn", zoom=13, hl="ko")

PlotOnStaticMap(BrooklynMap)

#The example below defines a polygonal area within Manhattan, passed a series of

#intersections as locations:

#MyMap <- GetMap(path = paste0("&path=color:0x00000000|weight:5|fillcolor:0xFFFF0033|",

#      "8th+Avenue+%26+34th+St,New+York,NY|8th+Avenue+%26+42nd+St,New+York,NY|",

#      "Park+Ave+%26+42nd+St,New+York,NY|Park+Ave+%26+34th+St,New+York,NY,NY"),

#      destfile = "MyTile3a.png");

#note that since the path string is just appended to the URL you can "abuse" the path

#argument to pass anything to the query, e.g. the style parameter:
```

```
#The following example displays a map of Brooklyn where local roads have been changed
#to bright green and the residential areas have been changed to black:

# MyMap <- GetMap(center="Brooklyn", zoom=12, maptype = "roadmap",

#path = paste0("&style=feature:road.local|element:geometry|hue:0x00ff00|",

#           "saturation:100&style=feature:landscape|element:geometry|lightness:-100"),

#           sensor='false', destfile = "MyTile4.png", RETURNIMAGE = FALSE);

#In the last example we set RETURNIMAGE to FALSE which is a useful feature in general
#if png is not installed. In that cases, the images can still be fetched
#and saved but not read into R.

#In the following example we let the Static Maps API determine the correct center and
#zoom level implicitly, based on evaluation of the position of the markers.

#However, to be of use within R we do need to know the values for zoom and
#center explicitly, so it is better practice to compute them ourselves and
#pass them as arguments, in which case meta information on the map tile can be saved as well.

#MyMap <- GetMap(markers = paste0("&markers=color:blue|label:S|40.702147,-74.015794&",
```

```
#         "markers=color:green|label:G|40.711614,-74.012318&markers=color:red|",
#
#         "color:red|label:C|40.718217,-73.998284"),
#
#         destfile = "MyTile1.png", RETURNIMAGE = FALSE);
```

---

GetMap.bbox

*GetMap bbox*

---

### Description

Wrapper function for [GetMap](#). Query the Google server for a static map tile, defined primarily by its lat/lon range and/or center and/or zoom.

Multiple additional arguments allow the user to customize the map tile.

### Usage

```
GetMap.bbox(lonR, latR, center, size = c(640, 640), destfile = "MyTile.png",
```

```
MINIMUMSIZE = FALSE, RETURNIMAGE = TRUE, GRAYSCALE = FALSE,
```

```
NEWMAP = TRUE, zoom, verbose = 0, SCALE = 1, ...)
```

### Arguments

lonR	longitude range
latR	latitude range
center	optional center
size	desired size of the map tile image. defaults to maximum size returned by the Gogle server, which is 640x640 pixels
destfile	File to load the map image from or save to, depending on NEWMAP.
MINIMUMSIZE	reduce the size of the map to its minimum size that still fits the lat/lon ranges ?
RETURNIMAGE	return image yes/no default: TRUE
GRAYSCALE	Boolean toggle; if TRUE the colored map tile is rendered into a black & white image, see <a href="#">RGB2GRAY</a>

NEWMAP	if TRUE, query the Google server and save to destfile, if FALSE load from destfile.
zoom	Google maps zoom level. optional
verbose	level of verbosity
SCALE	use the API's scale parameter to return higher-resolution map images. The scale value is multiplied with the size to determine the actual output size of the image in pixels, without changing the coverage area of the map
...	extra arguments to <a href="#">GetMap</a>

**Value**

map tile

**Author(s)**

Markus Loecher

**Examples**

```
mymarkers <- cbind.data.frame(lat = c(38.898648,38.889112, 38.880940),  
  
  lon = c(-77.037692, -77.050273, -77.03660), size = c('tiny','tiny','tiny'),  
  
  col = c('blue', 'green', 'red'), char = c('','',''));  
  
##get the bounding box:  
  
bb <- qbbox(lat = mymarkers["lat"], lon = mymarkers["lon"]);  
  
##download the map:  
  
MyMap <- GetMap.bbox(bb$lonR, bb$latR, destfile = "DC.png", GRAYSCALE =TRUE,  
  
  markers = mymarkers);
```

```
##The function qbbox() basically computes a bounding box for the given lat,lon

#points with a few additional options such as quantile boxes, additional buffers, etc.

bb <- qbbox(c(40.702147,40.711614,40.718217),c(-74.015794,-74.012318,-73.998284),

          TYPE = "all", margin = list(m=rep(5,4), TYPE = c("perc", "abs")[1]));

##download the map:

MyMap <- GetMap.bbox(bb$lonR, bb$latR,destfile = "MyTile3.png", maptype = "satellite")
```

---

GetMap.OSM

*Query the Open Street Map server for map tiles instead of Google Maps*

---

### **Description**

The querying parameters for Open Street Maps are somewhat different in this version. Instead of a zoom, center and size, the user supplies a scale parameter and a lat/lon bounding box. The scale determines the image size.

### **Usage**

```
GetMap.OSM(lonR = c(-74.02132, -73.98622), latR = c(40.69983,

          40.72595), scale = 20000, destfile = "MyTile.png", format = "png",

          RETURNIMAGE = TRUE, GRAYSCALE = FALSE, NEWMAP = TRUE, verbose = 1,

          ...)
```

**Arguments**

lonR	longitude range
latR	latitude range
scale	Open Street map scale parameter. The larger this value, the smaller the resulting map tile in memory. There is a balance to be struck between the lat/lon bounding box and the scale parameter.
destfile	File to load the map image from or save to, depending on NEWMAP.
format	(optional) defines the format of the resulting image.
RETURNIMAGE	return image yes/no default: TRUE
GRAYSCALE	Boolean toggle; if TRUE the colored map tile is rendered into a black & white image, see <a href="#">RGB2GRAY</a>
NEWMAP	if TRUE, query the Google server and save to destfile, if FALSE load from destfile.
verbose	level of verbosity,
...	extra arguments to be used in future versions

**Value**

map structure or URL used to download the tile.

**Note**

The OSM maptile server is frequently too busy to accomodate every request, so patience is warranted.

**Author(s)**

Markus Loecher

**Examples**

```
if (interactive()) {

  CologneMap <- GetMap.OSM(lonR= c(6.89, 7.09), latR = c(50.87, 51), scale = 150000,

                           destfile = "Cologne.png");

  PlotOnStaticMap(CologneMap, mar=rep(4,4), NEWMAP = FALSE, TrueProj = FALSE, axes= TRUE);
```

```
PrincetonMap <- GetMap.OSM(lonR= c(-74.67102, -74.63943), latR = c(40.33804,40.3556),  
  
                           scale = 12500, destfile = "Princeton.png");  
  
png("PrincetonWithAxes.png", 1004, 732)  
  
  PlotOnStaticMap(PrincetonMap, axes = TRUE, mar = rep(4,4));  
  
  dev.off()  
  
}
```

---

IdentifyPoints	<i>identify points by clicking on map</i>
----------------	---

---

### Description

The user can try to identify lat/lon pairs on the map by clicking on them

### Usage

```
IdentifyPoints(MyMap, n = 1, verbose = 0)
```

### Arguments

MyMap	map object
n	the maximum number of points to locate.
verbose	level of verbosity

### Value

the lat/lon coordinates of the chosen points are returned

### Author(s)

Markus Loecher

## Examples

#The first step naturally will be to download a static map from the Google server. A simple example:

```
#identify points:
```

```
#IdentifyPoints(MyMap,5)
```

---

LatLon2XY	<i>computes the coordinate transformation from lat/lon to map tile coordinates</i>
-----------	--

---

## Description

The function `LatLon2XY(lat,lon,zoom)` computes the coordinate transformation from lat/lon to map tile coordinates given a zoom level.

It returns the tile coordinates as well as the pixel coordinates within the Tile itself.

Thanks to Neil Young (see [http://groups.google.com/group/Google-Maps-API/browse\\_thread/thread/d2103ac29e95696f?hl=en](http://groups.google.com/group/Google-Maps-API/browse_thread/thread/d2103ac29e95696f?hl=en)) for providing the formulae used.

## Usage

```
LatLon2XY(lat, lon, zoom)
```

## Arguments

lat	latitude values to transform
lon	longitude values to transform
zoom	zoom level.lat,lon,zoom

## Value

A list with values

Tile	integer numbers specifying the tile
Coords	pixel coordinate within the Tile

**Note**

The fractional part times 256 is the pixel coordinate within the Tile itself.

**Author(s)**

Markus Loecher

**Examples**

```
LatLon2XY(38.45, -122.375, 11)
```

---

LatLon2XY.centered	<i>computes the centered coordinate transformation from lat/lon to map tile coordinates</i>
--------------------	---

---

**Description**

The function `LatLon2XY.centered(MyMap, lat,lon,zoom)` computes the coordinate transformation from lat/lon to map tile coordinates given a map object.

**Usage**

```
LatLon2XY.centered(MyMap, lat, lon, zoom)
```

**Arguments**

MyMap	map object
lat	latitude values to transform
lon	longitude values to transform
zoom	optional zoom level. If missing, taken from MyMap

**Value**

properly scaled and centered (with respect to the center of MyMap ) coordinates

newX	transformed longitude
newY	transformed latitude

**Author(s)**

Markus Loecher

**See Also**

[LatLon2XY Tile2R](#)

---

MapBackground	<i>get static Map from the Google server</i>
---------------	--

---

### Description

get static Map from the Google server

### Usage

```
MapBackground(lat, lon, destfile, NEWMAP = TRUE, myTile, zoom = NULL,  
  
              size = c(640, 640), GRAYSCALE = FALSE, mar = c(0, 0, 0, 0),  
  
              PLOT = FALSE, verbose = 1, ...)
```

### Arguments

lat	
lon	
destfile	File to load the map image from or save to, depending on NEWMAP.
NEWMAP	if TRUE, query the Google server and save to destfile, if FALSE load from destfile.
myTile	map tile from previous downloads
zoom	Google maps zoom level.
size	desired size of the map tile image. defaults to maximum size returned by the Gogle server, which is 640x640 pixels
GRAYSCALE	Boolean toggle; if TRUE the colored map tile is rendered into a black & white image, see <a href="#">RGB2GRAY</a>
mar	outer margin in plot; if you want to see axes, change the default
PLOT	if TRUE, leave the plotting to <a href="#">PlotOnStaticMap</a> , highly recommended
verbose	level of verbosity
...	further arguments to be passed to <a href="#">GetMap.bbox</a>

### Value

list containing the map tile

### Author(s)

Markus Loecher

---

MaxZoom	<i>computes the maximum zoom level which will contain the given lat/lon range</i>
---------	---

---

**Description**

computes the maximum zoom level which will contain the given lat/lon range

**Usage**

```
MaxZoom(latrangle, lonrange, size = c(640, 640))
```

**Arguments**

latrange	range of latitude values
lonrange	range of longitude values
size	desired size of the map tile image. defaults to maximum size returned by the Gogle server, which is 640x640 pixels

**Value**

zoom level

**Author(s)**

Markus Loecher

---

mypolygon	<i>simple wrapper function to plot colored polygons</i>
-----------	---

---

**Description**

same as [polygon](#), execept the value for color is taken from the 1st element of the extra column 'col'

**Usage**

```
mypolygon(x, ...)
```

**Arguments**

x	matrix containing columns X,Y,col
...	extra arguments passed to <a href="#">polygon</a>

**Author(s)**

Markus Loecher

---

NYleukemia

*Upstate New York Leukemia Data*

---

### Description

Census tract level (n=281) leukemia data for the 8 counties in upstate New York from 1978-1982, paired with population data from the 1980 census.

### Usage

```
data(NYleukemia)
```

### Format

List with 5 items:

geo	table of the FIPS code, longitude, and latitude of the geographic centroid of each census tract
data	table of the FIPS code, number of cases, and population of each census tract
spatial.polygon	object of class SpatialPolygons (See <a href="#">SpatialPolygons-class</a> ) containing a map of the study region
surrounded	row IDs of the 4 census tracts that are completely surrounded by the surrounding census tracts
surrounding	row IDs of the 4 census tracts that completely surround the surrounded census tracts

### Source

<http://www.sph.emory.edu/~lwaller/ch4index.htm>

### References

Turnbull, B. W. et al (1990) Monitoring for clusters of disease: application to leukemia incidence in upstate New York *American Journal of Epidemiology*, **132**, 136–143

### Examples

```
data(NYleukemia)
population <- NYleukemia$data$population
cases <- NYleukemia$data$cases
mapNY <- GetMap(center=c(lon=-76.00365, lat=42.67456), destfile = "NYstate.png",
  maptypes = "mobile", zoom=9)
ColorMap(100*cases/population, mapNY, NYleukemia$spatial.polygon, add = FALSE,
  alpha = 0.35, log = TRUE, location = "topleft")
```

---

pennLC

*Pennsylvania Lung Cancer*

---

### Description

County-level (n=67) population/case data for lung cancer in Pennsylvania in 2002, stratified on race (white vs non-white), gender and age (Under 40, 40-59, 60-69 and 70+). Additionally, county-specific smoking rates.

### Usage

```
data(pennLC)
```

### Format

List of 3 items:

geo	a table of county IDs, longitude/latitude of the geographic centroid of each county
data	a table of county IDs, number of cases, population and strata information
smoking	a table of county IDs and proportion of smokers
spatial.polygon	an object of class SpatialPolygons (See <a href="#">SpatialPolygons-class</a> )

### Source

Population data was obtained from the 2000 decennial census, lung cancer and smoking data were obtained from the Pennsylvania Department of Health website: <http://www.dsf.health.state.pa.us/>

### See Also

[NYleukemia](#)

### Examples

```
data(pennLC)
#pennLC$geo
#pennLC$data
#pennLC$smoking

# Map smoking rates in Pennsylvania
#mapvariable(pennLC$smoking[,2], pennLC$spatial.polygon)
```

---

PlotArrowsOnStaticMap *plots arrows or segments on map*

---

### Description

This function plots/overlays arrows or segments on a map.

### Usage

```
PlotArrowsOnStaticMap(MyMap, lat0, lon0, lat1 = lat0, lon1 = lon0,
    TrueProj = TRUE, FUN = arrows, add = FALSE, verbose = 0,
    ...)
```

### Arguments

MyMap	map image returned from e.g. GetMap()
lat0	latitude values of points FROM which to draw.
lon0	longitude values of points FROM which to draw.
lat1	latitude values of points TO which to draw.
lon1	longitude values of points TO which to draw.
TrueProj	set to FALSE if you are willing to accept some degree of inaccuracy in the mapping. In that case, the coordinates of the image are in lat/lon and the user can simply overlay points/lines/axis without worrying about projections
FUN	, plotting function to use for overlay; typical choices would be <a href="#">arrows</a> and <a href="#">segments</a>
add	start a new plot or add to an existing
verbose	level of verbosity
...	further arguments to be passed to FUN

### Value

return value of FUN

### Author(s)

Markus Loecher

### See Also

[PlotOnStaticMap arrows](#)

**Examples**

```
MyMap <- GetMap(center=c(lat=40.7,lon=-74), zoom=11)

PlotArrowsOnStaticMap(MyMap, lat0=40.69, lon0=-73.9, lat1=40.71, lon1=-74.1, col = 'red')
```

---

PlotOnStaticMap      *overlays plot on background image of map tile*

---

**Description**

This function is the workhorse of the package RgoogleMaps. It overlays plot on background image of map tile

**Usage**

```
PlotOnStaticMap(MyMap, lat, lon, destfile, zoom = NULL, size,

                GRAYSCALE = FALSE, add = FALSE, FUN = points, mar = c(0,

                0, 0, 0), NEWMAP = TRUE, TrueProj = TRUE, axes = FALSE,

                atX = NULL, atY = NULL, verbose = 0, ...)
```

**Arguments**

MyMap	optional map object
lat	latitude values to be overlaid
lon	longitude values to be overlaid
destfile	File to load the map image from or save to, depending on whether MyMap was passed.
zoom	Google maps zoom level. optional if MyMap is passed, required if not.
size	desired size of the map tile image. defaults to maximum size returned by the Gogle server, which is 640x640 pixels
GRAYSCALE	Boolean toggle; if TRUE the colored map tile is rendered into a black & white image, see <a href="#">RGB2GRAY</a>

add	start a new plot or add to an existing
FUN	plotting function to use for overlay; typical choices would be <a href="#">points</a> and <a href="#">lines</a>
mar	outer margin in plot; if you want to see axes, change the default
NEWMAP	load map from file or get it "new" from the static map server
TrueProj	set to FALSE if you are willing to accept some degree of inaccuracy in the mapping. In that case, the coordinates of the image are in lat/lon and the user can simply overlay points/lines/axis without worrying about projections
axes	overlay axes ?
atX	numeric; position of ticks on x-axis; if missing, <a href="#">axTicks</a> is called for nice values; see <a href="#">axis</a>
atY	numeric; position of ticks on y-axis; if missing, <a href="#">axTicks</a> is called for nice values; see <a href="#">axis</a>
verbose	level of verbosity
...	further arguments to be passed to FUN

**Value**

the map object is returned via `invisible(MyMap)`

**Author(s)**

Markus Loecher

**Examples**

#The first step naturally will be to download a static map from the Google server. A simple example:

```
lat = c(40.702147,40.718217,40.711614);

lon = c(-74.012318,-74.015794,-73.998284);

center = c(mean(lat), mean(lon));

zoom <- min(MaxZoom(range(lat), range(lon)));

#this overhead is taken care of implicitly by GetMap.bbox();
```

```
MyMap <- GetMap(center=center, zoom=zoom, markers = paste0("&markers=color:blue|label:S|",  
"40.702147,-74.015794&markers=color:green|label:G|40.711614,-74.012318&markers=",  
"color:red|color:red|label:C|40.718217,-73.998284"), destfile = "MyTile1.png");  
  
tmp <- PlotOnStaticMap(MyMap, lat = c(40.702147,40.711614,40.718217),  
lon = c(-74.015794,-74.012318,-73.998284),  
destfile = "MyTile1.png", cex=1.5,pch=20,  
col=c('red', 'blue', 'green'), add=FALSE);  
  
#and add lines:  
  
PlotOnStaticMap(MyMap, lat = c(40.702147,40.711614,40.718217),  
lon = c(-74.015794,-74.012318,-73.998284),  
lwd=1.5,col=c('red', 'blue', 'green'), FUN = lines, add=TRUE)
```

---

PlotPolysOnStaticMap *plots polygons on map*

---

### Description

This function plots/overlays polygons on a map. Typically, the polygons originate from a shapefile.

**Usage**

```
PlotPolysOnStaticMap(MyMap, polys, col, border = NULL, lwd = 0.25,
  verbose = 0, add = TRUE, textInPolys = NULL, ...)
```

**Arguments**

MyMap	map image returned from e.g. <code>GetMap()</code>
polys	or of class <a href="#">SpatialPolygons</a> from the package <code>sp</code> polygons to overlay; these can be either of class <a href="#">PolySet</a> from the package <code>PBSmapping</code>
col	(optional) vector of colors, one for each polygon
border	the color to draw the border. The default, <code>NULL</code> , means to use <code>par("fg")</code> . Use <code>border = NA</code> to omit borders, see <a href="#">polygon</a>
lwd	line width, see <a href="#">par</a>
verbose	level of verbosity
add	start a new plot or add to an existing
textInPolys	text to be displayed inside polygons.
...	further arguments passed to <code>PlotOnStaticMap</code>

**Author(s)**

Markus Loecher

**See Also**

[PlotOnStaticMap](#) [mypolygon](#)

**Examples**

```
if (interactive()){
  #require(PBSmapping);

  shpFile <- paste(system.file(package = "RgoogleMaps"), "/shapes/bg11_d00.shp", sep = "")

  #shpFile <- system.file('bg11_d00.shp', package = "RgoogleMaps");
```

```
shp=importShapefile(shpFile,projection="LL");

bb <- qbbox(lat = shp[,"Y"], lon = shp[,"X"]);

MyMap <- GetMap.bbox(bb$lonR, bb$latR, destfile = "DC.png");

PlotPolysOnStaticMap(MyMap, shp, lwd=.5, col = rgb(0.25,0.25,0.25,0.025), add = F);

#Try an open street map:

mapOSM <- GetMap.OSM(lonR=bb$lonR, latR=bb$latR, scale = 150000, destfile = "DC.png");

PlotPolysOnStaticMap(mapOSM, shp, lwd=.5, col = rgb(0.75,0.25,0.25,0.15), add = F);

#North Carolina SIDS data set:

shpFile <- system.file("shapes/sids.shp", package="mapproj");

shp=importShapefile(shpFile,projection="LL");

bb <- qbbox(lat = shp[,"Y"], lon = shp[,"X"]);

MyMap <- GetMap.bbox(bb$lonR, bb$latR, destfile = "SIDS.png");

#compute regularized SID rate

sid <- 100*attr(shp, "PolyData")$SID74/(attr(shp, "PolyData")$BIR74+500)

b <- as.integer(cut(sid, quantile(sid, seq(0,1,length=8)) ));
```

```
b[is.na(b)] <- 1;

opal <- col2rgb(grey.colors(7), alpha=TRUE)/255; opal["alpha",] <- 0.2;

shp[, "col"] <- rgb(0.1,0.1,0.1,0.2);

for (i in 1:length(b))

  shp[shp[, "PID"] == i, "col"] <- rgb(opal[1,b[i]],opal[2,b[i]],opal[3,b[i]],opal[4,b[i]]);

PlotPolysOnStaticMap(MyMap, shp, lwd=.5, col = shp[, "col"], add = F);

#compare the accuracy of this plot to a Google Map overlay:

library(maptools);

qk <- SpatialPointsDataFrame(as.data.frame(shp[, c("X", "Y")]), as.data.frame(shp[, c("X", "Y")]))

sp::proj4string(qk) <- CRS("+proj=longlat");

tf <- "NC.counties";

SGqk <- GE_SpatialGrid(qk)

png(file=paste(tf, ".png", sep=""), width=SGqk$width, height=SGqk$height,

bg="transparent")

par(mar=c(0,0,0,0), xaxs="i", yaxs="i");par(mai = rep(0,4))

PBSmapping::plotPolys(shp, plt=NULL)

dev.off()
```

```

maptools::kmlOverlay(SGqk, paste(tf, ".kml", sep=""), paste(tf, ".png", sep=""));

#This kml file can now be inspected in Google Earth or Google Maps

#or choose an aspect ratio that corresponds better to North Carolina's elongated shape:

MyMap <- GetMap.bbox(bb$lonR, bb$latR, destfile = "SIDS.png", size = c(640, 320), zoom = 7);

PlotPolysOnStaticMap(MyMap, shp, lwd=.5, col = shp[,"col"], add = F);

}

```

---

qbbox

*computes bounding box*


---

### Description

The function `qbbox` computes a bounding box for the given `lat,lon` points with a few additional options such as quantile boxes, additional margins, etc.

### Usage

```

qbbox(lat, lon, TYPE = c("all", "quantile")[1], margin = list(m = c(1,
  1, 1), TYPE = c("perc", "abs")[1]), q.lat = c(0.1, 0.9),
  q.lon = c(0.1, 0.9), verbose = 0)

```

### Arguments

`lat`            latitude values  
`lon`            longitude values  
`TYPE`  
`margin`

q.lat  
q.lon  
verbose

**Value**

latR            latitude range  
lonR            longitude range

**Author(s)**

Markus Loecher

**Examples**

```
lat = 37.85 + rnorm(100, sd=0.001);

lon = -120.47 + rnorm(100, sd=0.001);

#add a few outliers:

lat[1:5] <- lat[1:5] + rnorm(5, sd =.01);

lon[1:5] <- lon[1:5] + rnorm(5, sd =.01);

#range, discarding the upper and lower 10% of the data

qbbox(lat, lon, TYPE = "quantile");

#full range:

qbbox(lat, lon, TYPE = "all");

#add a 10% extra margin on all four sides:

qbbox(lat, lon, margin = list(m = c(10, 10, 10, 10), TYPE = c("perc", "abs")[1]));
```

---

ReadMapTile	<i>Read a bitmap image stored in the PNG format</i>
-------------	---

---

**Description**

Reads an image from a PNG file/content into a raster array.

**Usage**

```
ReadMapTile(destfile, METADATA = TRUE, native = TRUE)
```

**Arguments**

destfile	png file to read
METADATA	read MetaInfo as well ?
native	determines the image representation - if FALSE then the result is an array, if TRUE then the result is a native raster representation, see <a href="#">readPNG</a> in package png.

**Value**

map or tile object

**Author(s)**

Markus Loecher

---

RGB2GRAY	<i>translates an RGB image matrix to gray scale</i>
----------	---

---

**Description**

This function translates the rgb values of the array myTile into a scalar matrix with just one gray value per pixel.

**Usage**

```
RGB2GRAY(myTile)
```

**Arguments**

myTile                    rgb image matrix, usually array with 3 dimensions

**Details**

Gray scale intensity defined as  $0.30R + 0.59G + 0.11B$

**Value**

image tile

**Author(s)**

Markus Loecher

**Examples**

```
if (interactive()){  
  
  BrooklynLatLon = getGeoCode("Brooklyn")  
  
  mapBrooklyn <- GetMap(center=BrooklynLatLon, destfile = file.path(tempdir(), "Brooklyn.png"),  
  
                        zoom=11, size = c(240,240))  
  
  mapBrooklynBW$myTile = RGB2GRAY(mapBrooklyn$myTile)  
  
  PlotOnStaticMap(mapBrooklynBW)  
  
}
```

---

SpatialToPBS	<i>converts spatial objects as defined in package sp to simpler PBSmapping type dataframes</i>
--------------	--

---

**Description**

The PlotPolysOnStaticMap() function currently does not take sp objects directly but instead needs PBSmapping type data.frames. This function converts sp objects into such.

**Usage**

```
SpatialToPBS(xy, verbose = 0)
```

**Arguments**

xy	spatial object, such as SpatialPoints, SpatialPolygons, etc..
verbose	level of verbosity

**Value**

list with elements xy = converted object, bb = bounding box, fun = plot function

**Author(s)**

Markus Loecher

**Examples**

```
if (interactive()) {  
  
  data("NYleukemia", envir = environment())  
  
  population <- NYleukemia$data$population  
  
  cases <- NYleukemia$data$cases  
  
  mapNY <- GetMap(center=c(lat=42.67456,lon=-76.00365),  
  
                  destfile = file.path(tempdir(),"NYstate.png"),  
  
                  maptype = "mobile", zoom=9)  
  
  #mapNY=ReadMapTile("NYstate.png")  
  
  clrStuff=ColorMap(100*cases/population, alpha = 0.35, log = TRUE)  
  
  NYpolys = SpatialToPBS(NYleukemia$spatial.polygon)  
  
  PlotPolysOnStaticMap(mapNY, NYpolys$xy, col = clrStuff$colcode, add = FALSE)
```

```

legend("topleft", legend = clrStuff$legend, fill = clrStuff$fill,

      bg = rgb(0.1,0.1,0.1,0.3))

}

```

---

TextOnStaticMap      *plots text on map*

---

### Description

TextOnStaticMap draws the strings given in the vector labels at the coordinates given by x and y on a map. y may be missing since `xy.coords(x,y)` is used for construction of the coordinates.

### Usage

```

TextOnStaticMap(MyMap, lat, lon, labels = seq_along(lat), TrueProj = TRUE,

               FUN = text, add = FALSE, verbose = 0, ...)

```

### Arguments

MyMap	map image returned from e.g. <code>GetMap()</code>
lat	latitude where to put text.
lon	longitude where to put text.
labels	a character vector or <a href="#">expression</a> specifying the text to be written. An attempt is made to coerce other language objects (names and calls) to expressions, and vectors and other classed objects to character vectors by <code>as.character</code> . If labels is longer than x and y, the coordinates are recycled to the length of labels.
TrueProj	set to FALSE if you are willing to accept some degree of inaccuracy in the mapping. In that case, the coordinates of the image are in lat/lon and the user can simply overlay points/lines/axis without worrying about projections
FUN	overlay function, typical choice would be <a href="#">text</a>
add	start a new plot or add to an existing
verbose	level of verbosity
...	further arguments to be passed to FUN

**Value**

return value of FUN

**Author(s)**

Markus Loecher

**Examples**

```
lat = c(40.702147,40.718217,40.711614);

lon = c(-74.012318,-74.015794,-73.998284);

center = c(mean(lat), mean(lon));

zoom <- min(MaxZoom(range(lat), range(lon)));

MyMap <- GetMap(center=center, zoom=zoom,markers = paste0("&markers=color:blue|label:S|",
  "40.702147,-74.015794&markers=color:green|label:G|40.711614,-74.012318&markers=",
  "color:red|color:red|label:C|40.718217,-73.998284"), destfile = "MyTile1.png");

TextOnStaticMap(MyMap, lat=40.711614,lon=-74.012318, "Some Text", cex=2, col = 'red')
```

---

Tile2R	<i>simple utility to offset and scale XY coordinates with respect to the center</i>
--------	---

---

**Description**

simple utility to offset and scale XY coordinates with respect to the center

**Usage**

```
Tile2R(points, center)
```

**Arguments**

points	XY coordinates returned by e.g. <a href="#">LatLon2XY</a>
center	XY coordinates of center returned by e.g. <a href="#">LatLon2XY</a>

**Details**

mainly used for shrinking the size of a tile to the minimum size.

**Value**

list with X and Y pixel values

**Author(s)**

Markus Loecher

**Examples**

```
latR <- c(34.5,34.9);

lonR <- c(-100.3, -100);

lat.center <- 34.7;

lon.center <- -100.2;

zoom = 10;

ll <- LatLon2XY(latR[1], lonR[1], zoom);#lower left corner
```

```

ur <- LatLon2XY(latR[2], lonR[2], zoom );#upper right corner

cr <- LatLon2XY(lat.center, lon.center, zoom );#center

ll.Rcoords <- Tile2R(ll, cr);

ur.Rcoords <- Tile2R(ur, cr);

```

---

updateusr

*Updates the 'usr' coordinates in the current plot.*


---

### Description

For a traditional graphics plot this function will update the 'usr' coordinates by transforming a pair of points from the current usr coordinates to those specified.

### Usage

```
updateusr(x1, y1 = NULL, x2, y2 = NULL)
```

### Arguments

x1	The x-coords of 2 points in the current 'usr' coordinates, or anything that can be passed to <code>xy.coords</code> .
y1	The y-coords of 2 points in the current 'usr' coordinates, or an object representing the points in the new 'usr' coordinates.
x2	The x-coords for the 2 points in the new coordinates.
y2	The y-coords for the 2 points in the new coordinates.

### Details

Sometimes graphs (in the traditional graphing scheme) end up with usr coordinates different from expected for adding to the plot (for example `barplot` does not center the bars at integers). This function will take 2 points in the current 'usr' coordinates and the

desired 'usr' coordinates of the 2 points and transform the user coordinates to make this happen. The updating only shifts and scales the coordinates, it does not do any rotation or warping transforms.

If x1 and y1 are lists or matrices and x2 and y2 are not specified, then x1 is taken to be the coordinates in the current system and y1 is the coordinates in the new system.

Currently you need to give the function exactly 2 points in each system. The 2 points cannot have the same x values or y values in either system.

**Value**

An invisible list with the previous 'usr' coordinates from par.

**Note**

Currently you need to give coordinates for exactly 2 points without missing values. Future versions of the function will allow missing values or multiple points.

Note by Markus Loecher: both the source and the documentations were copied from the package TeachingDemos version 2.3

**Author(s)**

Markus Loecher

**Examples**

```
tmp <- barplot(1:4)

updateusr(tmp[1:2], 0:1, 1:2, 0:1)

lines(1:4, c(1,3,2,2), lwd=3, type='b',col='red')

# update the y-axis to put a reference distribution line in the bottom

# quarter
```

```
tmp <- rnorm(100)

hist(tmp)

tmp2 <- par('usr')

xx <- seq(min(tmp), max(tmp), length.out=250)

yy <- dnorm(xx, mean(tmp), sd(tmp))

updateusr( tmp2[1:2], tmp2[3:4], tmp2[1:2], c(0, max(yy)*4) )

lines(xx,yy)
```

---

XY2LatLon	<i>computes the centered coordinate transformation from lat/lon to map tile coordinates</i>
-----------	---

---

### Description

The function `XY2LatLon(MyMap, X,Y,zoom)` computes the coordinate transformation from map tile coordinates to lat/lon given a map object.

### Usage

```
XY2LatLon(MyMap, X, Y, zoom)
```

### Arguments

MyMap	map object
X	latitude values to transform
Y	longitude values to transform
zoom	optional zoom level. If missing, taken from MyMap

**Value**

properly scaled and centered (with respect to the center of MyMap ) coordinates

lon	longitude
lat	latitude

**Author(s)**

Markus Loecher

**See Also**

[LatLon2XY Tile2R](#)

**Examples**

```
#quick test:
```

```
zoom=12;MyMap <- list(40,-120,zoom, url="google");
```

```
LatLon <- c(lat = 40.0123, lon = -120.0123);
```

```
Rcoords <- LatLon2XY.centered(MyMap,LatLon["lat"],LatLon["lon"])
```

```
newLatLon <- XY2LatLon(MyMap, Rcoords$newX, Rcoords$newY)
```

```
max(abs(newLatLon - LatLon));
```

```
#more systematic:
```

```
for (zoom in 2:10){
```

```
  cat("zoom: ", zoom, "\n");
```

```
MyMap <- list(40,-120,zoom, url="google");

LatLon <- c(lat = runif(1,-80,80), lon = runif(1,-170,170));

Rcoords <- LatLon2XY.centered(MyMap,LatLon["lat"],LatLon["lon"])

newLatLon <- XY2LatLon(MyMap, Rcoords$newX, Rcoords$newY)

if(max(abs(newLatLon - LatLon)) > 0.0001) print(rbind(LatLon, newLatLon));

}
```

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