

Data on Maps

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March, 2020

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Introduction

Here we will explore a basic code to build maps in R using the marmap package and base plot

You can explore more about the package here: marmap: <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0073051>

Install required packages

```
# We will require these following packages
# to use some handy custom made functions
# install.packages("raster")
library(raster)

# install.packages("grid")
library(grid)

# install.packages("maptools")
library(maptools)

# install.packages("GISTools")
library(GISTools)

# install.packages("rgdal")
library(rgdal)

#Lastly to access some online ready-to-use data
```

```
# install.packages("marmap")
library(marmap)
```

Load custom made functions

```
# This one calls a set of functions in another script
# These functions are custom made, not part of any package
# In this case they build a scale bar and a north arrow
# You can explore on your own this file and figure out how it works =)
source("/Volumes/GoogleDrive/My Drive/IIO-UABC/Cursos/FCM/Analisis_R/Posgrado/wk8/Week08_Maps/functions.R")
```

Figure 1 baseline map

```
# Creates a simple map of Baja with bathymetric lines

# This next line requires internet connection
# This function uses the marmap package to download
# coastline and bathymetric data from NOAA

Baja <- getNOAA.bathy(lon1=-106,lon2=-121,lat1=34,lat2=22,
                      resolution = 2) # reduce resolution number to get finer details

## Querying NOAA database ...
## This may take seconds to minutes, depending on grid size
## Building bathy matrix ...
summary(Baja)

## Bathymetric data of class 'bathy', with 450 rows and 360 columns
## Latitudinal range: 22.02 to 33.98 (22.02 N to 33.98 N)
## Longitudinal range: -120.98 to -106.02 (120.98 W to 106.02 W)
## Cell size: 2 minute(s)
##
## Depth statistics:
##      Min. 1st Qu. Median Mean 3rd Qu. Max.
## -4884.0 -3671.0 -340.5 -1156.3 557.0 3315.0
##
## First 5 columns and rows of the bathymetric matrix:
##          22.01666666666667 22.05 22.083333333333 22.1166666666667
## -120.983333333333 -3942 -4064 -4174 -4220
## -120.95 -4042 -4093 -4166 -4199
## -120.916666666667 -4112 -4085 -4110 -4070
## -120.883333333333 -4132 -4055 -4001 -3873
## -120.85 -4108 -4007 -3861 -3746
```

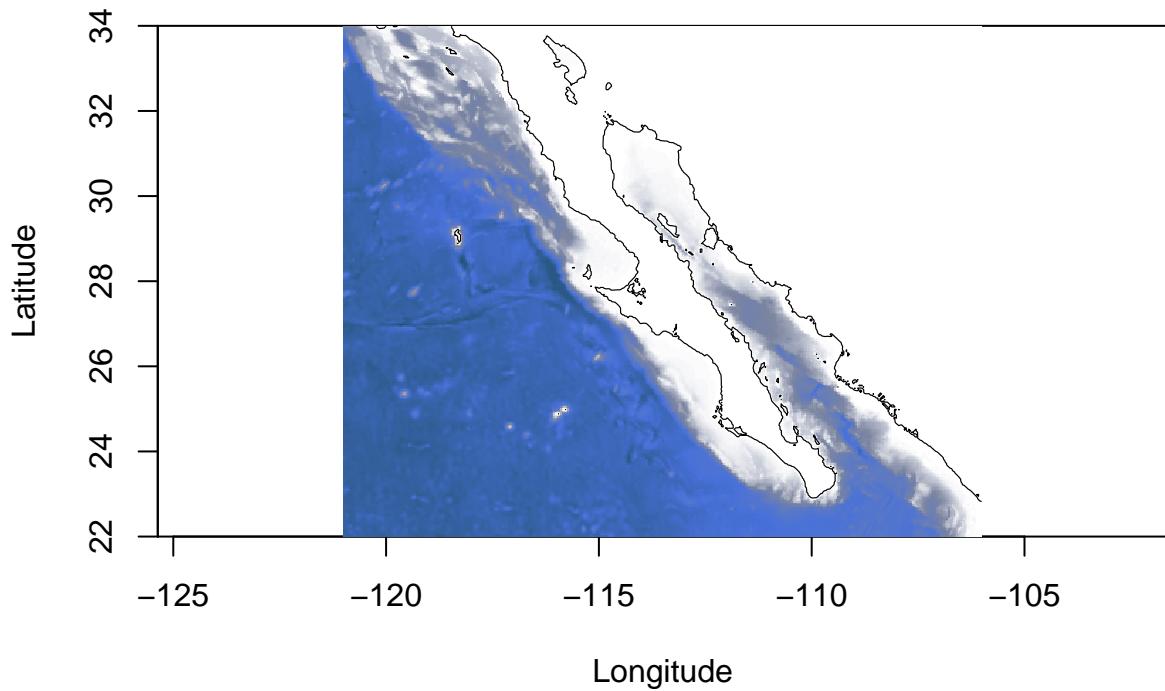
```

##          22.15
## -120.983333333333 -4191
## -120.95           -4183
## -120.916666666667 -4039
## -120.883333333333 -3892
## -120.85           -3846

# This is the basic map that is created

plot(Baja, xlim=c(-121, -106), ylim=c(22, 34),
      image=T,
      deepest.isobath = 0, #Try: c(-500, -250, 0),
      shallowest.isobath = 0, #Try: c(-500, -250, 0),
      col="black", # With above, try: c("grey80", "grey40", "black")
      step=1, # c(1,1,1),
      lty=1, #c(1,1,1),
      lwd=0.6, # c(0.6,0.6,1.2),
      drawlabels=F) #With above, try: c(T,T,F))

```



```

# Not bad at all
# But, if you need this for a publication you may need something more like this

# Run this when you are ready to save the map plot as TIFF file
# Remember you can save in other formats too
# tiff(filename = "./plots/Baja_test.tiff",
#       width = 20, height = 18, units = "cm",
#       res = 300,
#       compression ="lzw")

# Plot basic coastline
plot(Baja, xlim=c(-121, -106), ylim=c(22, 34),
      deepest.isobath = 0, #Depth lines, Try: c(-500, -250, 0),
      shallowest.isobath = 0, #Depth lines, Try: c(-500, -250, 0),

```

```

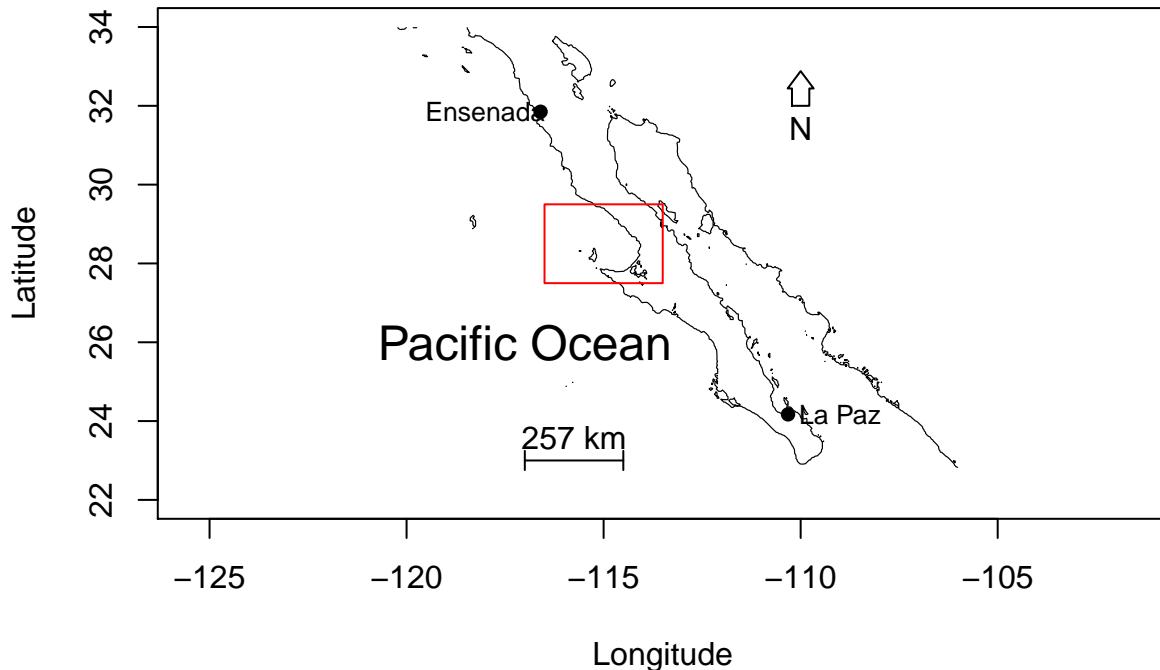
col="black", # With above, try: c("grey80", "grey40", "black")
step=1, # c(1,1,1),
lty=1, #c(1,1,1),
lwd=0.6, # c(0.6,0.6,1.2),
drawlabels=F) #With above, try: c(T,T,F))

# Here we add a scale bar and a north arrow for reference
scaleBathy(Baja, deg=2.5, y=23, x=-117) #add a scale
north.arrow(xb=-110, yb=32, len=0.22, lab="N")

# Annotate some key reference points
text(x = -117, y = 26, "Pacific Ocean", cex = 1.5)
points(x = -116.6, y = 31.85, pch=16)
text(x = -118, y = 31.85, "Ensenada", cex = 0.8)
points(x = -110.32, y = 24.17, pch=16)
text(x = -109, y = 24.17, "La Paz", cex = 0.8)

# Assign some specific study area
rect(xleft = -116.5, xright = -113.5,
      ybottom = 27.5, ytop = 29.5,
      col=NA,
      border="red")

```



```
# dev.off() # Run this is saving to tiff as output file
```

Figure 2 zoomed in map

```

# Also, it may help to create a zoomed in map,
# This is a hypothetical Vizcaino Bay study area map

```

```

# Create some fictional sampling sites
lat <- runif(20, 27.9, 28.75)
lon <- runif(20, -115, -114.4)
# Store these sites in a df
BVSites <- data.frame(lon, lat)

# Create df from NOAA of specific study area
BVMMap <- getNOAA.bathy(lon1 = -116.45, lon2 = -113.45,
                         lat1 = 27.45, lat2 = 29.45,
                         resolution = 1) # reduce resolution number to get finer details

## Querying NOAA database ...
## This may take seconds to minutes, depending on grid size
## Building bathy matrix ...
summary(BVMMap)

## Bathymetric data of class 'bathy', with 180 rows and 120 columns
## Latitudinal range: 27.46 to 29.44 (27.46 N to 29.44 N)
## Longitudinal range: -116.44 to -113.46 (116.44 W to 113.46 W)
## Cell size: 1 minute(s)
##
## Depth statistics:
##      Min. 1st Qu. Median    Mean 3rd Qu.    Max.
## -4582.0 -1351.0   -93.0  -798.4    48.0  1477.0
##
## First 5 columns and rows of the bathymetric matrix:
##          27.45833333333333 27.475 27.4916666666667 27.50833333333333
## -116.441666666667     -3645  -3666      -3695      -3725
## -116.425                 -3655  -3687      -3726      -3748
## -116.408333333333     -3676  -3698      -3721      -3746
## -116.391666666667     -3704  -3707      -3707      -3732
## -116.375                 -3734  -3724      -3715      -3722
##          27.525
## -116.441666666667     -3755
## -116.425                 -3772
## -116.408333333333     -3765
## -116.391666666667     -3749
## -116.375                 -3727

# Run this when you are ready to save the map plot as TIFF file
# Remember you can save in other formats too
# tiff(filename = "./plots/BV_map.tiff",
#       width = 14, height = 18, units = "cm",
#       res = 300,
#       compression = "lzw")

## Plot it

```

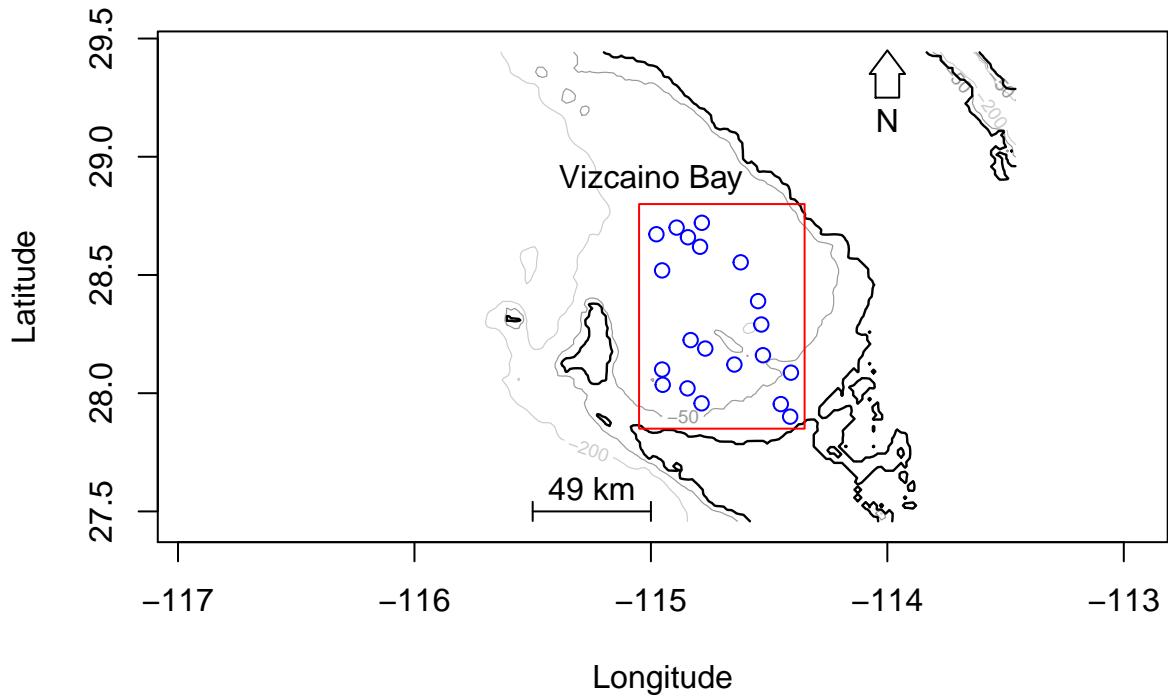
```

plot(BVMap, xlim=c(-116.45, -113.45), ylim=c(27.45, 29.45),
      deepest.isobath = c(-200, -50, 0),
      shallowest.isobath = c(-200, -50, 0),
      col= c("grey80", "grey60", "black"),
      step=c(1,1,1),
      lty=c(1,1,1),
      lwd=c(0.6,0.6,1.2),
      drawlabels=c(T,T,F))

# Add scale and north arrow
scaleBathy(BVMap, deg=0.5, y=27.5, x=-115.5) #add a scale
north.arrow(xb=-114, yb=29.25, len=0.05, lab="N")

# Add labels, study area and sampling locations
text(x = -115, y = 28.9, "Vizcaino Bay")
rect(xleft = -115.05, xright = -114.35,
      ybottom = 27.85, ytop = 28.8, col=NA, border="red")
points(BVSites, col="blue")

```



```
# dev.off() # Run this is saving to tiff as output file
```