Earthquake Challenge

Should you be worried about earthquakes? Let's make a map.

useful functions (what I used to do this): dim(), distm(), install.packages(), library(), map(), mapply(), mapproject(), max(), min(), function(){}, points(), read.csv()

Let's make a map. Make a map in R. Use data from https://earthquake.usgs.gov/earthquakes/search/ to generate a map of earthquakes.

Packages

```
# installing all the packages I'll use
# install.packages(c("maps","mapproj","geosphere")) # uncomment and run once
library(maps)
library(mapproj)
library(geosphere)
```

Generate dataset

- get data from https://earthquake.usgs.gov/earthquakes/search/
- download a CSV from this site (you select the time period) I used the last 30 days

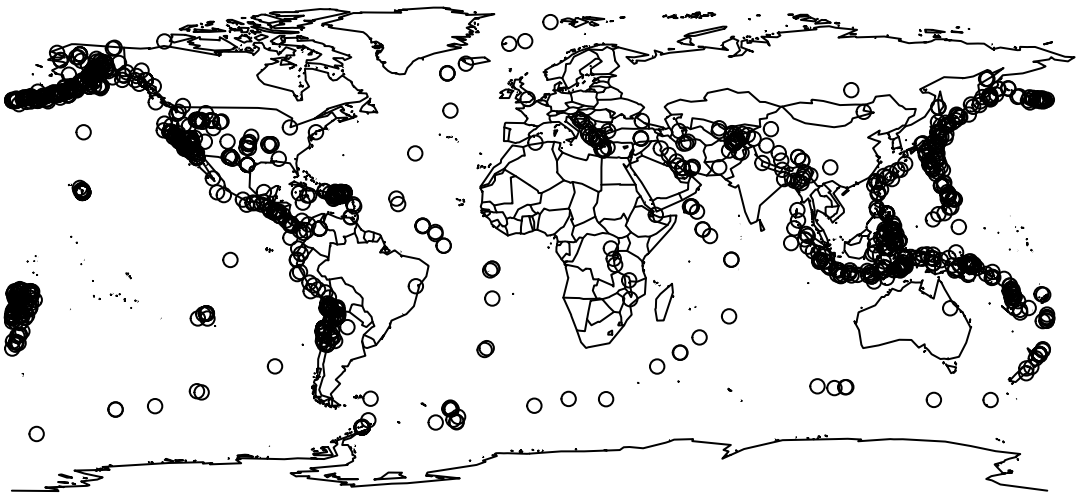
Import earthquake data in R

```
recentquakes <- read.csv("~/Downloads/query.csv", stringsAsFactors=F)
# you'll need to put your own file here
```

Map all the recent earth quakes.

```
# get a map
par(mar=c(0,0,0,0))
map("world")

# get points on the map
ptsproj <- mapproject(recentquakes$longitude, recentquakes$latitude)
points(ptsproj)
```



How big was the biggest earthquake?

```
max(recentquakes$mag)
```

```
## [1] 6.9
```

How far was your home from the biggest earthquake?

```
# where do you live?
# my (approximate) address where I used to live
mylat = 30.35
mylong = -97.75

# orders earthquakes biggest to smallest
orderedquakes <- recentquakes[order(recentquakes$mag, decreasing = T), ]

# biggest earthquake
biggest <- orderedquakes[1, ]
biggest
```

```
##                          time latitude longitude  depth mag magType nst gap
## 1215 2020-08-21T04:09:52.276Z  -6.6704  123.4927 627.33 6.9     mww  NA  20
##       dmin  rms net         id                  updated
## 1215 2.315 0.98  us us6000bi4p 2020-08-24T14:36:26.040Z
##                               place       type horizontalError depthError
## 1215 220 km SSE of Katabu, Indonesia earthquake             9.3        4.9
##      magError magNst   status locationSource magSource
## 1215    0.071     19 reviewed             us        us
```

```
# note: this can also be solved this way,
# but we still use [1, ] to take just 1 row in case there are ties
# biggest quake:
recentquakes[recentquakes$mag == max(recentquakes$mag), ][1, ]
```

```
##                          time latitude longitude  depth mag magType nst gap
## 1215 2020-08-21T04:09:52.276Z  -6.6704  123.4927 627.33 6.9     mww  NA  20
##       dmin  rms net         id                  updated
## 1215 2.315 0.98  us us6000bi4p 2020-08-24T14:36:26.040Z
##                               place       type horizontalError depthError
```

```
## 1215 220 km SSE of Katabu, Indonesia earthquake             9.3        4.9
##      magError magNst   status locationSource magSource
## 1215    0.071     19 reviewed             us        us
```

```
# how big was it?
biggest$mag
```

```
## [1] 6.9
```

```
# distance from home (m)
distm(c(mylong, mylat), c(biggest$long, biggest$lat))
```

```
##          [,1]
## [1,] 14986748
```

Write a function to calculate distance from your home

```
fromhome <- function(lat, long) {distm(c(mylong, mylat), c(long, lat))}
```

Add the distance from home as a column in the original dataframe. Then identify the closest recent earthquake. What was it's magnitude?

```
recentquakes$distancesfromhome <- mapply(fromhome,
                                  recentquakes$latitude,
                                  recentquakes$longitude)
# Closest earthquake
closestquake <- recentquakes[recentquakes$distancesfromhome ==
                               min(recentquakes$distancesfromhome), ]

# Look at the magnitude
closestquake$mag
```

```
## [1] 2.5
```

Improve your map

- Play around with colors to make your map appealing and readable.
- Map all the recent earth quakes.
- Put the biggest earthquake on the map with a different symbol and color.
- Put your home on the map, too, in another different color and symbol.
- Then add the earthquake closest to your home, again in a different color.

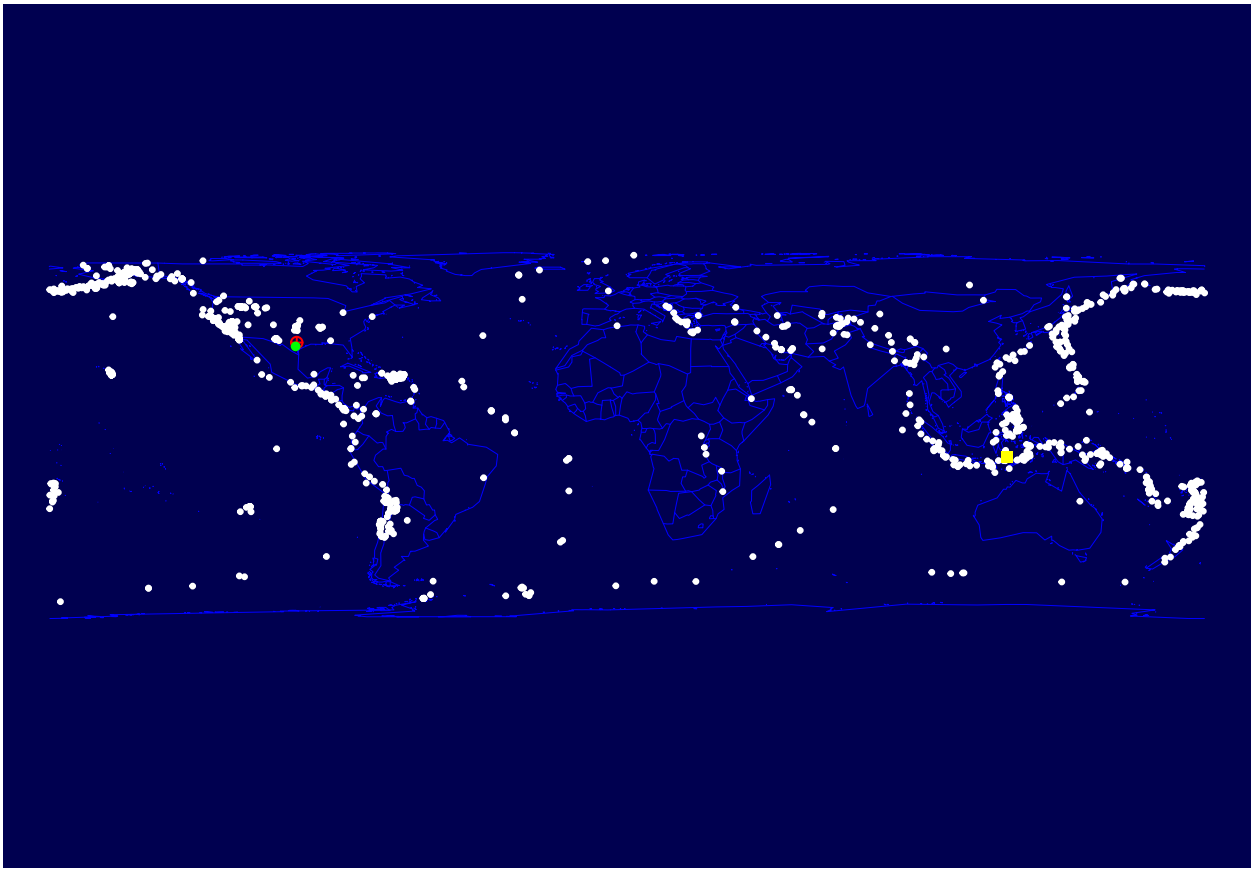
```
# get a map
par(mar=c(0,0,0,0))
map("world",
    col = "blue",
    bg = "#000050",
    fill = FALSE,
    interior = TRUE,
    lwd = 0.5,
    projection = "cylequalarea",
    par = 0,
    wrap = TRUE)
```

```
# get points on the map
ptsproj <- mapproject(recentquakes$longitude, recentquakes$latitude)
points(ptsproj, pch=20, cex=.5, col="white")

# Biggest earthquake on the map
biggest_loc <- mapproject(biggest$long, biggest$lat)
points(biggest_loc, cex=.8, pch=15, col="yellow")

# get home on the map
# put on the map with a star
myloc <- mapproject(mylong, mylat) # home longitude and latitude
points(myloc, cex=.8, pch=10, col="red")

# get the coordinates for the closest earthquake
closequake <- mapproject(closestquake$long, closestquake$lat)
# and plot it in a different color
points(closequake, cex=.8, pch=20, col="green")
```



How many earthquakes occured within a long days drive of you (500 miles)? How big was the biggest one of these?

```
# find all the close earthquakes
# 500 miles= 800,000 m
quakes500close <- recentquakes[(recentquakes$distancesfromhome) < 800000, ]
```

```r
dim(quakes500close) # number of earthquakes close to me
```

```
## [1] 42 23
```

```r
max(quakes500close$mag) # biggest earthquake
```

```
## [1] 3.5
```