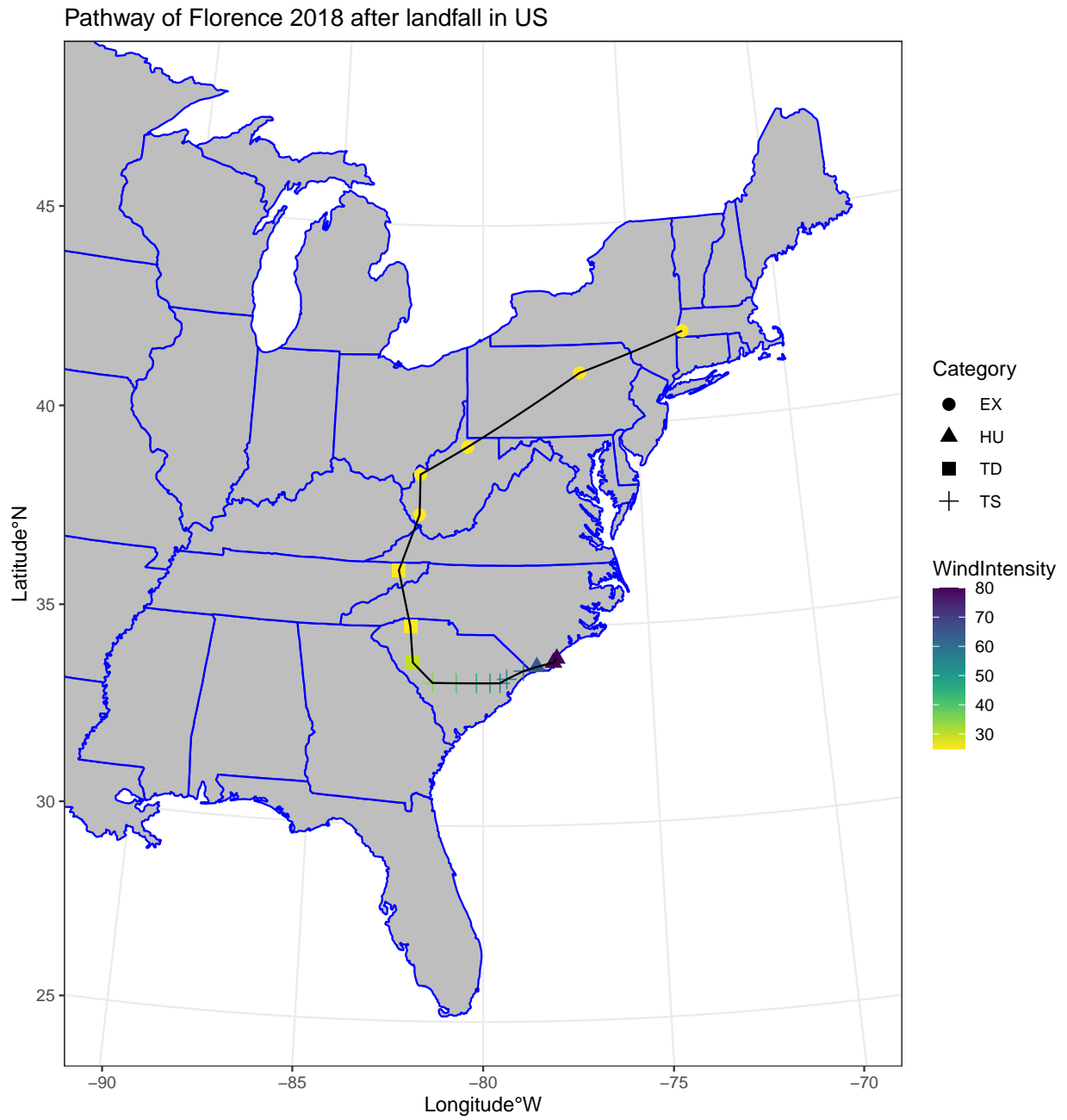


Homework 1: Solution

August 19, 2020

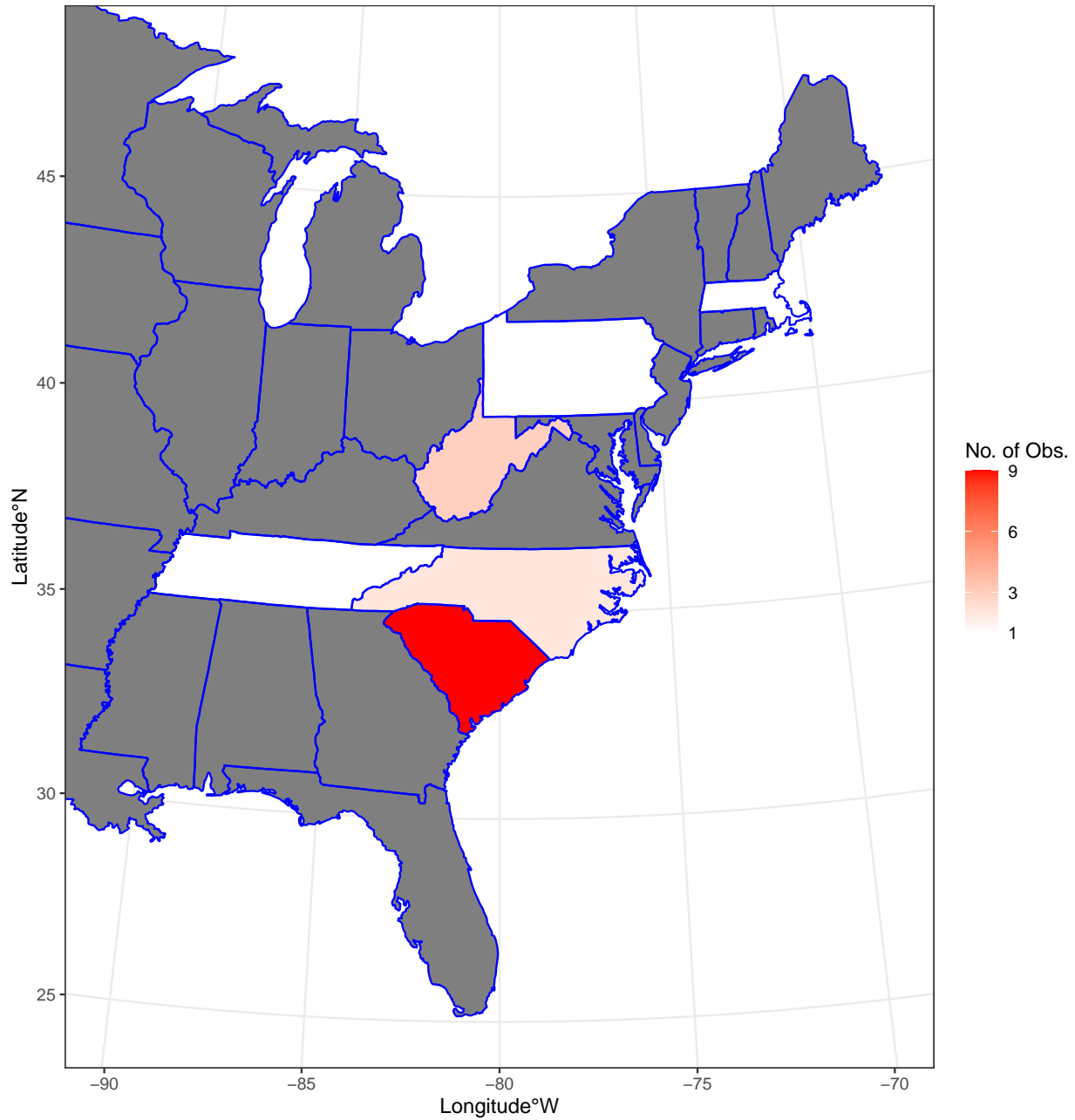
Part (a)



The plot shows the pathway of Hurricane Florence after its landfall on continental US, the colour indicates measured wind intensity and shape of the point indicates the storm category.

Part (b)

Map of the number of observations per state zoomed in Eastern US



The choropleth map shows the number of observations of the Hurricane's Florence in eastern states of US during the given time period. Colour ranges from white to bright red, as the observation number increases.

Grey denotes zero observations.

Codes

```
##### Part (a) #####

library(readr)
library(ggplot2)
library(mapproj)
library(viridis)

#downloading data
hurdat_533 <- read.csv("~/Downloads/hurdat_533.txt", header=FALSE)

#extracting Florence 2018
ind <- which((endsWith(as.character(hurdat_533$V1), '2018')) &
             (trimws(as.character(hurdat_533$V2))) == 'FLORENCE'))
data <- hurdat_533[(ind+1):(ind+79),]

#check landfall
indexL <- which(trimws(as.character(data$V3)) == 'L')

#Lat, Long, WindIntensity
work_data <- data.frame(data[indexL:nrow(data), 4:7])
colnames(work_data) <- c("Category", "Latitude", "Longitude", "WindIntensity")

#converting to numeric or character as required
work_data$Category <- as.character(work_data$Category)
work_data$Latitude <- as.numeric(gsub("N", "", work_data$Latitude))
work_data$Longitude <- -as.numeric(gsub("W", "", work_data$Longitude))
work_data$WindIntensity <- as.numeric(work_data$WindIntensity)

ggplot(data = work_data, aes(Longitude, Latitude)) + borders("state", col="blue", fill = "grey") +
  geom_point(aes(color = WindIntensity, shape=Category), size=3) + #specifying the colour to vary
#with intensity, shape to vary
#with Category

  scale_colour_gradientn(colours = rev(viridis(12))) + #controls colour of wind intensity
  geom_path() + #connects the point of the hurricane
  coord_map(projection = "albers", lat0 = 39, lat1 = 45, xlim=c(-85, -70), ylim=c(25, 48)) +
  theme_bw() + #theme puts background white
  xlab("Longitude°W") + ylab("Latitude°N") + #axes titles
  ggtitle("Pathway of Florence 2018 after landfall in US") #main title
```

```

##### Part (b) #####

library(usmap)

#using map.where to get states from coordinates
reg <- apply(as.matrix(work_data[,2:3]),1,function(z) map.where("state",x=z[2],y=z[1]))
reg <- reg[!is.na(reg)]

#omitting :main from north carolina:main
reg <- as.character(gsub(":main","",reg))
dat <- as.data.frame(table(reg))

#get a pre-existing data
states <- map_data("state")
#adding a Freq column to it
statesnew <- data.frame(states,"Freq"=NA)

#check for the states which have Hurricane obs, add the freq
for(i in 1:length(dat$reg)){
  ind <- which(toupper(statesnew$region) == toupper(as.character(dat$reg[i])))
  if(length(ind)>0) statesnew$Freq[ind] <- rep(as.numeric(dat$Freq[i]),length(ind))
}

#map
ggplot()+geom_polygon(data=statesnew,aes(x=long,y=lat,group=group,fill=Freq))+
  borders("state",col="blue")+
  scale_fill_gradient(name="No. of Obs.",high="red",low="white",limits=c(1,9),breaks=c(1,3,6,9))+
  #Colours vary from white to red, denoting increasing observations

  coord_map(projection = "albers",lat0 = 39, lat1 = 45,xlim=c(-90,-70 ),ylim=c(25,48))+
  xlab("Longitude°W")+ylab("Latitude°N")+ #axes titles
  ggtitle("Map of the number of observations per state zoomed in Eastern US")+ #main title
  theme_bw()

```