

615map

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```
library(ggplot2)
library(tmap)
library(hurricaneexposedata)
library(hurricaneexposure)
library(tidyverse)

## -- Attaching packages ----- tidyverse 1.3.0 --

## v tibble 3.0.4      v dplyr 1.0.2
## v tidyr 1.1.2       v stringr 1.4.0
## v readr 1.4.0       v forcats 0.5.0
## v purrr 0.3.4

## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()     masks stats::lag()

library(maps)

##
## Attaching package: 'maps'

## The following object is masked from 'package:purrr':
##
##      map

library(dplyr)
library(magrittr)

##
## Attaching package: 'magrittr'

## The following object is masked from 'package:purrr':
##
##      set_names

## The following object is masked from 'package:tidyr':
##
##      extract
```

```
library(sp)
library(sf)
```

```
## Linking to GEOS 3.8.0, GDAL 3.0.4, PROJ 6.3.1
```

```
knitr::opts_chunk$set(echo = TRUE)
```

Introduction

In this project, I make following goal maps by using ggplot2 and tmap.

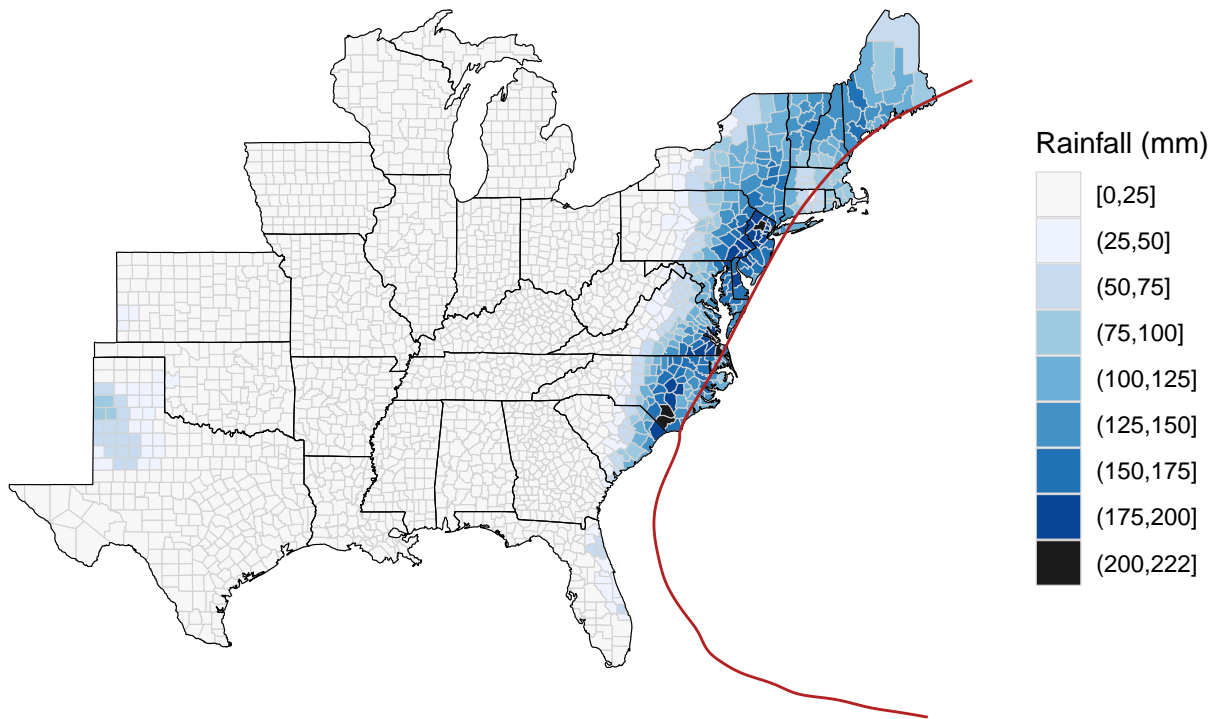
Goal maps

```
map_counties(storm = "Floyd-1999", metric = "rainfall") +
  ggtitle("Floyd-1999") +
  theme(plot.title = element_text(hjust = 0.5))
```

```
## Warning: 'tbl_df()' is deprecated as of dplyr 1.0.0.
## Please use 'tibble::as_tibble()' instead.
## This warning is displayed once every 8 hours.
## Call 'lifecycle::last_warnings()' to see where this warning was generated.
```

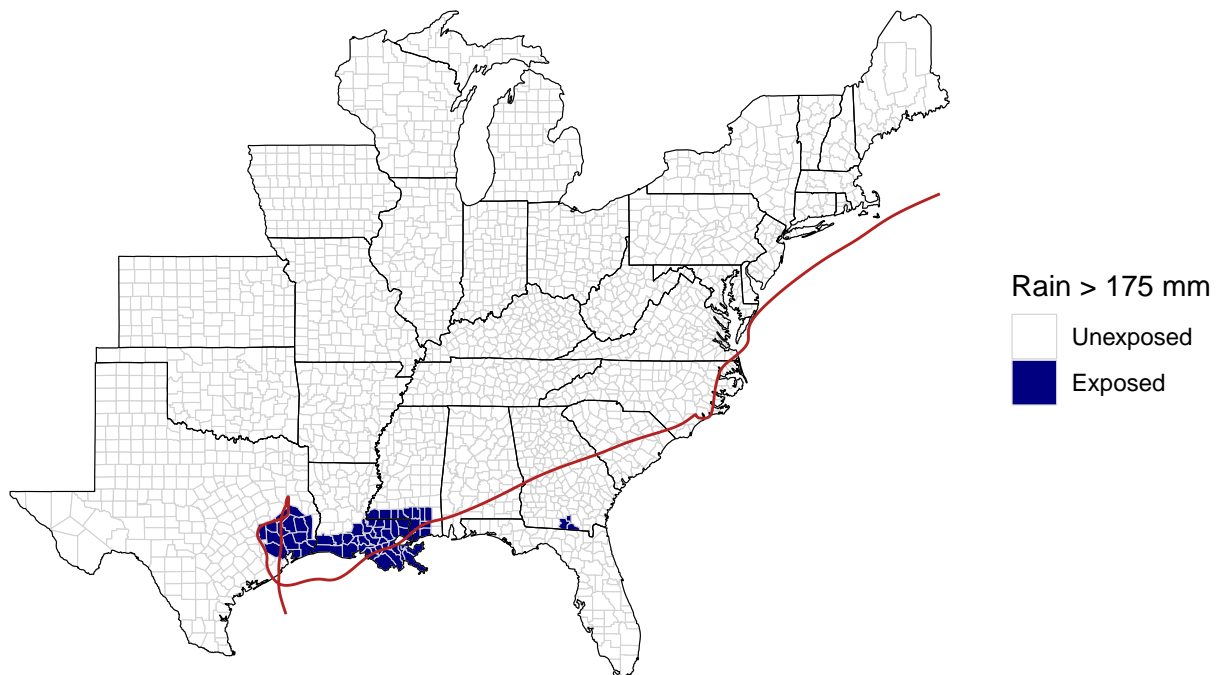
```
## Warning: 'mutate_()' is deprecated as of dplyr 0.7.0.
## Please use 'mutate()' instead.
## See vignette('programming') for more help
## This warning is displayed once every 8 hours.
## Call 'lifecycle::last_warnings()' to see where this warning was generated.
```

Floyd-1999



```
map_rain_exposure(storm = "Allison-2001",  
  rain_limit = 175,  
  dist_limit = 500,  
  days_included = -5:3) +  
ggtitle("Allison-2001") +  
theme(plot.title = element_text(hjust = 0.5))
```

Allison-2001



Data prepare

```
##Floyd
# filter data
Floyd_ht <- hurr_tracks %>%
  filter(storm_id == "Floyd-1999")
Floyd_rain <- rain %>%
  filter(storm_id == "Floyd-1999")
# The county.fips data contains information for fips, but fips are integers
Floyd_rain$fips <- as.integer(Floyd_rain$fips)
# head(Floyd_rain)
Floyd_rain <- Floyd_rain %>%
  group_by(fips) %>%
  summarize(precip = sum(precip), precip_max = sum(precip_max))
```

```
## 'summarise()' ungrouping output (override with '.groups' argument)
```

```
# Add the county information into our rain data set
Floyd_rain <- left_join(Floyd_rain, county.fips, by = "fips")
# A new row polynome is added at the end, needs to separate into two columns
Floyd_rain %>% separate(polynome, c("county1", "county2"), sep = ",")
# Obtain county and state data
f_county <- map_data(map = "county",
```

```

        region = c("texas","oklahoma","kansas","louisiana", "arkansas",
        "missouri", "iowa","wisconsin", "michigan","illinois","indiana",
        "ohio", "kentucky", "tennessee", "alabama", "mississippi",
        "florida", "georgia", "south carolina", "north carolina", "virginia",
        "west virginia", "maryland", "delaware", "pennsylvania", "new jersey",
        "new york", "connecticut", "rhode island", "massachusetts", "vermont",
        "new hampshire", "maine"))
f_state <- map_data(map = "state",
        region = c("texas","oklahoma","kansas","louisiana", "arkansas",
        "missouri", "iowa","wisconsin", "michigan","illinois","indiana",
        "ohio", "kentucky", "tennessee", "alabama", "mississippi",
        "florida", "georgia", "south carolina", "north carolina", "virginia",
        "west virginia", "maryland", "delaware", "pennsylvania", "new jersey",
        "new york", "connecticut", "rhode island", "massachusetts", "vermont",
        "new hampshire", "maine"))
# Rename the rain data set for consistency
Floyd_rain <-Floyd_rain %>%
  rename(region = county1, subregion = county2)
# Add the longitude and latitude information into our rain data set
Floyd_rain <- left_join(f_county, Floyd_rain,
  by = c("region", "subregion"))
# Create different range groups that will be showed on the map based on the
# precip level
Floyd_rain <- Floyd_rain %>%
  mutate(`Rainfall (mm)` = cut(Floyd_rain$precip,
    breaks = c(0, 25, 50, 75, 100, 125, 150, 175, 200, 225),
    include.lowest = TRUE))
Floyd_rain <- na.omit(Floyd_rain)

## Allison
# filter
Allison_ht <- hurr_tracks %>%
  filter(storm_id == "Allison-2001")
Allison_rain <- rain %>%
  filter(storm_id == "Allison-2001")
# use left_join to link rain and county
Allison_rain$fips <- as.integer(Allison_rain$fips)
Allison_rain <- Allison_rain %>%
  group_by(fips) %>%
  summarize(precip = sum(precip), precip_max = sum(precip_max))

## 'summarise()' ungrouping output (override with '.groups' argument)

```

```

Allison_rain <- left_join(Allison_rain, county.fips, by = "fips")
Allison_rain %<>% separate(polynome, c("county1", "county2"), sep = ",")
# Obtain county and state data.
a_county <- f_county #because the regions are same
a_state <- f_state #because the regions are same
# rename column and left join
Allison_rain <-Allison_rain %>%
  rename(region = county1, subregion = county2)
Allison_rain <- left_join(a_county, Allison_rain,
  by = c("region", "subregion"))

```

```

# Create 2 different groups which are showed on the map based on the precip level
Allison_rain <- Allison_rain %>%
  mutate(`Rain > 175 mm` = ifelse(Allison_rain$precip < 175, "Unexposed", "Exposed"))
Allison_rain <- na.omit(Allison_rain)

## prepare data for tmap
# create a location data with ID
M=st_as_sf(map('county',plot=F,fill=T))
colnames(county.fips)[2]=colnames(M)[1]
M=left_join(M,county.fips,'ID')
# Floyd rain data
t_Floyd_rain=right_join(M,Floyd_rain,'fips')
# Floyd track data
t_Floyd_ht=cbind(Floyd_ht$longitude,Floyd_ht$latitude)%>%
  Line()%>%Lines(ID='Floyd-1999')%>%
  list()%>%SpatialLines()

# Allison rain data
t_Allison_rain=right_join(M,Allison_rain,'fips')
# Allison track data
t_Allison_ht=cbind(Allison_ht$longitude,Allison_ht$latitude)%>%
  Line()%>%Lines(ID='Allison-2001')%>%
  list()%>%SpatialLines()

```

Mapping

```

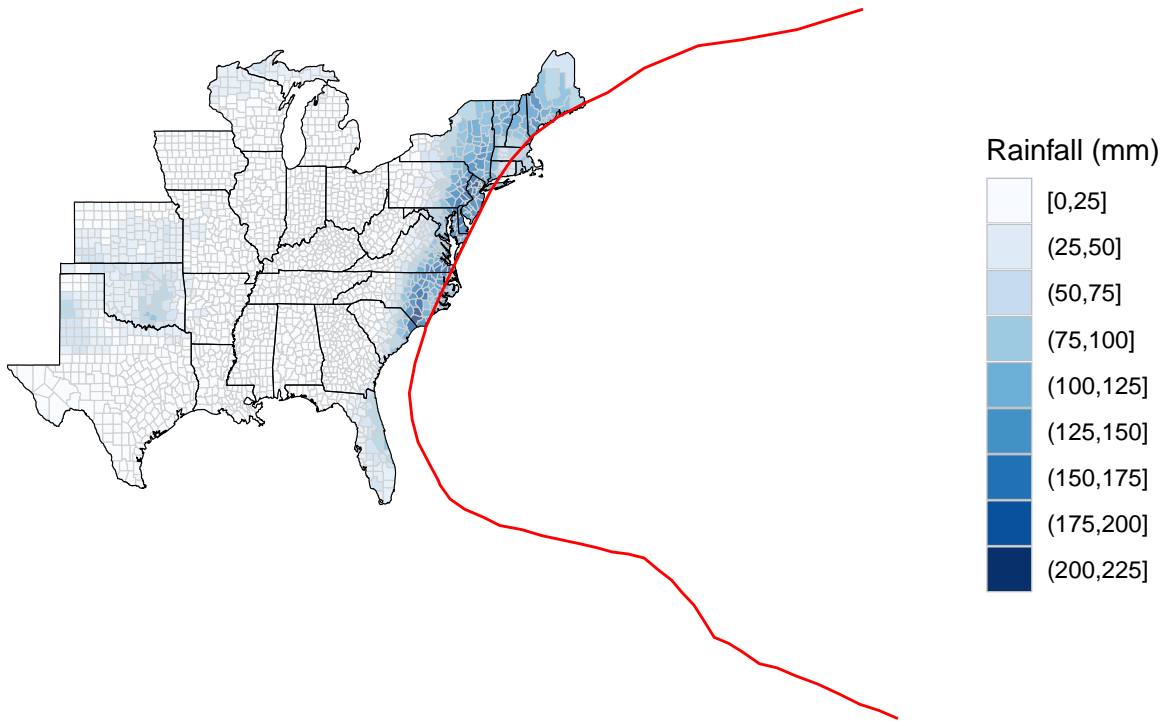
### ggplot2
## Floyd-1999
Floyd_g <-
  ggplot() +
    ggtitle("Floyd-1999") +
    geom_polygon(data = Floyd_rain, aes(x = long, y = lat, group = group,
                                         fill = `Rainfall (mm)`),
                color = "grey", size = 0.2, alpha = 1.6) +

    geom_polygon(data = f_state, aes(x = long, y = lat, group = group),
                color="black", fill="white", size = 0.2, alpha = 0.3) +

    geom_path(aes(x = Floyd_ht$longitude, y = Floyd_ht$latitude), color = "red") +
    scale_fill_brewer(palette = "Blues") +
    theme(plot.title=element_text(hjust=0.5),
          panel.background=element_blank(),
          panel.border=element_blank(),
          axis.title=element_blank(),
          axis.text=element_blank(),
          axis.ticks=element_blank())
Floyd_g

```

Floyd-1999



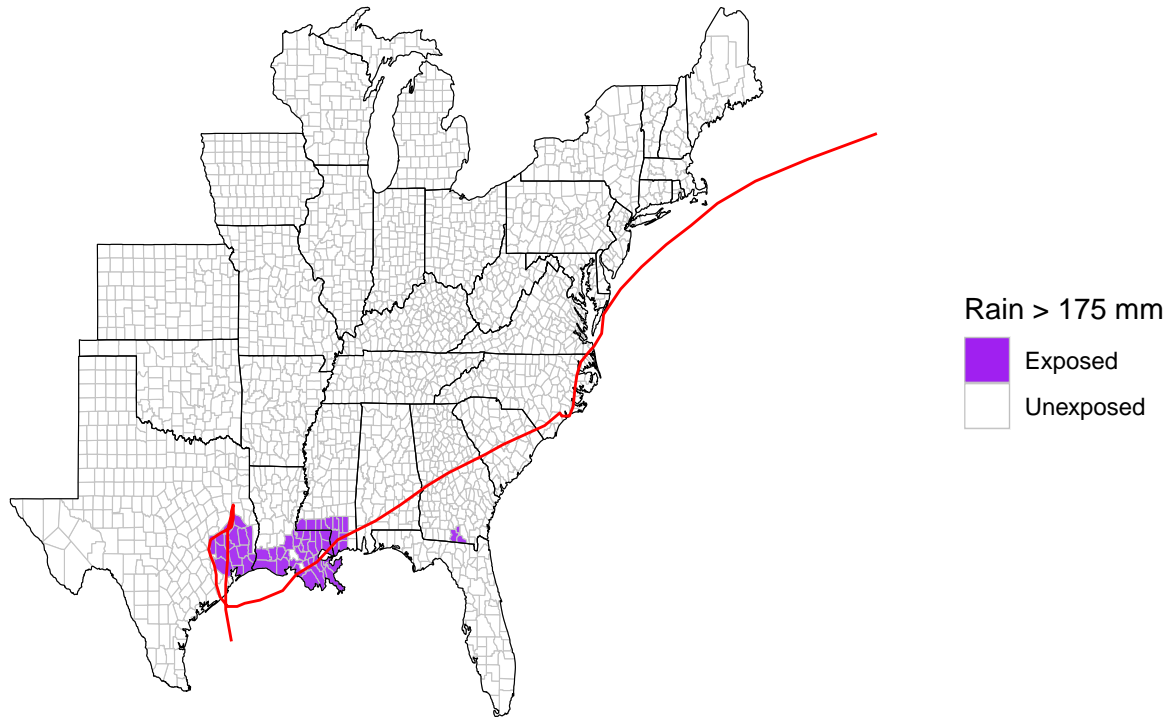
```
## Allison-2001
Allison_g <-
ggplot() +
  ggtitle("Allison-1999") +
  geom_polygon(data = Allison_rain, aes(x = long, y = lat, group = group,
                                         fill = `Rain > 175 mm`),
               color = "grey", size = 0.2, alpha = 1.6) +

  geom_polygon(data = a_state, aes(x = long, y = lat, group = group),
               color="black", fill="white", size = 0.2, alpha = 0.1) +

  geom_path(aes(x = Allison_ht$longitude, y = Allison_ht$latitude), color = "red") +
  scale_fill_manual(values = c("purple", "white"))+

  theme(plot.title=element_text(hjust=0.5),
        panel.background=element_blank(),
        panel.border=element_blank(),
        axis.title=element_blank(),
        axis.text=element_blank(),
        axis.ticks=element_blank())
Allison_g
```

Allison-1999

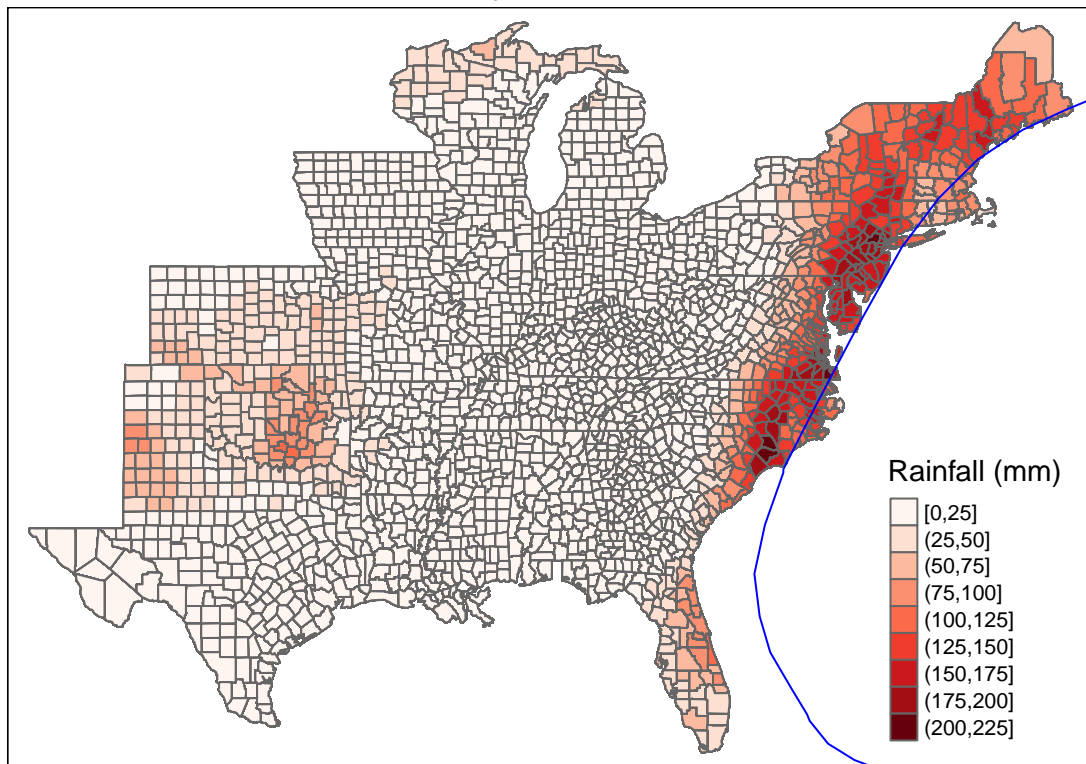


```
### tmap
## Floyd-1999
Floyd_t=tm_shape(t_Floyd_rain)+
  tm_polygons(col="Rainfall (mm)",palette = "Reds", title="Rainfall (mm)") +
  tm_legend(position=c("right","bottom"))+

  tm_shape(t_Floyd_ht)+
  tm_lines(col='blue')+
  tm_layout(main.title=t_Floyd_ht@lines[[1]]@ID,
            main.title.position="center")
Floyd_t
```

```
## Warning: Current projection of shape t_Floyd_ht unknown. Long-lat (WGS84) is
## assumed.
```


Floyd-1999



```
## Allison-2001
Allison_t=tm_shape(t_Allison_rain)+
  tm_polygons(col="Rain > 175 mm",title="Rain > 175 mm")+
  tm_legend(position=c("right","bottom"))+

  tm_shape(t_Allison_ht)+
  tm_lines(col='darkblue')+
  tm_layout(main.title=t_Allison_ht@lines[[1]]@ID,
            main.title.position="center")
Allison_t
```

```
## Warning: Current projection of shape t_Allison_ht unknown. Long-lat (WGS84) is
## assumed.
```

Allison-2001

