Mapping for Hurricane

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Summary

In this assignment, we mainly plot 2 maps for hurricanes $Floyd-1999$ and $Allison-2000$ using $ggplot2$ and $tmap$ packages respectively.

Obtain map data

In this step, we obtain county map data from map package and for each county, we merge its FIPS information within map data.

```r
data(county.fips)
M=st_as_sf(map('county',plot=F,fill=T))
colnames(county.fips)[2]=colnames(M)[1]
M=left_join(M,county.fips,'ID')
```

Obtain hurricane data

In this step, we obtain hurricanes' track and rainfall data of $Floyd-1999$ and $Allison-2000$ from $hurricaneexposuredata$ package.

```r
Floyd_track=force(hurr_tracks)%>%
  filter(storm_id=='Floyd-1999')

Floyd_rain=force(rain)%>%
  filter(storm_id=='Floyd-1999')%>%
  group_by(fips)%>%
  summarise(storm_id=storm_id[1],precip=sum(precip))%>%
  mutate(fips=as.numeric(fips))
Floyd_rain=right_join(M,Floyd_rain,'fips')


Allison_track=force(hurr_tracks)%>%
  filter(storm_id=='Allison-2001')

Allison_rain=force(rain)%>%
  filter(storm_id=='Allison-2001')%>%
  group_by(fips)%>%
  summarise(storm_id=storm_id[1],precip=sum(precip))%>%
  mutate(fips=as.numeric(fips))
Allison_rain=right_join(M,Allison_rain,'fips')
```

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Select Allison-2000 data

Since the *Allison* − 2000 only requires data with storm distance less than 500 and cumulative rainfall larger than 175mm, we need to select these data and create *Allison_rain_limit* for futher mapping.

```
Allison_dist=force(closest_dist)%>%
  filter(storm_id=='Allison-2001',storm_dist<500)

Allison_rain_limit=Allison_rain%>%
  filter(precip>175,fips%in%Allison_dist$fips)
```

Prepare data for tmap

Since the *tmap* requires track data with *sp* format, here we transform original track data.

```
t_Floyd_track=cbind(Floyd_track$longitude,Floyd_track$latitude)%>%
  Line()%>%Lines(ID='Floyd-1999')%>%
  list()%>%SpatialLines()

t_Allison_track=cbind(Allison_track$longitude,Allison_track$latitude)%>%
  Line()%>%Lines(ID='Allison-2001')%>%
  list()%>%SpatialLines()
```

Mapping with ggplot2

Now we use *ggplot*2 for mapping, with *geom_sf* function for rainfall mapping and *geom_path* function for track mapping.

```
Floyd_g=ggplot()+
  geom_sf(data=Floyd_rain,mapping=aes(fill=precip))+
  scale_fill_steps(low='white',high='red',name='Rainfall (mm)')+
  geom_path(data=Floyd_track,mapping=aes(x=longitude,y=latitude))+
  ggtitle('Floyd-1999')+
  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=ggplot()+
  geom_sf(data=Allison_rain)+
  geom_sf(data=Allison_rain_limit,mapping=aes(fill=precip))+
  scale_fill_steps(low='white',high='red', name='Rainfall (mm)')+
  geom_path(data=Allison_track,mapping=aes(x=longitude,y=latitude))+
  ggtitle("Allison-2001")+
  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–1999

Rainfall (mm)

200
150
100
50

Allison–2001

Rainfall (mm)
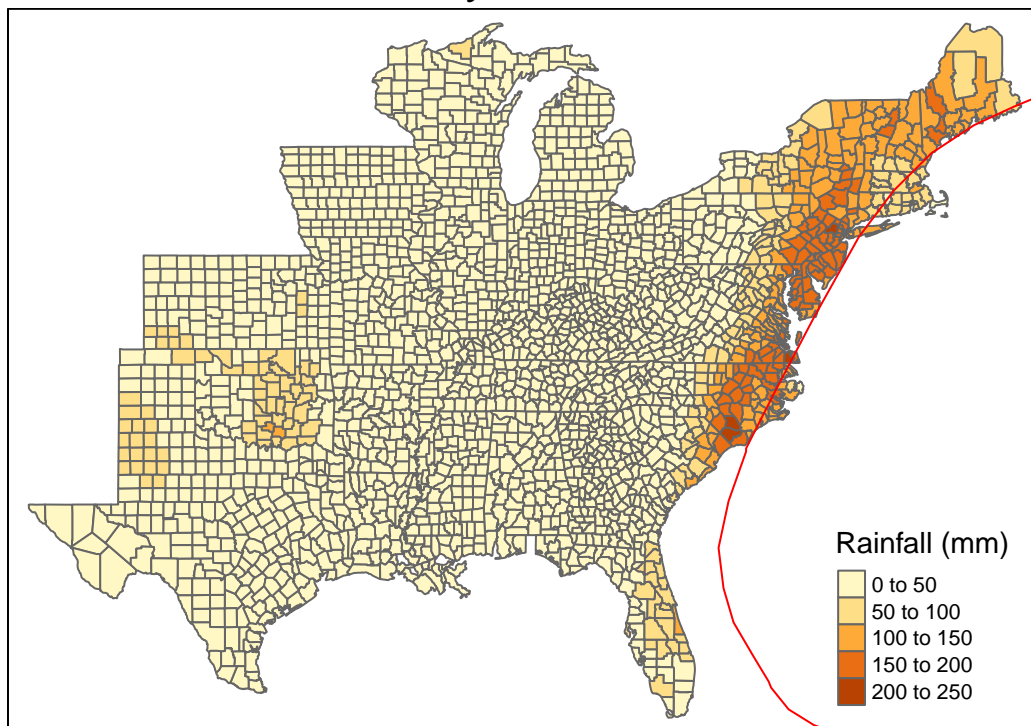
400
350
300
250
200

3
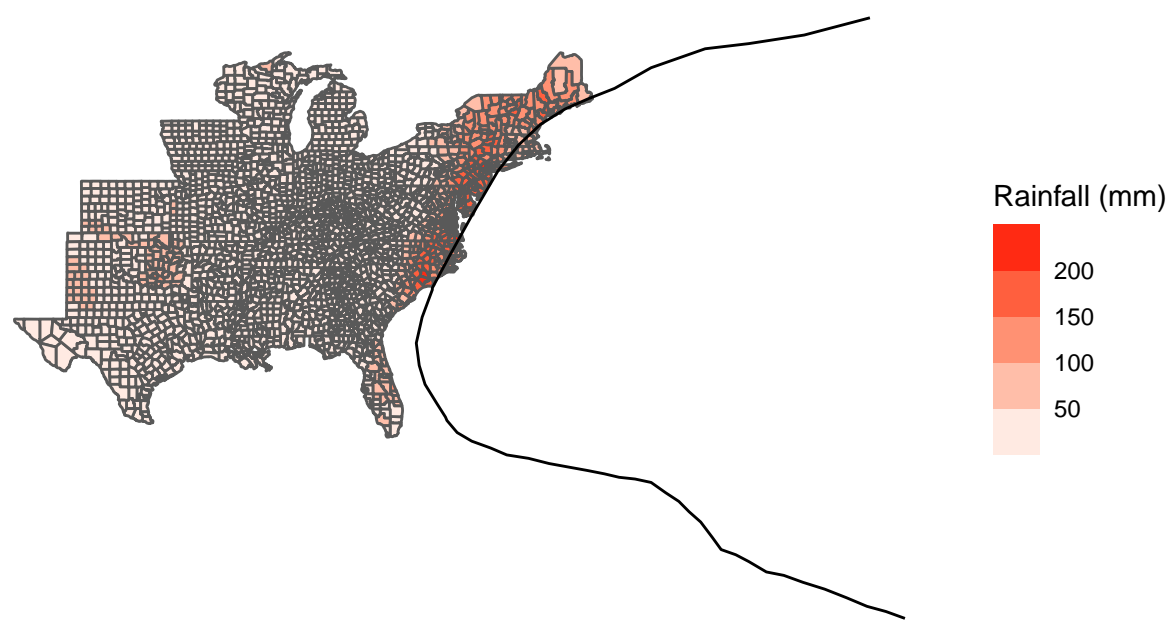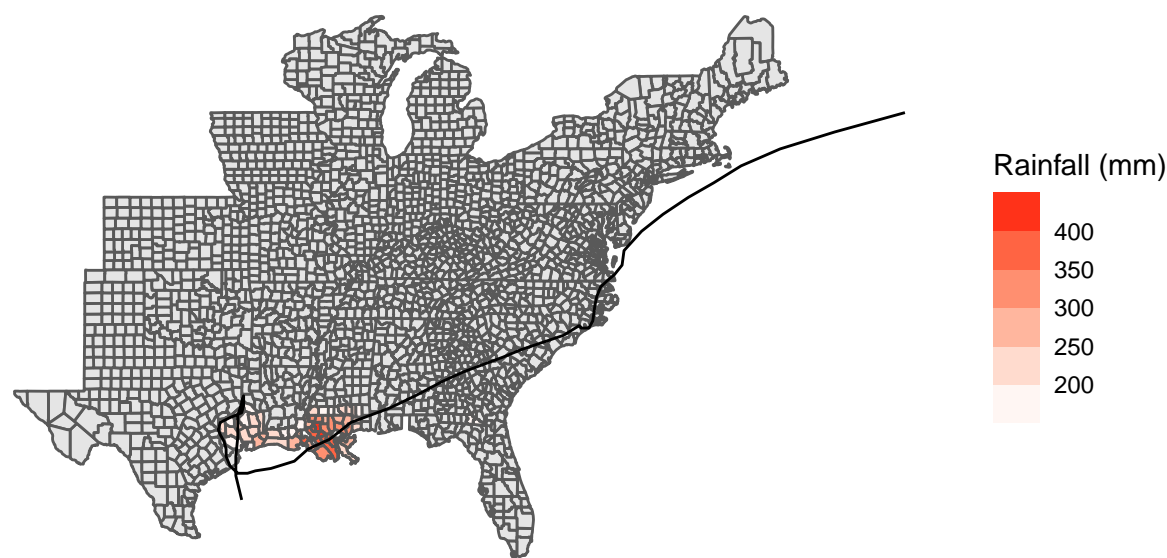
Mapping with tmap

Now we use *tmap* for mapping, with *tm_polygons* function for rainfall mapping and *tm_lines* function for track mapping.

```
Floyd_t=tm_shape(Floyd_rain)+
  tm_polygons(col='precip',title="Rainfall (mm)")+
  tm_legend(position=c("right","bottom"))+
  tm_shape(t_Floyd_track)+
  tm_lines(col='red')+
  tm_layout(main.title=t_Floyd_track@lines[[1]]@ID,
            main.title.position="center")

Allison_t=tm_shape(Allison_rain)+
  tm_polygons(col='precip',title="Rainfall (mm)")+
  tm_legend(position=c("right","bottom"))+
  tm_shape(t_Allison_track)+
  tm_lines(col='red')+
  tm_layout(main.title=t_Allison_track@lines[[1]]@ID,
            main.title.position="center")
```


Floyd–1999

Allison−2001

Rainfall (mm)

- 0 to 100
- 100 to 200
- 200 to 300
- 300 to 400
- 400 to 500