Final Document

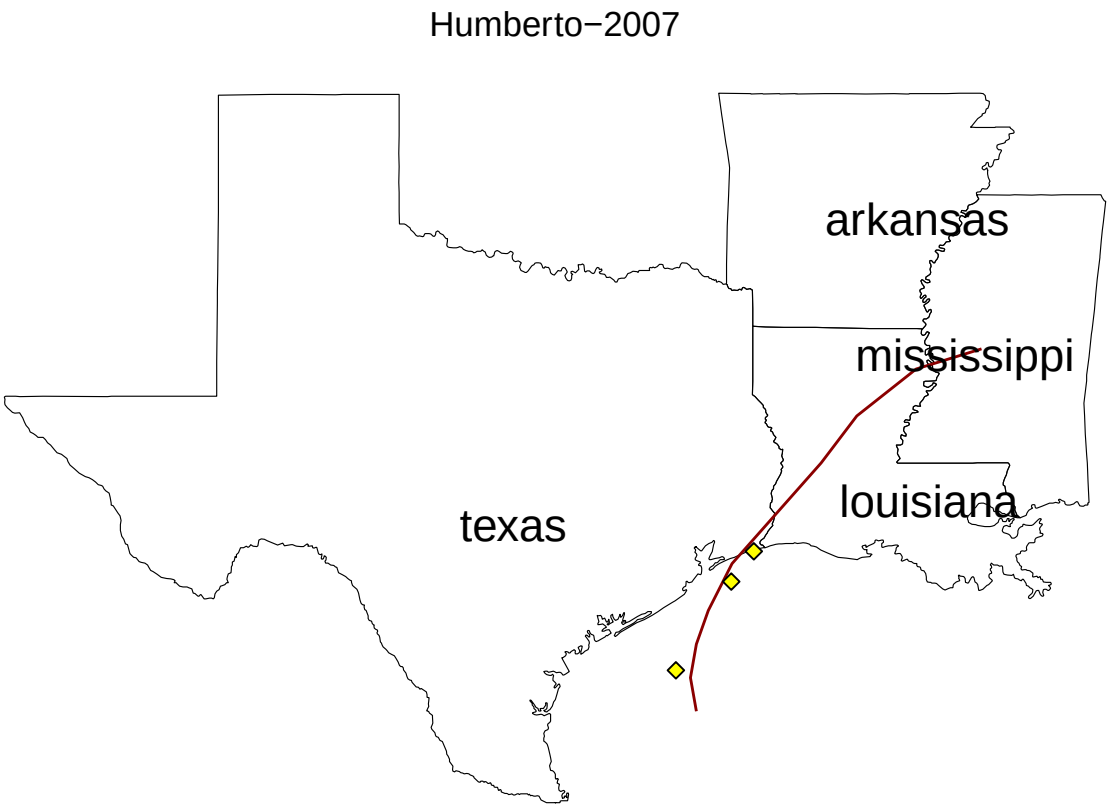
Yifan Zhang, Xiang Li, Shuting Li, Ranfei Xu

2021/11/22

Introduction

Hurricane Humberto is a tropical storm on September 12, 2007. Humberto is the first hurricane to make landfall in the United States since Wilma struck South Florida in October 2005 and the first hurricane to make landfall along the Texas coast since Rita struck the Texas-Louisiana area in September 2005. In this report, we are going to map Humberto's weather effect and compare average wind speed by using buoy's data from National Data Buoy Center.

Plotting Storm Tracks and Selected Buoys



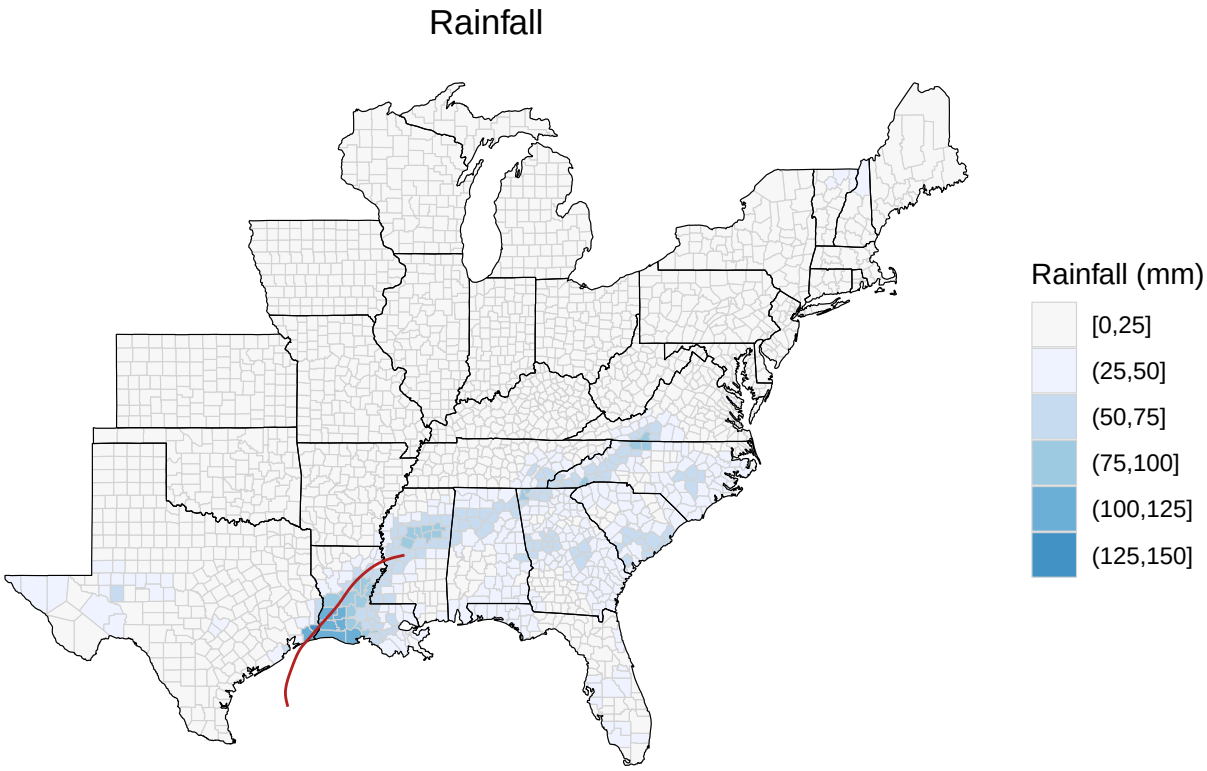
Maps for Hurricane Humberto from "Hurricane Exposure" Package

We generated maps of **Hurricane Humberto-2007** from the "Hurricane Exposure" package, which included rain maps, wind speed, and duration maps for sustained wind and wind gusts.

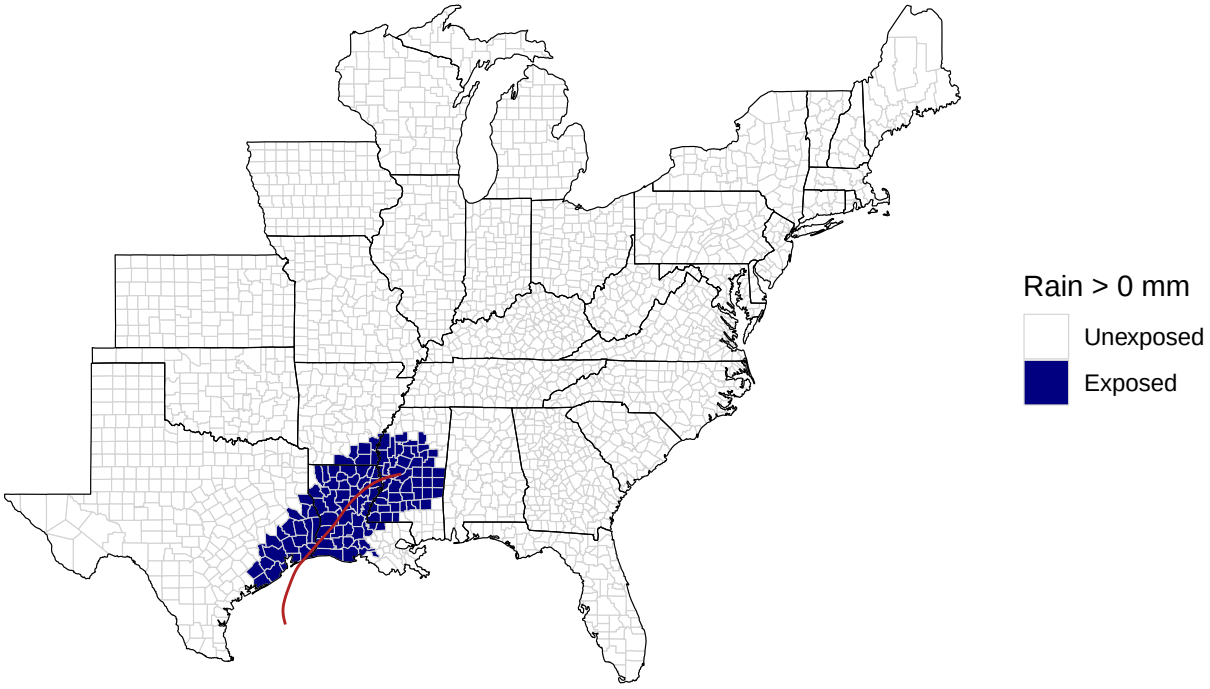
Here is the difference between sustained wind and wind gusts

Name	Definition
sust	A sustained wind is defined as the average wind speed over two minutes.
gust	A sudden burst in wind speed is called the wind gusts and typically lasts under 20 seconds.

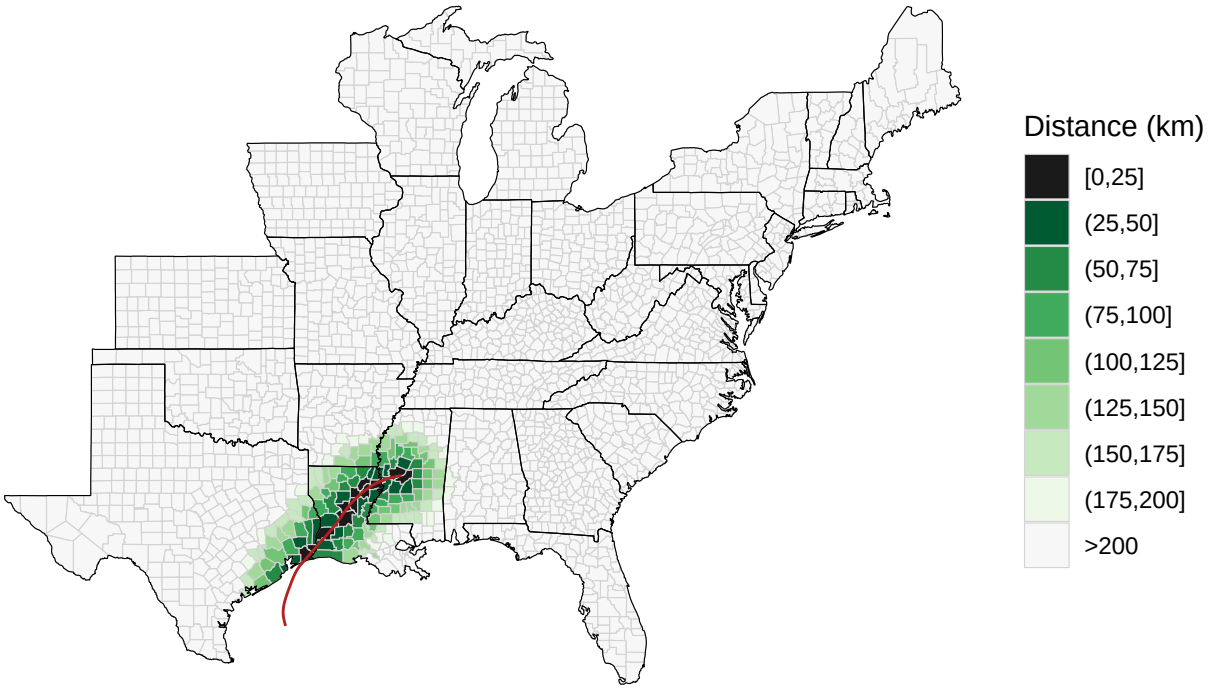
On average, the diameter of hurricane-force winds is about 100 miles (160 kilometers). Slower speed winds further out from the storm center increase the storm system's diameter on average 300 to 400 miles across. And the eye of the hurricane is 30 miles in diameter. Therefore, we only choose exposure counties, which are 117 counties in total.



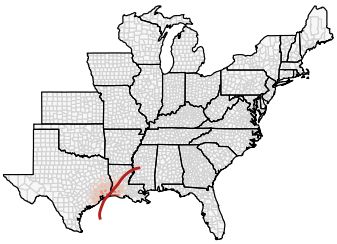
Counties Exposed by Rain



Distance



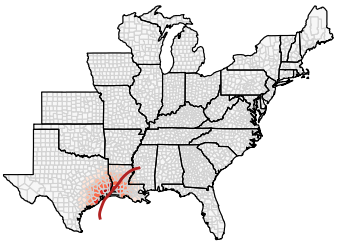
Wind vmax_sust



Wind speed (m / s)

- [0,15]
- (15,20]
- (20,25]
- (25,30]
- (30,35]

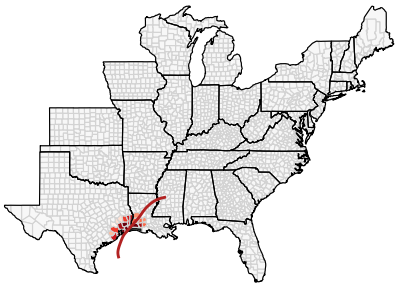
Wind vmax_gust



Wind speed (m / s)

- [0,15]
- (15,20]
- (20,25]
- (25,30]
- (30,35]
- (35,40]
- (40,45]
- (45,51.8]

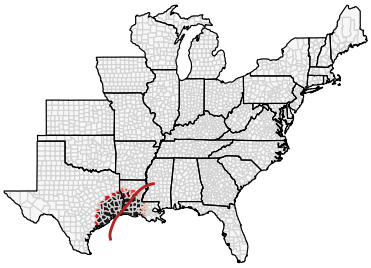
Wind sust_dur



Wind duration (minutes)

- [0,60]
- (60,120]
- (120,180]
- (180,240]
- (240,300]
- (300,360]
- (360,420]
- (420,480]
- (480,540]
- (540,600]
- (600,615]

Wind gust_dur



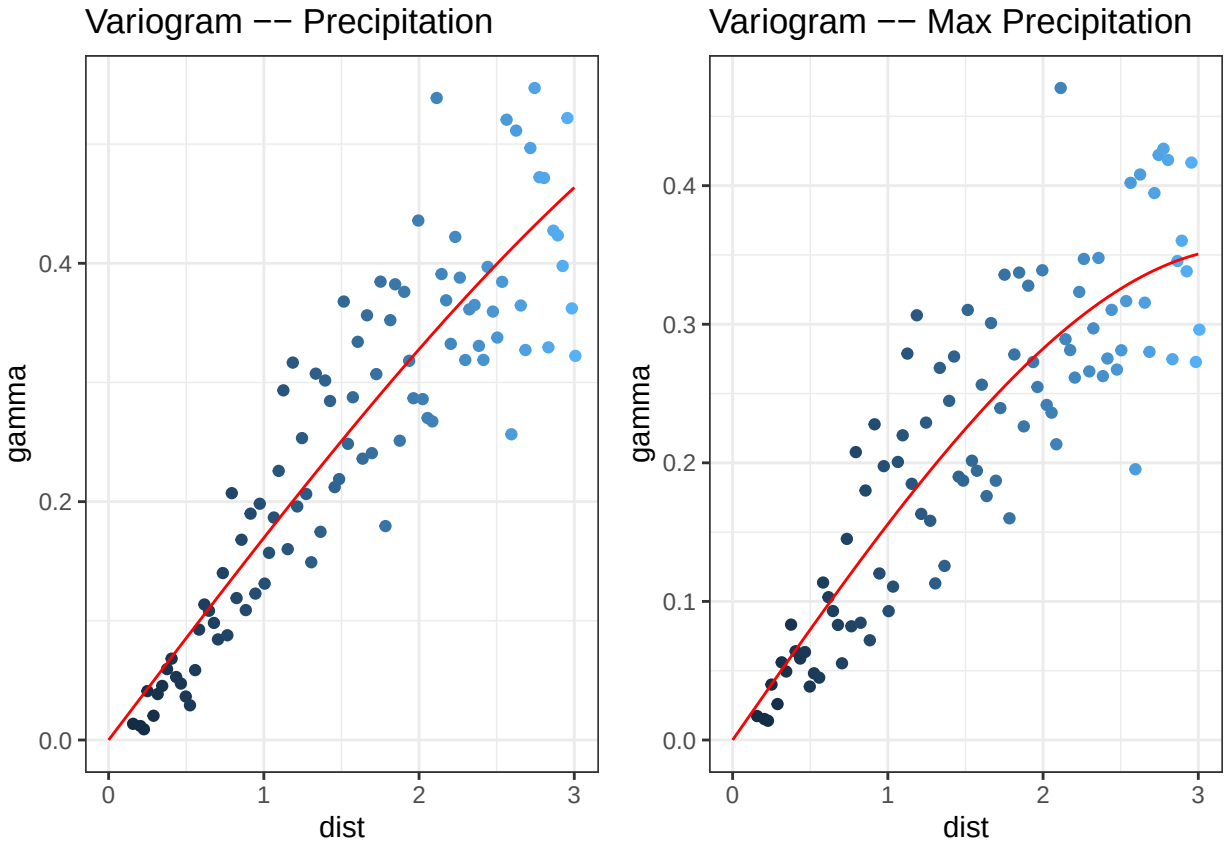
Wind duration (minutes)

- [0,60]
- (60,120]
- (120,180]
- (180,240]
- (240,300]
- (300,360]
- (360,420]
- (420,480]
- (480,540]
- (540,600]
- (600,1.2e+03]

Spatial Analysis

Here are the variogram analysis generated from the "Hurricane Exposure" Package

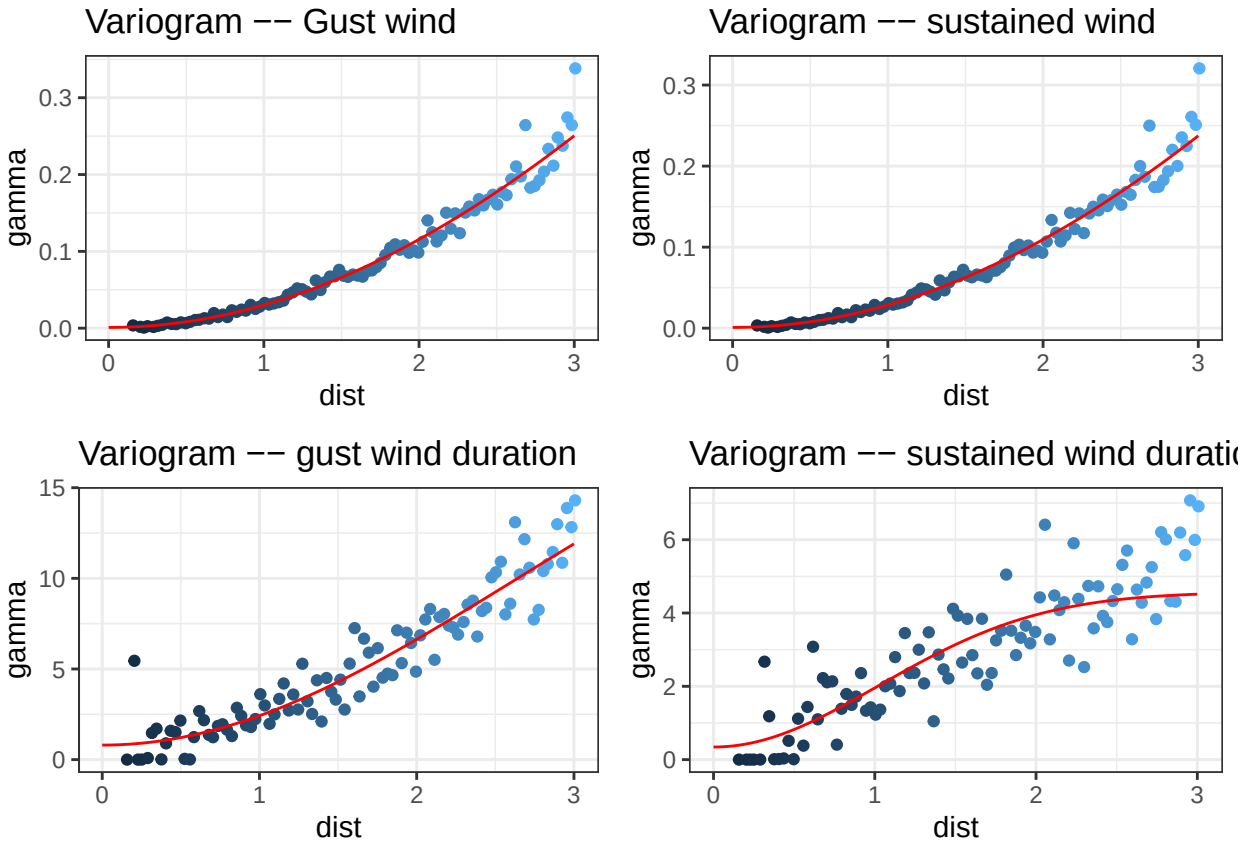
- Rain



Variogram interpretation:

Among 117 counties, the correlation between rain **Precipitation** and the correlation between **Max-Precipitation** are increasing as the distance between two random counties is increasing.

- Wind



Among 117 counties, the correlation between wind_gust, the correlation between wind_sust, the correlation between gust_dur, and the correlation between sust_dur are increasing as the distance between two random counties is increasing.

The reason why we do not have a sill in these variogram analyses is that we only choose 117 counties that are exposed by Hurricane Humberto.

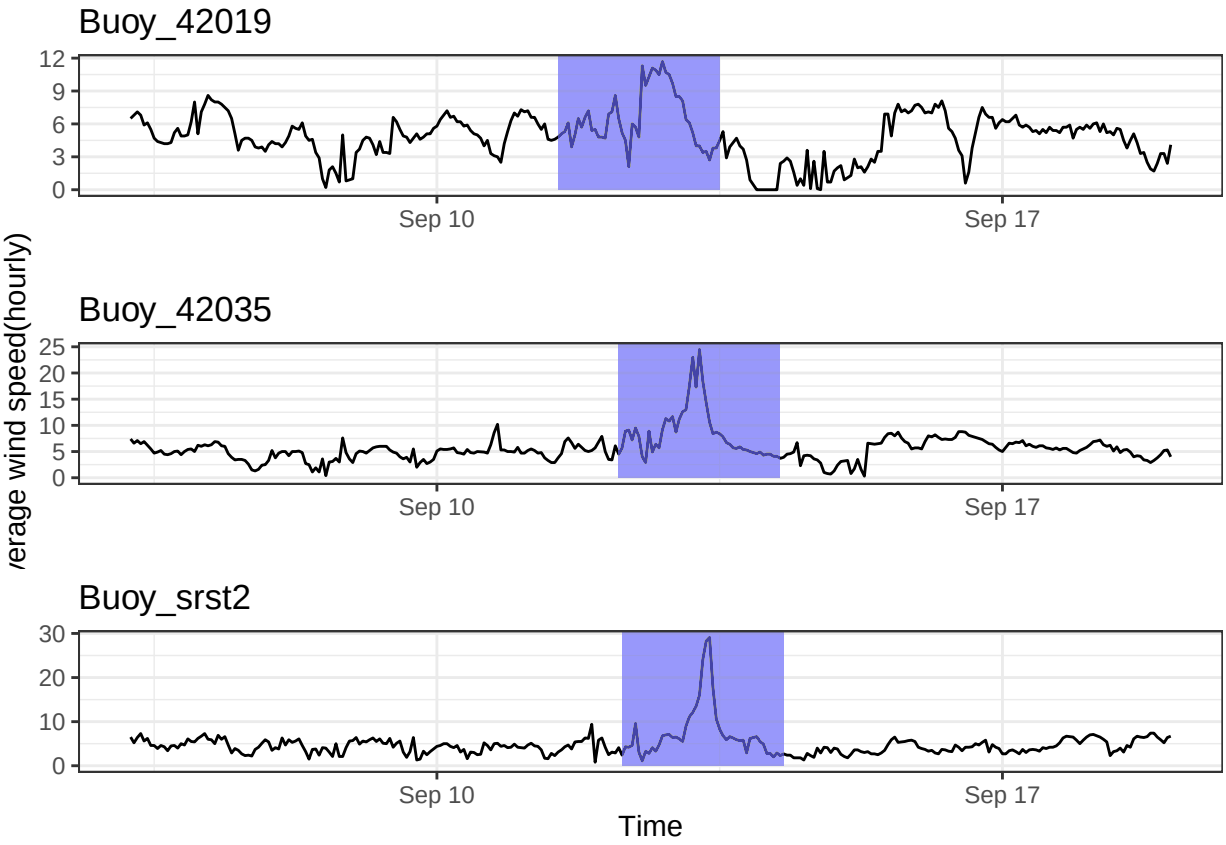
Exploration Data Analysis from Buoys

We generated plots from buoys 42019, 42035, and SRST2, which were significantly influenced by Humberto.

Here is the date and time when Hurricane Humberto was closest to each buoy.

```
##         buoy longitude latitude        closest_date
## 1 buoy_42019   -95.345   27.910 2007-09-12 12:00:00
## 2 buoy_42035   -94.413   29.232 2007-09-13 06:00:00
## 3 buoy_srst2   -94.033   29.683 2007-09-13 07:00:00
```

Time series



From these figures, we can see that the wind speed at each of the three buoys had a period of rapidly increasing and then decreasing, which indicated that the period is when Hurricane Humberto was passing by each buoy. According to the weather report, the hurricane is notable for its exceptionally rapid intensification near the coast of Texas from a tropical depression into a hurricane within 19 hours.

Citation

https://www.weather.gov/hgx/projects_humberto07

https://earthobservatory.nasa.gov/images/19056/hurricane-humberto

https://www.directenergy.com/learning-center/hurricane

https://www.nhc.noaa.gov/data/tcr/AL092007_Humberto.pdf