

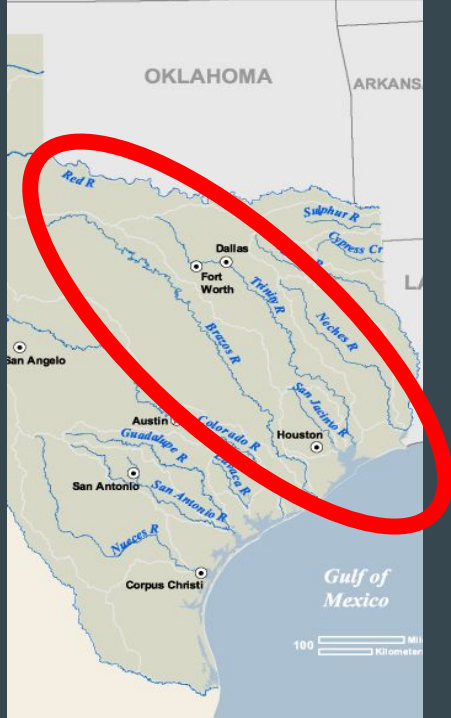
An aerial photograph showing a residential area in East Texas that has been severely flooded. Several large, two-story houses with brown roofs and yellow or tan siding are partially submerged in murky, brown floodwater. The water reaches up to the second floors of some houses. In the background, there is a dense line of green trees and a body of water, possibly a river or a large lake. The sky is overcast and grey. The text "Hurricane Rainfall Distribution in East Texas" is overlaid in large, white, sans-serif font across the upper half of the image. Below the title, there are three white dots and a black box containing the text "By Jordan Simons" in white, sans-serif font.

Hurricane Rainfall Distribution in East Texas

...

By Jordan Simons

Background and Motive



- Rain upriver can cause serious flooding downstream.
- The Brazos, Trinity, and Neches rivers have the potential to cause downstream flooding near Houston.
- Hurricanes drop rain over the entire basin in short time periods.



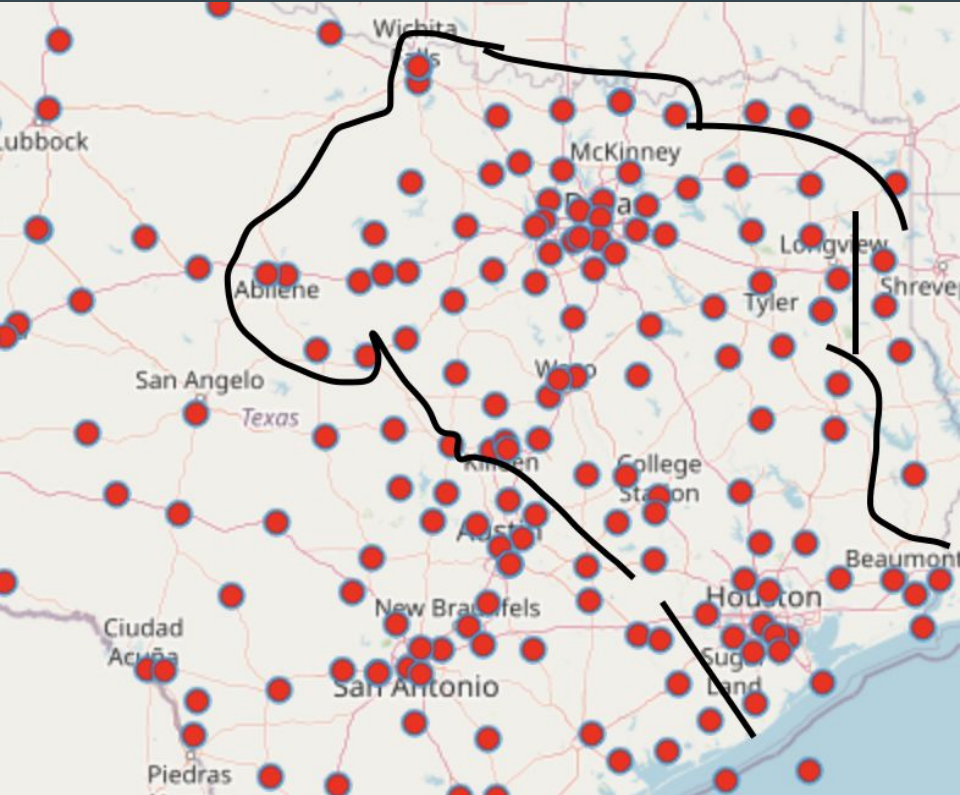
Research Questions

HOW DO HURRICANES DISTRIBUTE THEIR RAINFALL ACROSS THE BRAZOS,
TRINITY, AND NECHES BASINS?

ARE THERE ANY MEANINGFUL WAYS TO CATEGORIZE THESE HURRICANES
TO BETTER UNDERSTAND HOW ANY GIVEN STORM MIGHT DISTRIBUTE
RAINFALL?

DOES A PARTICULAR DISTRIBUTION OF RAINFALL CAUSE MORE
DESTRUCTIVE RIVER FLOODING?

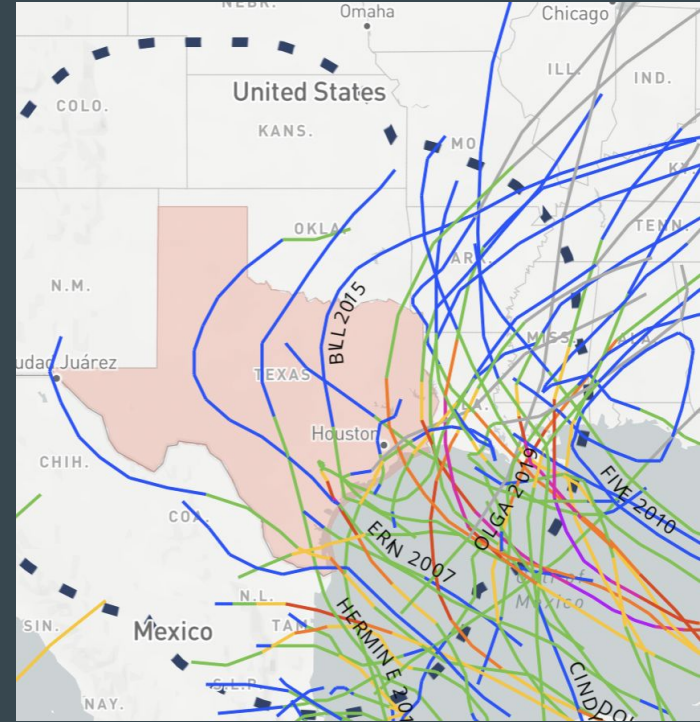
Gathering Data



- Download data from all stations in the Brazos, Trinity, and Neches basins.
- Each station comes with a large variety of frequently measured data, including precipitation.
- We are interested in times when hurricanes are present.

Selecting Hurricanes

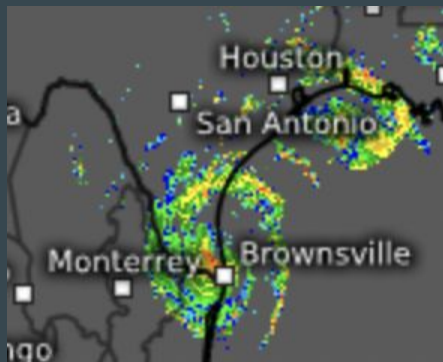
- Search NOAA records for all storms that tracked within 200 miles of Texas (see image).
- Filter to storms 2005 and after.
- Look at historical radar to see if storms dropped rain over the any part of area of interest.
- Record the time range storm drops rain over the area.



Handling Edge Cases



Trailing Bands
Ike 2008



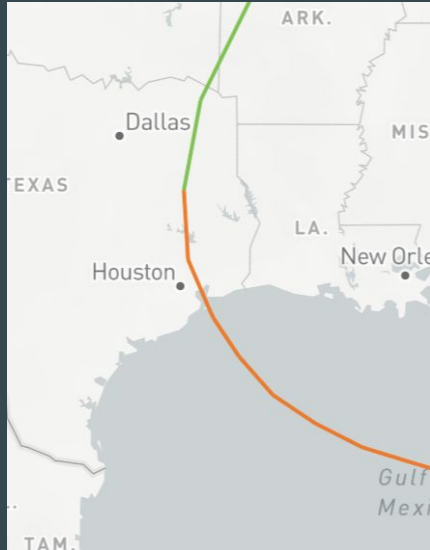
Distant Precip
Dolly 2008
EXCLUDED

Distant Precip and
Front
Laura 2020

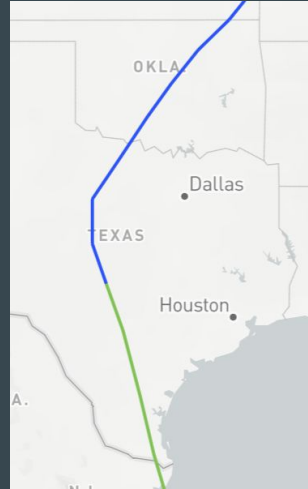


Grouping Hurricanes

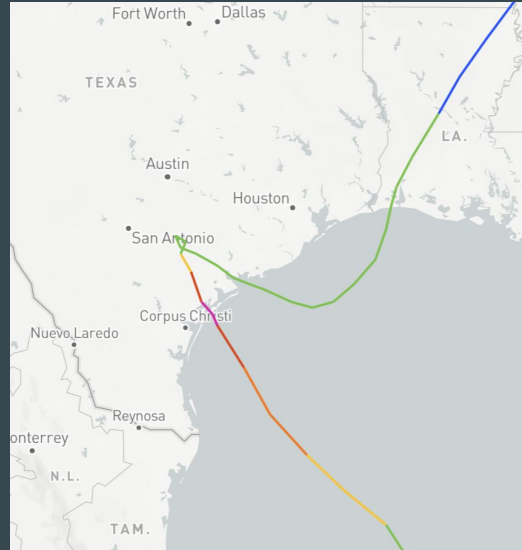
Northeast (NE)
Ike 2008



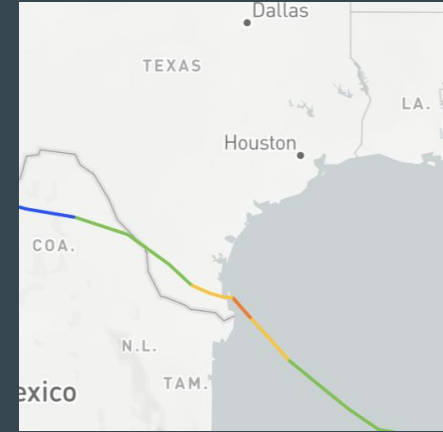
Drag
Harvey 2017



Northwest (NW)
Hermine 2010



Distant
Dolly 2008



Calculating Rainfall

Problem:

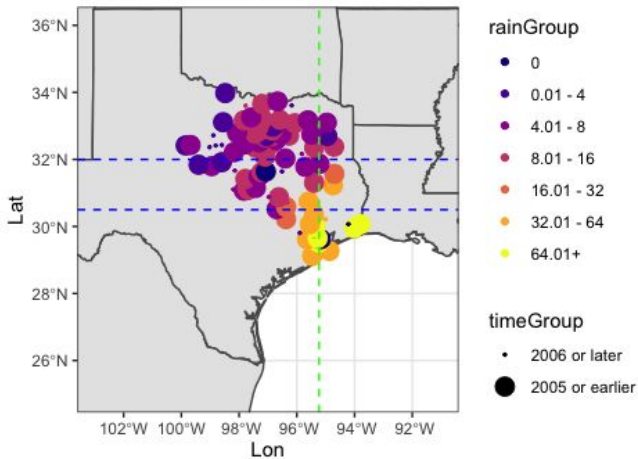
The precipitation column measures “one hour precipitation for the period from the observation time from the previous hourly reset.”

valid	p01i	rainfall		diff_p01i	reset	resetLag	timeIncrement	negativeDiff	hourChange
2010-09-07 20:22:00	0.00	0.00		-0.01	TRUE	120	1.67	TRUE	TRUE
2010-09-07 21:22:00	0.00	0.00		0.00	TRUE	60	1.00	FALSE	TRUE
2010-09-07 22:22:00	0.02	0.02		0.02	TRUE	60	1.00	FALSE	TRUE
2010-09-07 22:42:00	0.05	0.03		0.03	FALSE	NA	0.33	FALSE	FALSE
2010-09-07 23:02:00	0.02	0.02		-0.03	TRUE	40	0.33	TRUE	TRUE
2010-09-07 23:22:00	0.10	0.08		0.08	FALSE	NA	0.33	FALSE	FALSE
2010-09-07 23:42:00	0.14	0.04		0.04	FALSE	NA	0.33	FALSE	FALSE
2010-09-08 00:02:00	0.02	0.02		-0.12	TRUE	60	0.33	TRUE	TRUE
2010-09-08 00:22:00	0.11	0.09		0.09	FALSE	NA	0.33	FALSE	FALSE
2010-09-08 00:42:00	0.18	0.07		0.07	FALSE	NA	0.33	FALSE	FALSE
2010-09-08 01:22:00	0.01	0.01		-0.17	TRUE	80	0.67	TRUE	TRUE
2010-09-08 01:42:00	0.02	0.01		0.01	FALSE	NA	0.33	FALSE	FALSE
2010-09-08 02:22:00	0.01	0.01		-0.01	TRUE	60	0.67	TRUE	TRUE
2010-09-08 02:42:00	0.01	0.00		0.00	FALSE	NA	0.33	FALSE	FALSE

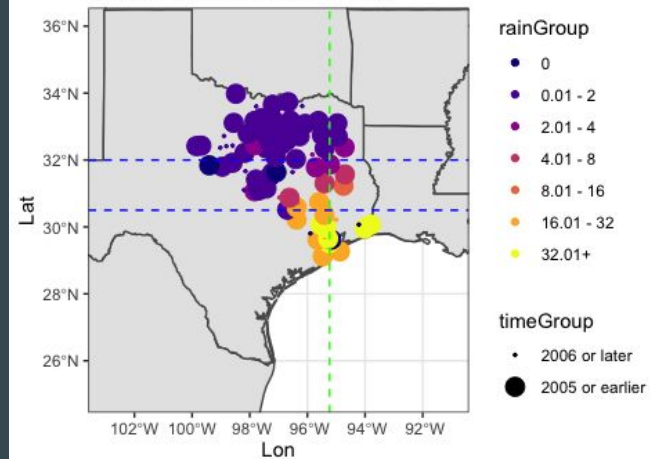
Solution:

Create a system to detect these resets to allow raw total rainfall in each time window to be recorded.

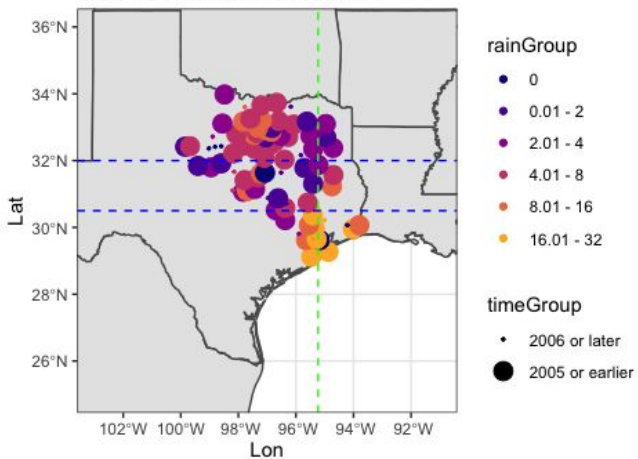
Total Rainfall ALL Storms



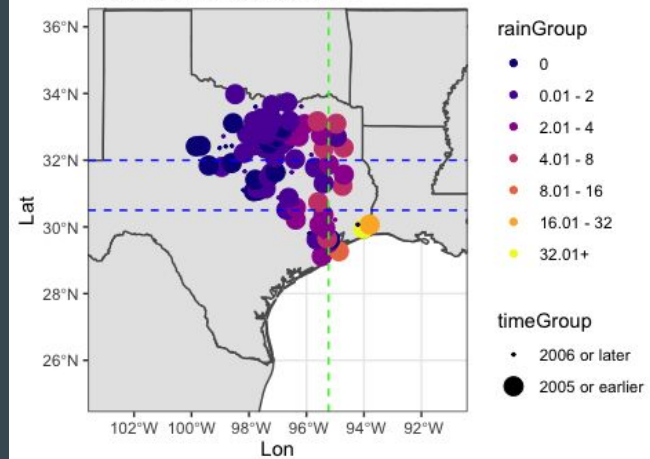
Total Rainfall DRAG Storms



Total Rainfall NW Storms



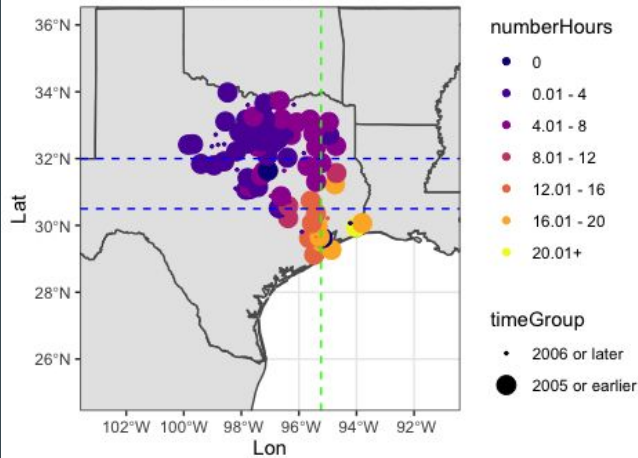
Total Rainfall NE Storms



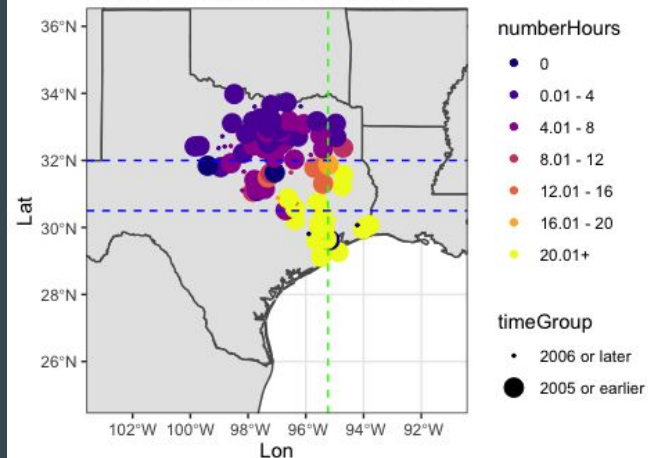
RESULTS: Total Rainfall by Storm Group

RESULTS: Hurricane Hours by Storm Group

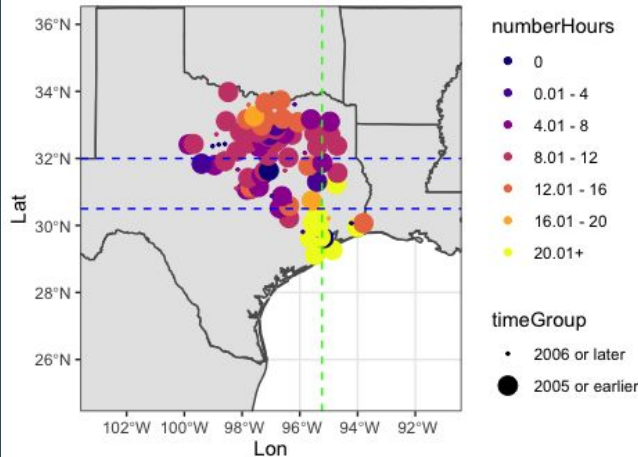
Average Hours ALL Storms



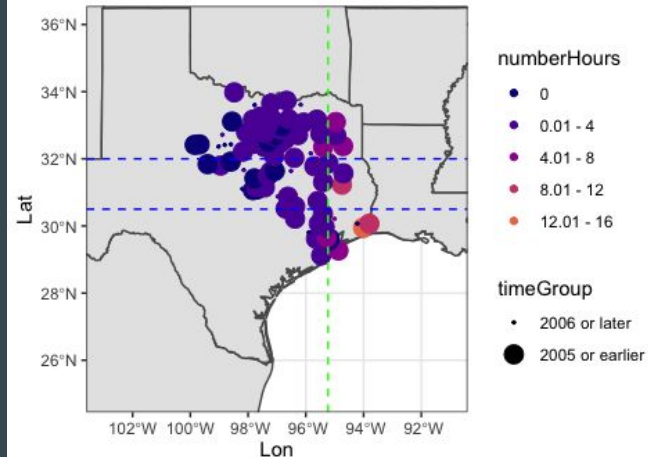
Average Hours DRAG Storms



Average Hours NW Storms



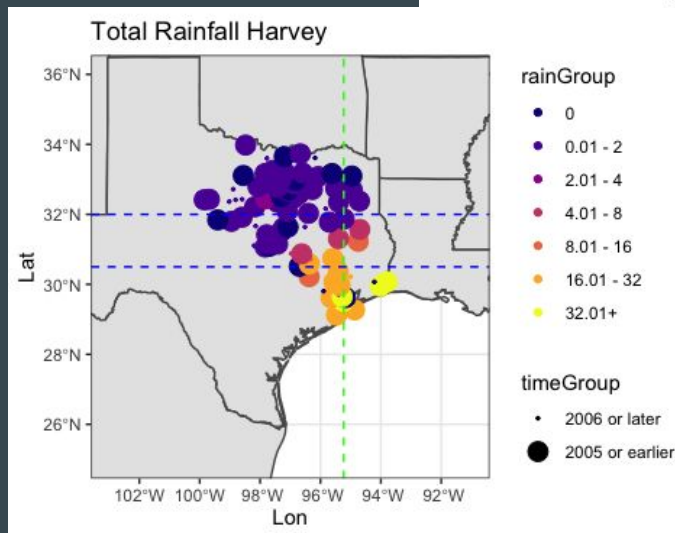
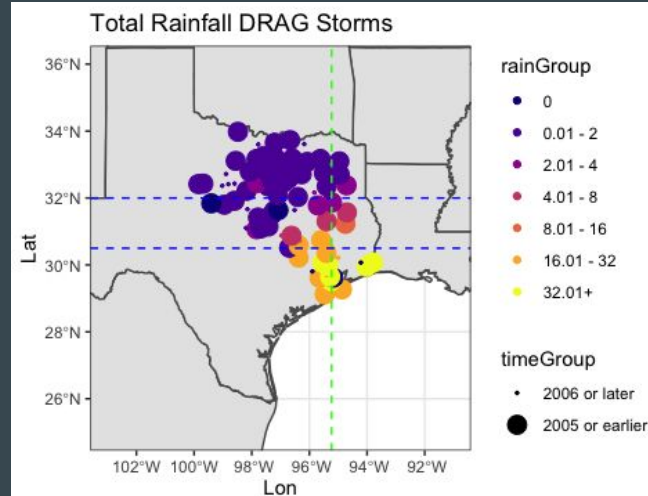
Average Hours NE Storms



RESULTS:

Harvey - The Average Skewer

billHours	cindyHours	harveyHours	barryHours	imeldaHours
25	4	80	4	38
21	15	84	9	44
20	6	93	1	31
27	8	94	2	39
0	0	0	0	0
17	7	71	0	34
24	12	97	1	44
13	9	0	2	38
0	0	0	0	0
18	13	99	12	51
20	10	93	1	38
2	16	80	7	45
24	5	93	3	35
0	0	0	0	0



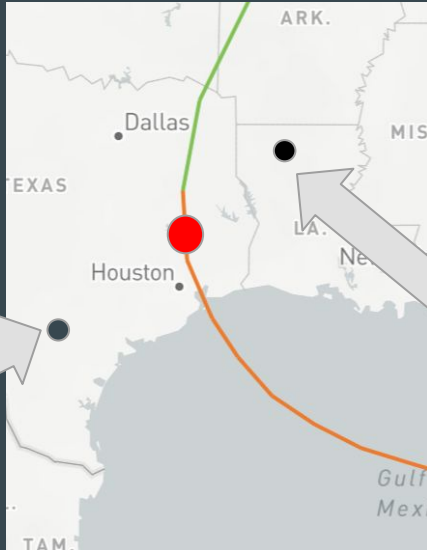
Conclusion

A few possible future directions:

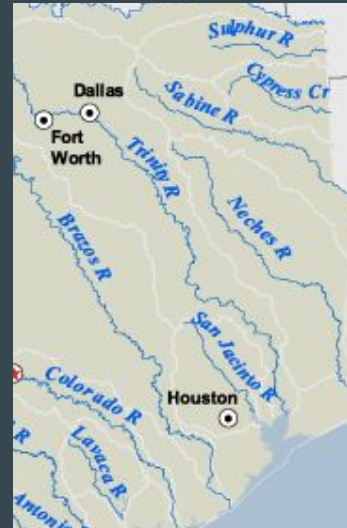
Precipitation related to direction from storm center or relative to track:

Or back to the rivers:

Southwest
of storm



Northeast
of storm



Investigate how
hurricane rain
from different
groups impacts
downstream river
flooding