Hurricane Rainfall Distribution in East Texas

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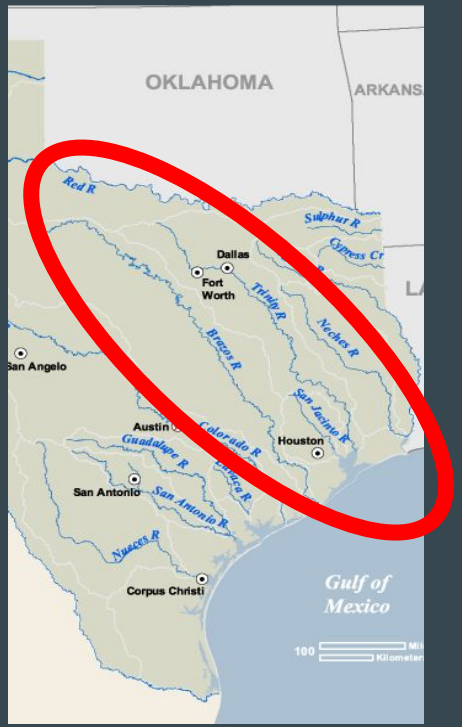
By Jordan Simons

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.

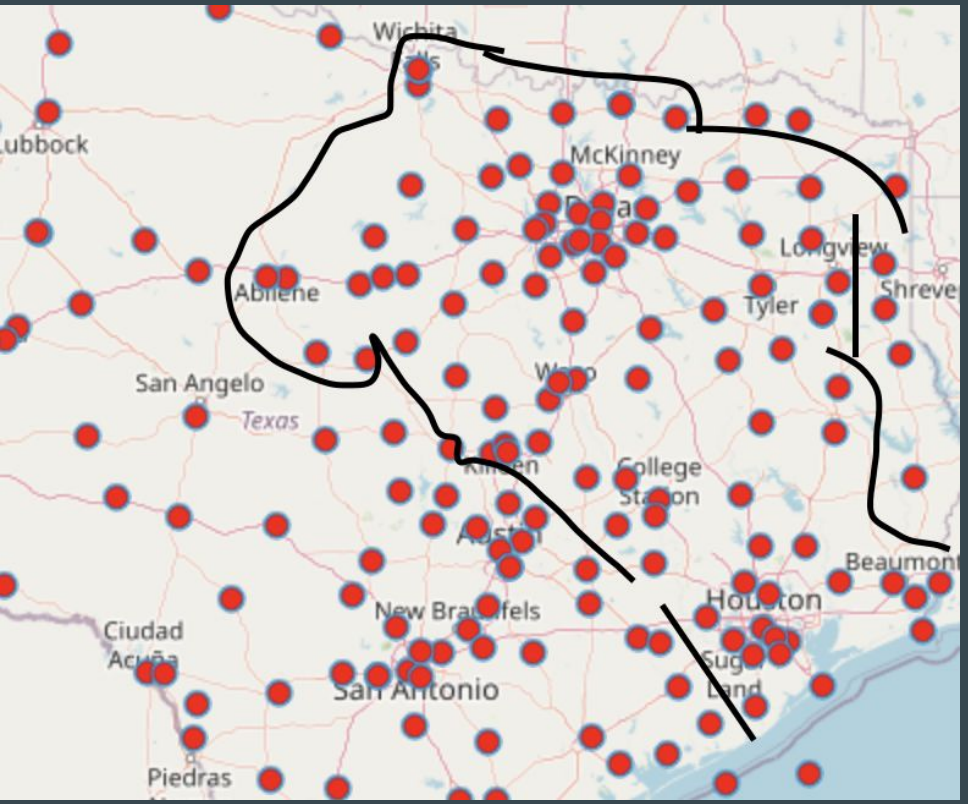
Research Questions

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.

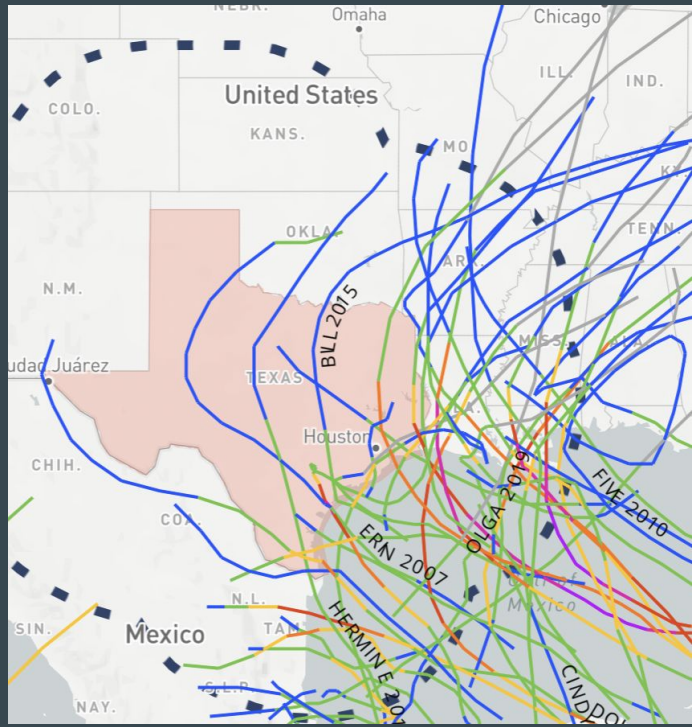
Selecting Hurricanes

-Search NOAA records for all storms that tracked within 200 miles of Texas (see image).

-Filter to storms 2005 and after.

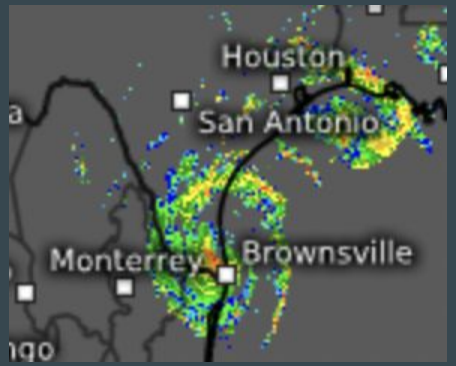
-Look at historical radar to see if storms dropped rain over the any part of area of interest.

-Record the time range storm drops rain over the area.



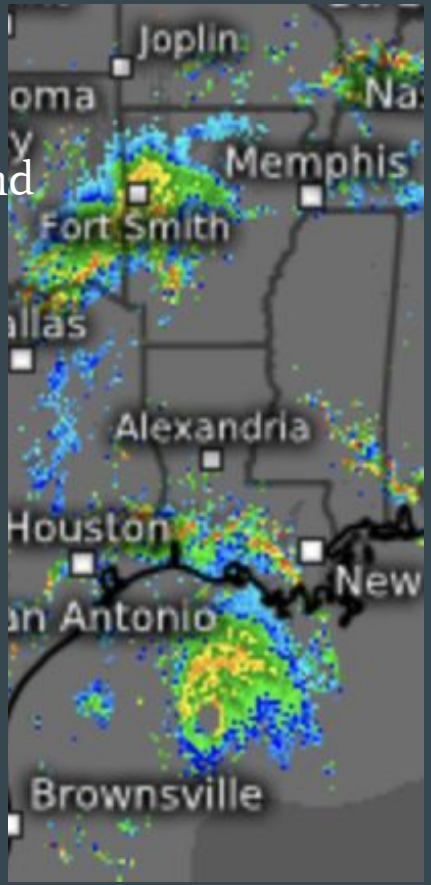
Handling Edge Cases

Trailing Bands
Ike 2008



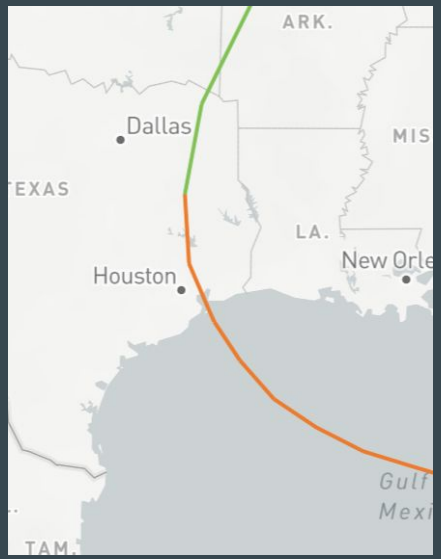
Distant Precip
Dolly 2008
EXCLUDED

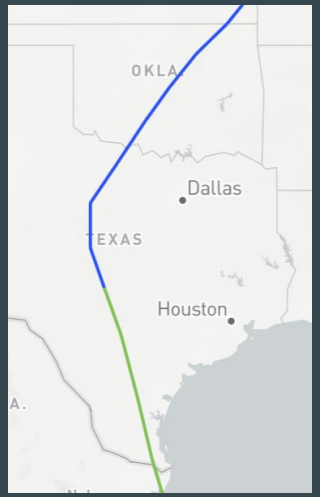
Distant Precip and
Front
Laura 2020



Grouping Hurricanes

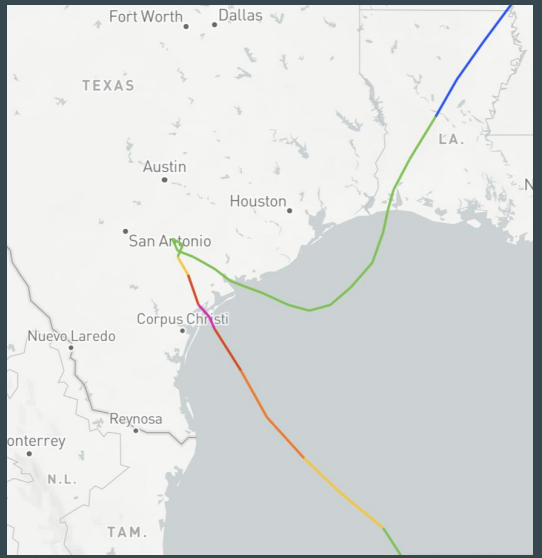
Northeast (NE)
Ike 2008

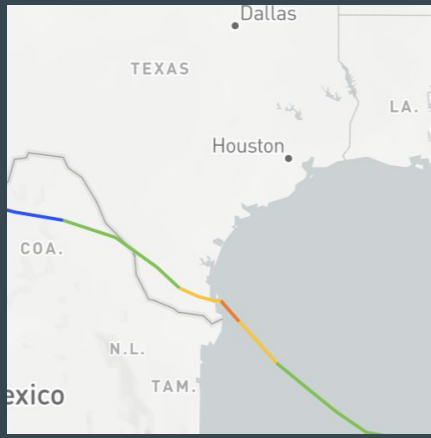




Northwest (NW)
Hermine 2010

Drag
Harvey 2017





Distant
Dolly 2008

Calculating Rainfall

Problem:

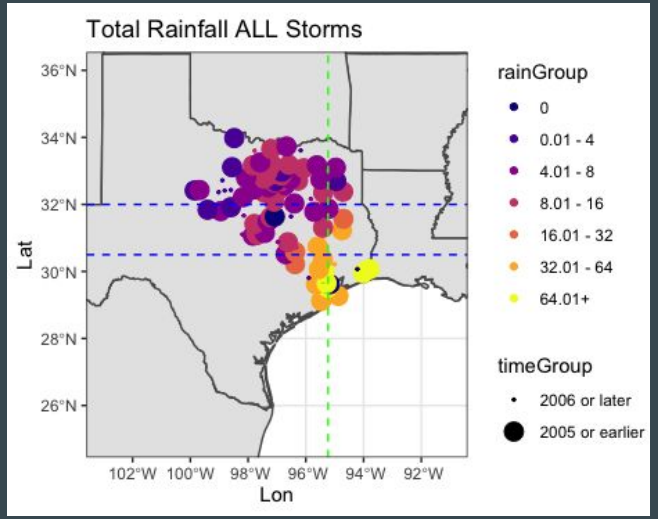
The precipitation column measures “one hour precipitation for the period from the observation time from the previous hourly reset.”

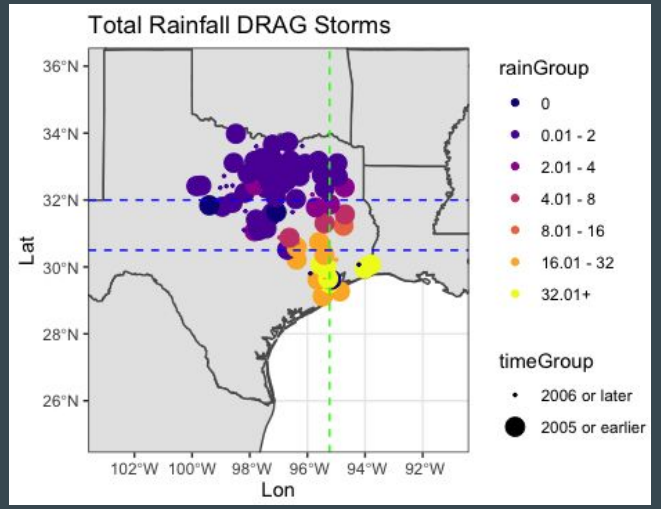
valid	p01i	rainfall	diff_p01i	reset	resetLag	timeIncrement	negativeDiff	hourChange
2010-09-07 20:22:00	0.00	0.00	-0.01	TRUE	120	1.67	TRUE	TRUE
2010-09-07 21:22:00	0.00	0.00	0.00	TRUE	60	1.00	FALSE	TRUE
2010-09-07 22:22:00	0.02	0.02	0.02	TRUE	60	1.00	FALSE	TRUE
2010-09-07 22:42:00	0.05	0.03	0.03	FALSE	*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

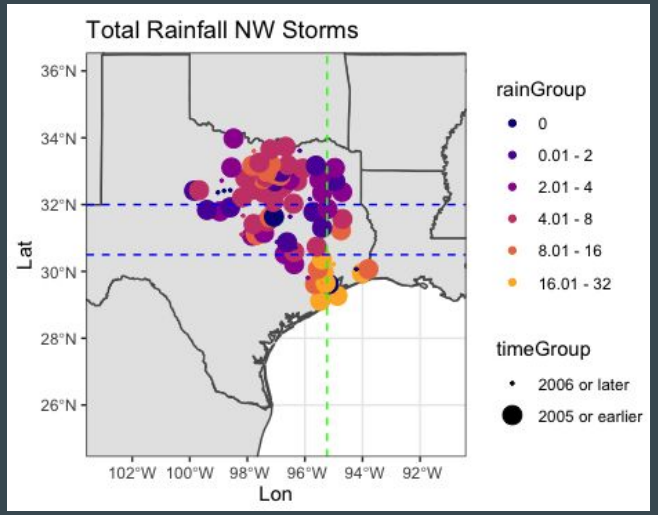
Solution:

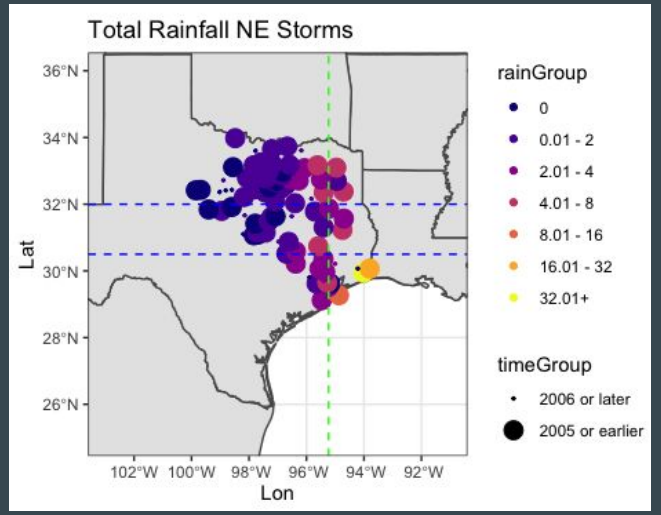
Create a system to detect these resets to allow raw total rainfall in each time window to be recorded.

RESULTS: Total Rainfall by Storm Group

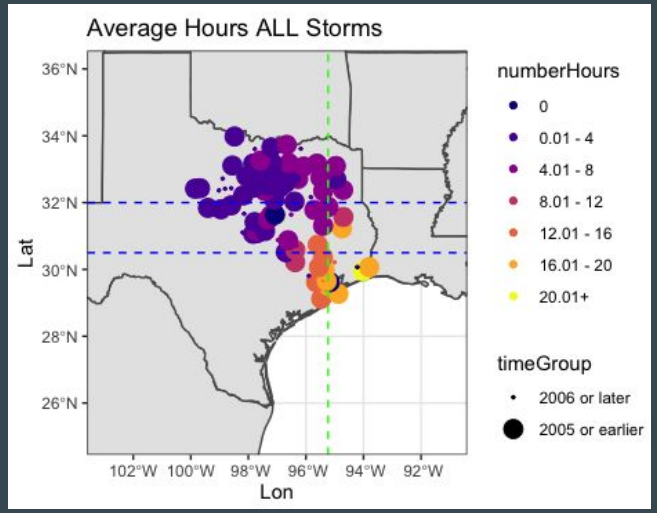


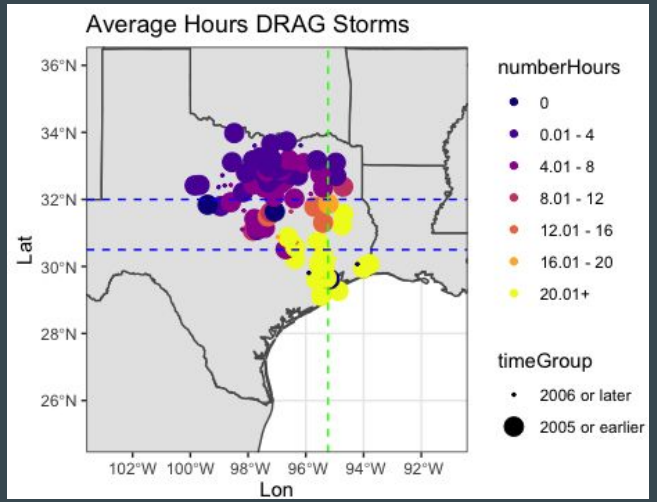


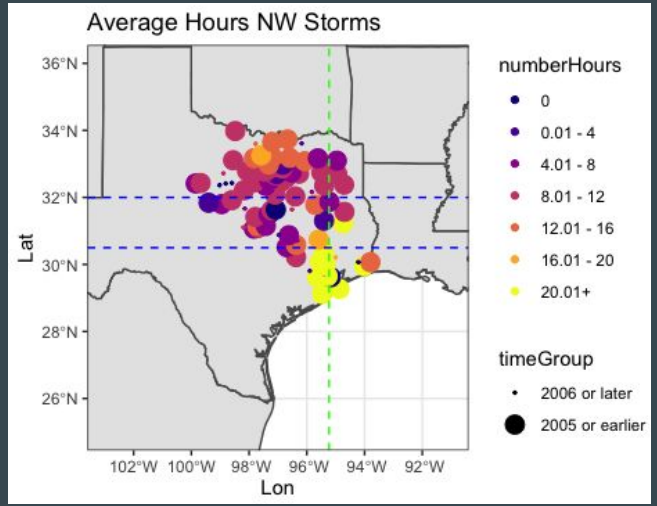


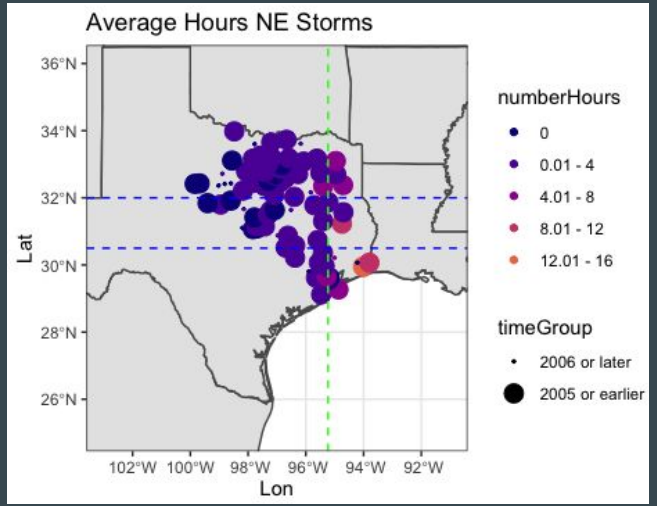


RESULTS: Hurricane Hours by Storm Group



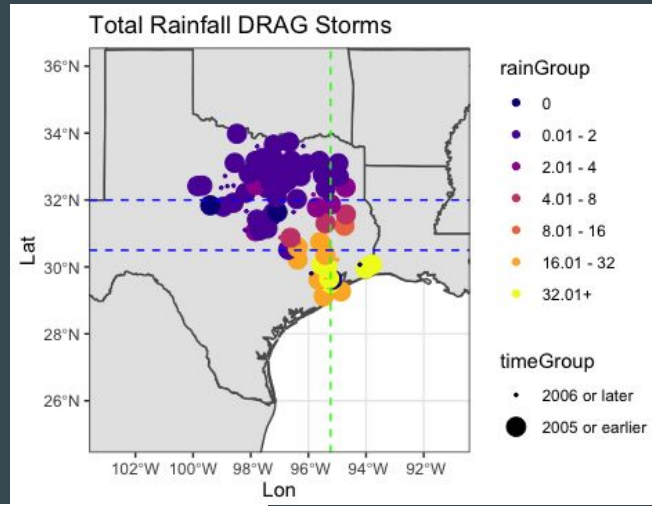


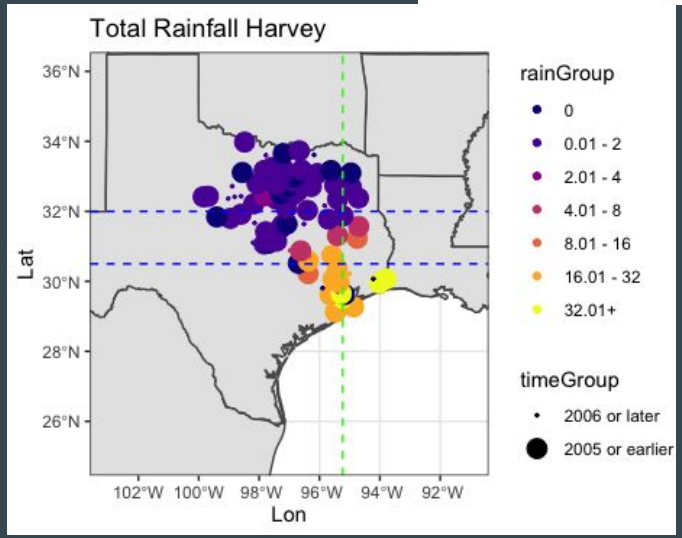




RESULTS:
Harvey - The Average Skewer

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

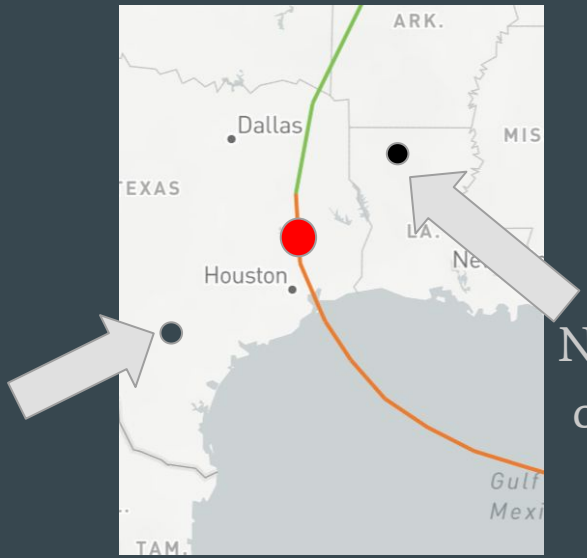




Conclusion

A few possible future directions:

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



Southwest of storm

Northeast of storm

Or back to the rivers:

Investigate how hurricane rain from different groups impacts downstream river flooding