

HARVEY'S IMPACT

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Background and Scope

Hurricane Harvey had a great impact and resulted in a lot of damage cost to the country. Let's find out the most affected areas.

Import the Data

Let us import dataset for the events held in 2017 and filter out the events with no data about property cost.

```
data = finalimport('StormEvents_2017_finalProject.csv');  
data = data(~ismissing(data.Property_Cost),:)
```

data = 46415x24 table

...

	EpisodeID	Event_ID	State	Year	Month	Event_Type	CZ_Name
1	113459	679228	FLORIDA	2017	April	Tornado	LEE
2	113448	679268	OHIO	2017	April	Thunderstorm Wind	GREENE
3	113697	682042	OHIO	2017	April	Flood	CLERMONT
4	113683	682062	NEBRASKA	2017	April	Hail	CASS
5	114718	688082	INDIANA	2017	April	Flash Flood	SWITZERLAND
6	114834	688895	VIRGINIA	2017	April	Thunderstorm Wind	WESTMOREL...
7	121068	724772	GULF OF ...	2017	October	Marine Thunders...	ATCHAFALA...
8	114489	686560	OHIO	2017	April	Flash Flood	CLERMONT
9	113683	682156	NEBRASKA	2017	April	Thunderstorm Wind	BURT
10	115066	690966	ARKANSAS	2017	April	Hail	FRANKLIN

	EpisodeID	Event_ID	State	Year	Month	Event_Type	CZ_Name
11	121162	725317	OKLAHOMA	2017	October	Hail	KIOWA
12	120474	721817	ATLANTIC...	2017	October	Marine Strong W...	DE BAY WA...
13	113797	681330	WISCONSIN	2017	February	Winter Weather	ROCK
14	113797	681332	WISCONSIN	2017	February	Winter Weather	WALWORTH
15	115634	694778	GULF OF ...	2017	June	Marine Thunders...	COASTAL W...
16	115688	695188	FLORIDA	2017	June	Thunderstorm Wind	CHARLOTTE
17	115811	696020	GULF OF ...	2017	June	Marine Thunders...	ENGLEWOOD...
18	115811	696023	GULF OF ...	2017	June	Marine Thunders...	ENGLEWOOD...
19	115752	695727	MONTANA	2017	June	Hail	CUSTER
20	115752	695729	MONTANA	2017	June	Hail	TREASURE
21	115752	695740	MONTANA	2017	June	Thunderstorm Wind	YELLOWSTONE
22	113797	681331	WISCONSIN	2017	February	Winter Weather	WAUKESHA
23	113797	681333	WISCONSIN	2017	February	Winter Weather	MILWAUKEE
24	113797	681334	WISCONSIN	2017	February	Winter Weather	RACINE
25	113797	681336	WISCONSIN	2017	February	Winter Weather	KENOSHA
26	115176	691471	GULF OF ...	2017	June	Waterspout	ENGLEWOOD...
27	115176	691472	GULF OF ...	2017	June	Waterspout	TAMPA BAY
28	115634	694777	GULF OF ...	2017	June	Marine Thunders...	ENGLEWOOD...
29	113797	681282	WISCONSIN	2017	February	Winter Weather	MARQUETTE
30	115811	696124	GULF OF ...	2017	June	Marine Thunders...	ENGLEWOOD...
31	115811	696134	GULF OF ...	2017	June	Marine Thunders...	CHARLOTTE...
32	115811	696176	GULF OF ...	2017	June	Marine Thunders...	COASTAL W...
33	115811	696179	GULF OF ...	2017	June	Marine Thunders...	CHARLOTTE...
34	115902	696463	FLORIDA	2017	June	Thunderstorm Wind	HILLSBORO...
35	115904	696474	GULF OF ...	2017	June	Marine Thunders...	CHARLOTTE...
36	115940	696653	GULF OF ...	2017	June	Marine Thunders...	TAMPA BAY
37	116635	701349	FLORIDA	2017	June	Flash Flood	LEON
38	116635	701350	FLORIDA	2017	June	Flash Flood	LEON
39	116635	701351	FLORIDA	2017	June	Flash Flood	LEON
40	116636	701352	FLORIDA	2017	June	Flash Flood	BAY
41	116636	701353	FLORIDA	2017	June	Flash Flood	WASHINGTON
42	116636	701354	FLORIDA	2017	June	Flood	WALTON
43	116636	701355	FLORIDA	2017	June	Flood	WALTON
44	115691	698754	MISSOURI	2017	June	Thunderstorm Wind	CHRISTIAN

	EpisodeID	Event_ID	State	Year	Month	Event_Type	CZ_Name
45	115691	698756	MISSOURI	2017	June	Thunderstorm Wind	GREENE
46	116224	698777	KANSAS	2017	June	Hail	CRAWFORD
47	116224	698778	KANSAS	2017	June	Hail	CRAWFORD
48	116224	698779	KANSAS	2017	June	Thunderstorm Wind	CRAWFORD
49	116224	698780	KANSAS	2017	June	Thunderstorm Wind	CRAWFORD
50	116224	698781	KANSAS	2017	June	Thunderstorm Wind	CRAWFORD
51	116224	698782	KANSAS	2017	June	Hail	CHEROKEE
52	115691	698760	MISSOURI	2017	June	Thunderstorm Wind	TANEY
53	115691	698761	MISSOURI	2017	June	Thunderstorm Wind	STONE
54	115691	698762	MISSOURI	2017	June	Thunderstorm Wind	TANEY
55	115691	698763	MISSOURI	2017	June	Thunderstorm Wind	TANEY
56	115691	698764	MISSOURI	2017	June	Thunderstorm Wind	HOWELL
57	115691	698765	MISSOURI	2017	June	Heavy Rain	GREENE
58	115691	698766	MISSOURI	2017	June	Heavy Rain	GREENE
59	116222	698768	MISSOURI	2017	June	Flash Flood	GREENE
60	116222	698769	MISSOURI	2017	June	Flash Flood	GREENE
61	116222	698770	MISSOURI	2017	June	Hail	GREENE
62	116636	701356	FLORIDA	2017	June	Flood	WALTON
63	116636	701357	FLORIDA	2017	June	Flood	WALTON
64	115330	692444	ATLANTIC...	2017	June	Marine Thunders...	VOLUSIA-B...
65	115330	692448	ATLANTIC...	2017	June	Marine Thunders...	VOLUSIA-B...
66	115330	692453	ATLANTIC...	2017	June	Marine Thunders...	VOLUSIA-B...
67	115691	698751	MISSOURI	2017	June	Lightning	DOUGLAS
68	115691	698752	MISSOURI	2017	June	Thunderstorm Wind	GREENE
69	115691	698753	MISSOURI	2017	June	Thunderstorm Wind	GREENE
70	115691	698757	MISSOURI	2017	June	Thunderstorm Wind	GREENE
71	115691	698758	MISSOURI	2017	June	Thunderstorm Wind	GREENE
72	115691	698759	MISSOURI	2017	June	Thunderstorm Wind	GREENE
73	116222	698771	MISSOURI	2017	June	Thunderstorm Wind	GREENE
74	116222	698772	MISSOURI	2017	June	Thunderstorm Wind	GREENE
75	116222	698773	MISSOURI	2017	June	Thunderstorm Wind	GREENE
76	116222	698774	MISSOURI	2017	June	Thunderstorm Wind	GREENE
77	116224	698775	KANSAS	2017	June	Hail	CRAWFORD
78	116224	698776	KANSAS	2017	June	Hail	CRAWFORD

	EpisodeID	Event_ID	State	Year	Month	Event_Type	CZ_Name
79	116224	698783	KANSAS	2017	June	Thunderstorm Wind	CHEROKEE
80	116224	698784	KANSAS	2017	June	Thunderstorm Wind	CRAWFORD
81	116224	698785	KANSAS	2017	June	Thunderstorm Wind	BOURBON
82	115940	696657	GULF OF ...	2017	June	Waterspout	ENGLEWOOD...
83	115968	696991	FLORIDA	2017	June	Thunderstorm Wind	CHARLOTTE
84	115966	697003	GULF OF ...	2017	June	Marine Thunders...	TAMPA BAY
85	115966	697015	GULF OF ...	2017	June	Marine Thunders...	TAMPA BAY
86	115992	697128	GULF OF ...	2017	June	Waterspout	ENGLEWOOD...
87	116634	701344	ALABAMA	2017	June	Thunderstorm Wind	GENEVA
88	116632	701345	ALABAMA	2017	June	Thunderstorm Wind	GENEVA
89	116224	698786	KANSAS	2017	June	Thunderstorm Wind	CRAWFORD
90	116224	698787	KANSAS	2017	June	Thunderstorm Wind	CRAWFORD
91	116224	698788	KANSAS	2017	June	Thunderstorm Wind	CHEROKEE
92	116224	698789	KANSAS	2017	June	Thunderstorm Wind	CHEROKEE
93	116224	698790	KANSAS	2017	June	Thunderstorm Wind	BOURBON
94	116225	698801	MISSOURI	2017	June	Thunderstorm Wind	VERNON
95	116225	698802	MISSOURI	2017	June	Thunderstorm Wind	CEDAR
96	116224	698791	KANSAS	2017	June	Thunderstorm Wind	BOURBON
97	116226	698792	MISSOURI	2017	June	Thunderstorm Wind	GREENE
98	116226	698793	MISSOURI	2017	June	Thunderstorm Wind	DALLAS
99	116226	698795	MISSOURI	2017	June	Thunderstorm Wind	BARTON
100	116226	698796	MISSOURI	2017	June	Thunderstorm Wind	GREENE

⋮

Two States Most Impacted by Harvey

Now, since Harvey impacted only **Arkansas, Kentucky, Louisiana, Mississippi, North Carolina, Tennessee, and Texas**, we shall filter out the remaining states from the table, i.e., events irrelevant from Harvey. We shall further filter out the events which didn't occur during or the irrelevant data as the Harvey's events occurred between 17th of August and 3rd of September.

```
harvey_data = data(ismember(data.State,{'ARKANSAS','KENTUCKY','LOUISIANA','MISSISSIPPI','NORTH
begindate = datetime("2017-08-17 00:00:00");
enddate = datetime("2017-09-03 23:59:59");

harvey_data = harvey_data(harvey_data.Begin_Date_Time >= begindate & harvey_data.End_Date_Time
```

```
harvey_data.Event_Type = removecats(harvey_data.Event_Type,{'Astronomical Low Tide','Avalanche'}
```

```
harvey_data = 562x24 table
```

...

	EpisodeID	Event_ID	State	Year	Month	Event_Type	CZ_Name
1	119753	723472	TEXAS	2017	August	Tropical Storm	MONTGOMERY
2	118750	713329	MISSISSI...	2017	September	Strong Wind	LOWNDES
3	120636	722605	NORTH CA...	2017	September	Flash Flood	WAKE
4	120636	722608	NORTH CA...	2017	September	Flash Flood	CUMBERLAND
5	120636	722610	NORTH CA...	2017	September	Hail	LEE
6	119753	723473	TEXAS	2017	August	Tropical Storm	FORT BEND
7	120636	722609	NORTH CA...	2017	September	Hail	WAYNE
8	120636	722619	NORTH CA...	2017	September	Thunderstorm Wind	RICHMOND
9	120636	722623	NORTH CA...	2017	September	Thunderstorm Wind	WAYNE
10	120636	722626	NORTH CA...	2017	September	Thunderstorm Wind	LEE
11	120636	722627	NORTH CA...	2017	September	Thunderstorm Wind	LEE
12	119753	723449	TEXAS	2017	August	Tropical Storm	GALVESTON
13	119753	723474	TEXAS	2017	August	Tropical Storm	SAN JACINTO
14	120636	722628	NORTH CA...	2017	September	Thunderstorm Wind	HARNETT
15	120636	722631	NORTH CA...	2017	September	Thunderstorm Wind	MOORE
16	120636	722632	NORTH CA...	2017	September	Thunderstorm Wind	HARNETT
17	120636	722634	NORTH CA...	2017	September	Thunderstorm Wind	JOHNSTON
18	120636	722637	NORTH CA...	2017	September	Thunderstorm Wind	HOKE
19	120636	722638	NORTH CA...	2017	September	Thunderstorm Wind	WAKE
20	120636	722639	NORTH CA...	2017	September	Thunderstorm Wind	FRANKLIN
21	120636	722640	NORTH CA...	2017	September	Hail	WAKE
22	120636	722641	NORTH CA...	2017	September	Hail	WAKE
23	119753	723475	TEXAS	2017	August	Tropical Storm	WALKER
24	119753	723648	TEXAS	2017	August	Tropical Storm	POLK
25	119821	718430	KENTUCKY	2017	September	Flash Flood	TODD
26	120011	719146	TEXAS	2017	August	Flash Flood	EL PASO
27	120012	719147	TEXAS	2017	August	Thunderstorm Wind	EL PASO
28	120012	719148	TEXAS	2017	August	Flash Flood	EL PASO
29	118746	713318	MISSISSI...	2017	August	Thunderstorm Wind	LAMAR
30	118746	713320	MISSISSI...	2017	August	High Wind	WASHINGTON
31	118746	713322	MISSISSI...	2017	August	Strong Wind	GRENADA

	EpisodeID	Event_ID	State	Year	Month	Event_Type	CZ_Name
32	119746	719493	TEXAS	2017	August	Flash Flood	HARDIN
33	119746	719496	TEXAS	2017	August	Flash Flood	JASPER
34	119746	719497	TEXAS	2017	August	Flash Flood	NEWTON
35	119753	720340	TEXAS	2017	August	Flash Flood	FORT BEND
36	120460	721724	TENNESSEE	2017	September	Heavy Rain	ROBERTSON
37	120460	721725	TENNESSEE	2017	September	Heavy Rain	MONTGOMERY
38	120460	721726	TENNESSEE	2017	September	Heavy Rain	ROBERTSON
39	120636	722624	NORTH CA...	2017	September	Thunderstorm Wind	RANDOLPH
40	120464	723037	NORTH CA...	2017	September	Flash Flood	MECKLENBURG
41	120464	723039	NORTH CA...	2017	September	Heavy Rain	IREDELL
42	117886	708461	ARKANSAS	2017	August	Heat	LITTLE RI...
43	117886	708463	ARKANSAS	2017	August	Heat	HOWARD
44	119659	717786	ARKANSAS	2017	August	Flash Flood	WOODRUFF
45	117836	708282	TEXAS	2017	August	Thunderstorm Wind	BRISCOE
46	118746	713323	MISSISSI...	2017	August	Flood	LAMAR
47	118746	713328	MISSISSI...	2017	August	Thunderstorm Wind	LOWNDES
48	118746	713321	MISSISSI...	2017	August	Strong Wind	ATTALA
49	118746	713326	MISSISSI...	2017	August	Thunderstorm Wind	LOWNDES
50	118746	713327	MISSISSI...	2017	August	Thunderstorm Wind	LOWNDES
51	119746	719740	TEXAS	2017	August	Thunderstorm Wind	JASPER
52	119746	720010	TEXAS	2017	August	Flood	ORANGE
53	119611	717581	ARKANSAS	2017	August	Flash Flood	PULASKI
54	120145	719894	TENNESSEE	2017	August	Flash Flood	DAVIDSON
55	119753	720464	TEXAS	2017	August	Flash Flood	MONTGOMERY
56	120636	722606	NORTH CA...	2017	September	Flash Flood	JOHNSTON
57	120636	722621	NORTH CA...	2017	September	Thunderstorm Wind	MOORE
58	120636	722618	NORTH CA...	2017	September	Hail	HARNETT
59	117886	708464	ARKANSAS	2017	August	Heat	HEMPSTEAD
60	117886	708465	ARKANSAS	2017	August	Heat	NEVADA
61	117886	708466	ARKANSAS	2017	August	Heat	MILLER
62	117886	708467	ARKANSAS	2017	August	Heat	LAFAYETTE
63	117886	708468	ARKANSAS	2017	August	Heat	COLUMBIA
64	119853	718515	TEXAS	2017	August	Thunderstorm Wind	ECTOR
65	118099	709783	KENTUCKY	2017	August	Thunderstorm Wind	PENDLETON

	EpisodeID	Event_ID	State	Year	Month	Event_Type	CZ_Name
66	120145	719849	TENNESSEE	2017	August	Tornado	PERRY
67	120145	719850	TENNESSEE	2017	August	Tornado	MAURY
68	120145	719851	TENNESSEE	2017	August	Thunderstorm Wind	DAVIDSON
69	119746	719342	TEXAS	2017	August	Flash Flood	JEFFERSON
70	118733	713256	MISSISSI...	2017	August	Tornado	HARRISON
71	119753	720344	TEXAS	2017	August	Flash Flood	GALVESTON
72	117886	708469	ARKANSAS	2017	August	Heat	UNION
73	117887	708470	LOUISIANA	2017	August	Heat	CADDO
74	117887	708471	LOUISIANA	2017	August	Heat	BOSSIER
75	117887	708472	LOUISIANA	2017	August	Heat	DE SOTO
76	117887	708473	LOUISIANA	2017	August	Heat	RED RIVER
77	118032	709519	TEXAS	2017	August	Thunderstorm Wind	SWISHER
78	118916	714375	LOUISIANA	2017	August	Tropical Storm	SABINE
79	118330	711050	TEXAS	2017	August	Flash Flood	ANGELINA
80	118330	711054	TEXAS	2017	August	Flash Flood	ANGELINA
81	118330	711059	TEXAS	2017	August	Flash Flood	ANGELINA
82	118330	711060	TEXAS	2017	August	Flash Flood	ANGELINA
83	120145	719854	TENNESSEE	2017	August	Tornado	DAVIDSON
84	120145	719856	TENNESSEE	2017	August	Tornado	DAVIDSON
85	119753	721087	TEXAS	2017	August	Flash Flood	SAN JACINTO
86	117997	709332	KENTUCKY	2017	August	Thunderstorm Wind	FAYETTE
87	117997	709333	KENTUCKY	2017	August	Thunderstorm Wind	FAYETTE
88	119753	720859	TEXAS	2017	August	Flash Flood	GALVESTON
89	120636	722616	NORTH CA...	2017	September	Hail	WAKE
90	117887	708474	LOUISIANA	2017	August	Heat	BIENVILLE
91	117887	708475	LOUISIANA	2017	August	Heat	WEBSTER
92	117887	708477	LOUISIANA	2017	August	Heat	CLAIBORNE
93	117887	708478	LOUISIANA	2017	August	Heat	LINCOLN
94	117887	708479	LOUISIANA	2017	August	Heat	JACKSON
95	118032	709521	TEXAS	2017	August	Thunderstorm Wind	LUBBOCK
96	118916	714376	LOUISIANA	2017	August	Tropical Storm	NATCHITOC...
97	118916	714377	LOUISIANA	2017	August	Tropical Storm	UNION
98	118330	711063	TEXAS	2017	August	Flash Flood	ANGELINA
99	118032	709520	TEXAS	2017	August	Flash Flood	SWISHER

	EpisodeID	Event_ID	State	Year	Month	Event_Type	CZ_Name
4	119753	723474	TEXAS	2017	August	Tropical Storm	SAN JACINTO
5	119753	723475	TEXAS	2017	August	Tropical Storm	WALKER
6	119753	723648	TEXAS	2017	August	Tropical Storm	POLK
7	120011	719146	TEXAS	2017	August	Flash Flood	EL PASO
8	120012	719147	TEXAS	2017	August	Thunderstorm Wind	EL PASO
9	120012	719148	TEXAS	2017	August	Flash Flood	EL PASO
10	119746	719493	TEXAS	2017	August	Flash Flood	HARDIN
11	119746	719496	TEXAS	2017	August	Flash Flood	JASPER
12	119746	719497	TEXAS	2017	August	Flash Flood	NEWTON
13	119753	720340	TEXAS	2017	August	Flash Flood	FORT BEND
14	117836	708282	TEXAS	2017	August	Thunderstorm Wind	BRISCOE
15	119746	719740	TEXAS	2017	August	Thunderstorm Wind	JASPER

Visualizations

Figure of Event Types

A figure showing the type and number of occurrences for events related to Harvey in the two states is shown below. Events with zero occurrences have already been removed from the dataset.

```

histogram(harvey_top.Event_Type)

title('Event Types and their Occurences')

xlabel('Type of Events')
ylabel('No. of Events')

```

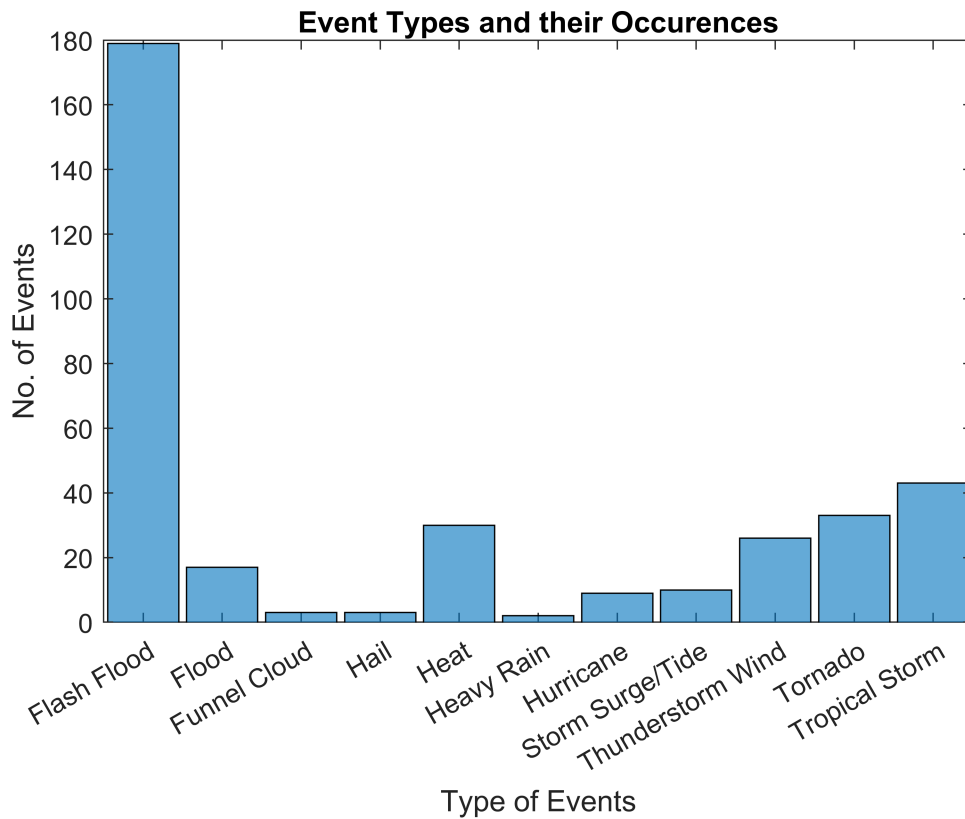


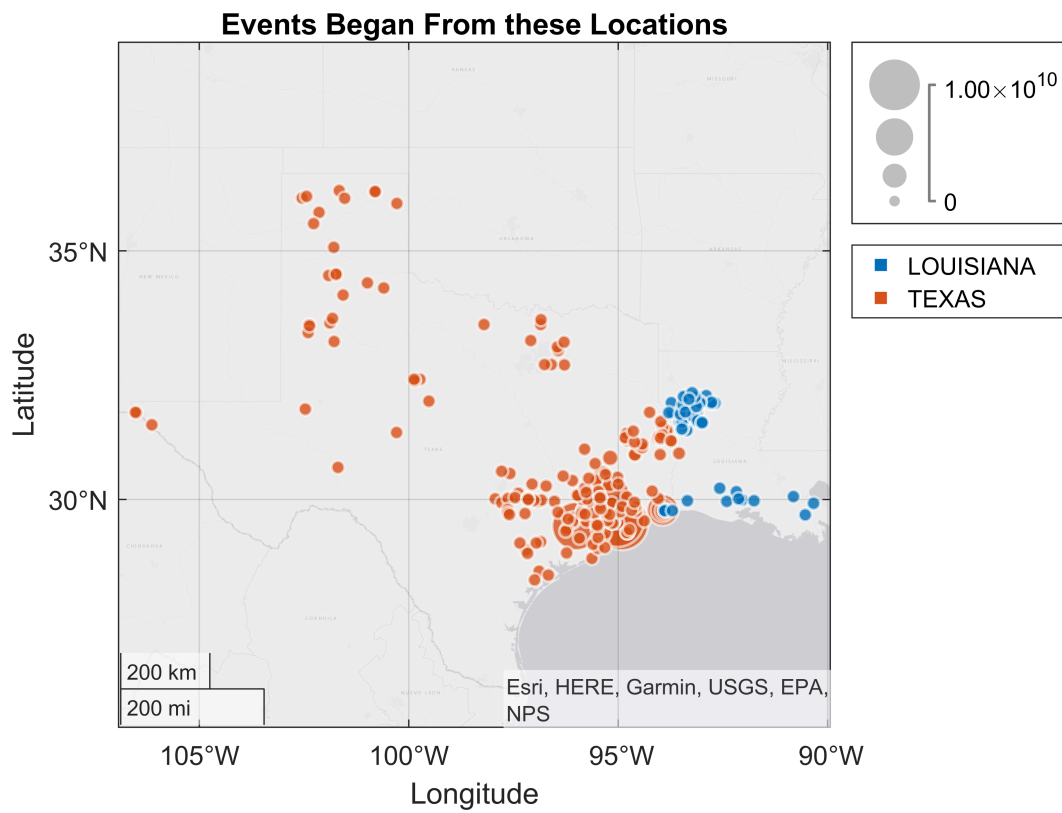
Figure of Event Locations

Below are the locations of events in the two states. The size of marker depends upon the property cost of the event.

Begin Locations

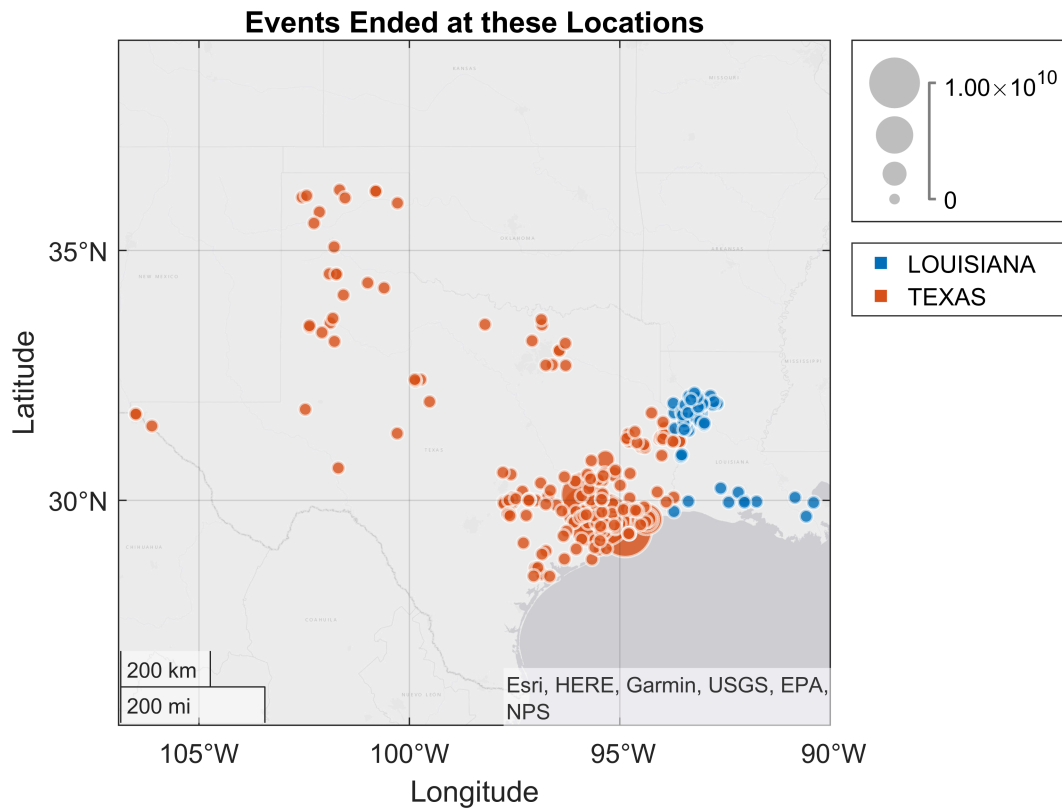
```
geobubble(harvey_top.Begin_Lat,harvey_top.Begin_Lon,harvey_top.Property_Cost, harvey_top.State)
legend show

title('Events Began From these Locations')
```



End Locations

```
geobubble(harvey_top.End_Lat,harvey_top.End_Lon,harvey_top.Property_Cost, harvey_top.State)
title('Events Ended at these Locations')
```



Analysis

Three Counties with Most Events in Texas

Below are given the **top 3** Counties in **Texas** which encountered the most number of events during Harvey.

```
state_1 = harvey_top(harvey_top.State == "TEXAS", :);
county_top = groupsummary(state_1, 'CZ_Name');
county_top = sortrows(county_top, 2, 'descend');
county_top = county_top(1:3,1)
```

county_top = 3×1 table

	CZ_Name
1	HARRIS
2	GALVESTON
3	FORT BEND

Three Counties with Most Events in Louisiana

Below are given the **top 3** Counties in **Louisiana** which encountered the most number of events during Harvey.

```
state_2 = harvey_top(harvey_top.State == "LOUISIANA", :);
county_top2 = groupsummary(state_2, 'CZ_Name');
```

```
county_top2 = sortrows(county_top2, 2, 'descend');
county_top2 = county_top2(1:3,1)
```

county_top2 = 3x1 table

	CZ_Name
1	NATCHITOC...
2	SABINE
3	RED RIVER

Three Counties with Highest Property Cost in Texas

The counties with most property cost in **Texas** are given below.

```
county1_property = groupsummary(state_1, 'CZ_Name', 'sum', 'Property_Cost');
county1_property = sortrows(county1_property, 3, 'descend');
county1_property = county1_property(1:3,[1,3])
```

county1_property = 3x2 table

	CZ_Name	sum_Property_Cost
1	GALVESTON	2.0000e+10
2	FORT BEND	1.6004e+10
3	MONTGOMERY	1.4000e+10

Three Counties with Highest Property Cost in Louisiana

The counties with most property cost in **Louisiana** are given below.

```
county2_property = groupsummary(state_2, 'CZ_Name', 'sum', 'Property_Cost');
county2_property = sortrows(county2_property, 3, 'descend');
county2_property = county2_property(1:3,[1,3])
```

county2_property = 3x2 table

	CZ_Name	sum_Property_Cost
1	CALCASIEU	60000000
2	BEAUREGARD	15000000
3	ACADIA	200000

Conclusions and Recommendations

The Most Affected states were Texas and Louisiana and hence the company should focus on these states firstly to send people to. However, the property cost to the counties in **Texas** was relatively much higher than that to the **Louisiana** and can be seen that the property cost of **Calcasieu** of **Louisiana** was lower than **Montgomery** of **Texas**, which means the company should be prioritising Texas over. We may also note that there may be

other counties in Texas too which had higher damage than **Calcasieu** of Louisiana which the company should look into too.

It is also clearly visible from the plots that the events did most damage at the coastal regions and the most affected areas are not much far from each other.