Hurricane Harvey Analysis

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Background and Scope

Import the Data

Imported:

1. State
2. Event_Table
3. CZ_Name
4. Begin_Date_Time
5. End_Date_Time
6. Property_Cost
7. Begin_Lat
8. Begin_Lon
9. End_Lat
10. End_Lon

```
uiimport("StormEvents\StormEvents_2017_finalProject.csv")
```

States Impacted by harvey

In order to filter the data to know which data is related to hurricane Harvey we need to filter the data to only include these states.

- Arkansas
- Kentucky

- Louisiana
- Mississippi
- North Carolina
- Tennessee
- Texas.

```
StormEvents2017finalProject = StormEvents2017finalProject(StormEvents2017finalProject.State ==
    | StormEvents2017finalProject.State == 'KENTUCKY' | StormEvents2017finalProject.State == 'L
    | StormEvents2017finalProject.State == 'MISSISSIPPI' | StormEvents2017finalProject.State ==
    | StormEvents2017finalProject.State == 'TENNESSEE' | StormEvents2017finalProject.State == '
```

```
StormEvents2017finalProject = 10667×10 table
```

...

	State	Event_Type	CZ_Name	Begin_Date_Time	End_Date_Time	Property_Cost
1	ARKANSAS	Hail	FRANKLIN	2017-04-26 07:57...	2017-04-26 07:...	0
2	TEXAS	Hail	HENDERSON	2017-05-03 14:06...	2017-05-03 14:...	1000
3	NORTH C...	Flash Flood	WAKE	2017-06-16 19:32...	2017-06-16 19:...	0
4	KENTUCKY	Flash Flood	KNOTT	2017-06-14 16:25...	2017-06-14 16:...	0
5	ARKANSAS	Drought	SEBASTIAN	2017-11-15 00:00...	2017-11-30 23:...	0
6	ARKANSAS	Drought	FRANKLIN	2017-11-15 00:00...	2017-11-30 23:...	0
7	ARKANSAS	Drought	CRAWFORD	2017-11-15 00:00...	2017-11-30 23:...	0
8	ARKANSAS	Drought	WASHINGTON	2017-11-15 00:00...	2017-11-30 23:...	0
9	ARKANSAS	Drought	MADISON	2017-11-15 00:00...	2017-11-30 23:...	0
10	TEXAS	Tornado	BOSQUE	2017-01-15 18:17...	2017-01-15 18:...	90000
11	TEXAS	Thunderstorm Wind	DALLAS	2017-01-02 05:50...	2017-01-02 05:...	5000
12	TEXAS	Thunderstorm Wind	LEON	2017-01-02 05:58...	2017-01-02 05:...	0
13	TEXAS	Thunderstorm Wind	ELLIS	2017-01-02 05:10...	2017-01-02 05:...	15000
14	TEXAS	Thunderstorm Wind	LEON	2017-01-02 06:04...	2017-01-02 06:...	0

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Dates that Hurricane Harvey happened in between

I will asume that assume that Harvey related events occurred only from the 17th of August to the 3rd of September.

```
StormEvents2017finalProject = StormEvents2017finalProject( ...
    StormEvents2017finalProject.Begin_Date_Time >= datetime('2017-08-17 00:00:00') ...
    & StormEvents2017finalProject.End_Date_Time < datetime('2017-09-04 00:00:00') , :);
```

At the end we will get the following table

```
StormEvents2017finalProject
```

```
StormEvents2017finalProject = 573×10 table
```

	State	Event_Type	CZ_Name	Begin_Date_Time	End_Date_Time	Property_Cost
1	TEXAS	Tropical Storm	MONTGOMERY	2017-08-25 12:00...	2017-08-30 00:...	7.0000e+09
2	MISSISS...	Strong Wind	LOWNDES	2017-09-01 01:00...	2017-09-01 01:...	5000
3	NORTH C...	Flash Flood	WAKE	2017-09-01 17:35...	2017-09-01 18:...	0
4	NORTH C...	Flash Flood	CUMBERLAND	2017-09-01 19:20...	2017-09-01 21:...	0
5	NORTH C...	Hail	LEE	2017-09-01 15:20...	2017-09-01 15:...	0
6	TEXAS	Tropical Storm	FORT BEND	2017-08-26 00:00...	2017-08-30 00:...	8.0000e+09
7	NORTH C...	Hail	WAYNE	2017-09-01 13:50...	2017-09-01 14:...	0
8	NORTH C...	Thunderstorm Wind	RICHMOND	2017-09-01 13:35...	2017-09-01 13:...	500
9	NORTH C...	Thunderstorm Wind	WAYNE	2017-09-01 14:10...	2017-09-01 14:...	15000
10	NORTH C...	Thunderstorm Wind	LEE	2017-09-01 14:52...	2017-09-01 14:...	8000
11	NORTH C...	Thunderstorm Wind	LEE	2017-09-01 15:00...	2017-09-01 15:...	75000
12	TEXAS	Tropical Storm	GALVESTON	2017-08-25 12:00...	2017-08-30 00:...	1.0000e+10
13	TEXAS	Tropical Storm	SAN JACINTO	2017-08-25 12:00...	2017-08-30 00:...	350000000
14	NORTH C...	Thunderstorm Wind	HARNETT	2017-09-01 15:45...	2017-09-01 15:...	8000

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Two States Most Impacted by Harvey

Here we will find the two most states that have the heighest property cost

```
T = groupsummary(StormEvents2017finalProject, 'State', 'sum', 'Property_Cost'); % finding the t
T = sortrows(T, 'sum_Property_Cost', "descend") % sort the rows in a descending order according
```

T = 7×3 table

	State	GroupCount	sum_Property_Cost
1	TEXAS	272	7.7427e+10
2	LOUISIANA	85	75277000
3	NORTH C...	59	12338500
4	MISSISS...	39	915000
5	TENNESSEE	46	504000
6	KENTUCKY	20	435000
7	ARKANSAS	52	61000

```
T([1, 2], :) % display the first two rows
```

ans = 2×3 table

	State	GroupCount	sum_Property_Cost
1	TEXAS	272	7.7427e+10

	State	GroupCount	sum_Property_Cost
2	LOUISIANA	85	75277000

From here we can see that the two most impacted states are TEXAS and LOUISIANA.

Table of Events for Two Most Impacted States

Here we will create a table with only the rows which contains the states TEXAS and LOUISIANA and group them with the events most frequent

```
clearvars -except StormEvents2017finalProject % delete the variables T and ans
T = StormEvents2017finalProject(StormEvents2017finalProject.State == "TEXAS" ...
    | StormEvents2017finalProject.State == 'LOUISIANA', :);
T = groupsummary(T, "Event_Type");
T = sortrows(T, 'GroupCount', "descend");
T
```

T = 11×2 table

	Event_Type	GroupCount
1	Flash Flood	179
2	Tropical Storm	44
3	Tornado	33
4	Heat	30
5	Thunderstorm Wind	27
6	Flood	17
7	Storm Surge/Tide	10
8	Hurricane	9
9	Funnel Cloud	3
10	Hail	3
11	Heavy Rain	2

```
clear T
```

From the table above we can see that the events that impactes these states from most frequent to least frequent are:

1. Flash Flood
2. Tropical Storm
3. Tornado
4. Heat
5. Thunderstorm Wind
6. Flood
7. Strorm Surge
8. Hurricane

9. Funnel Cloud

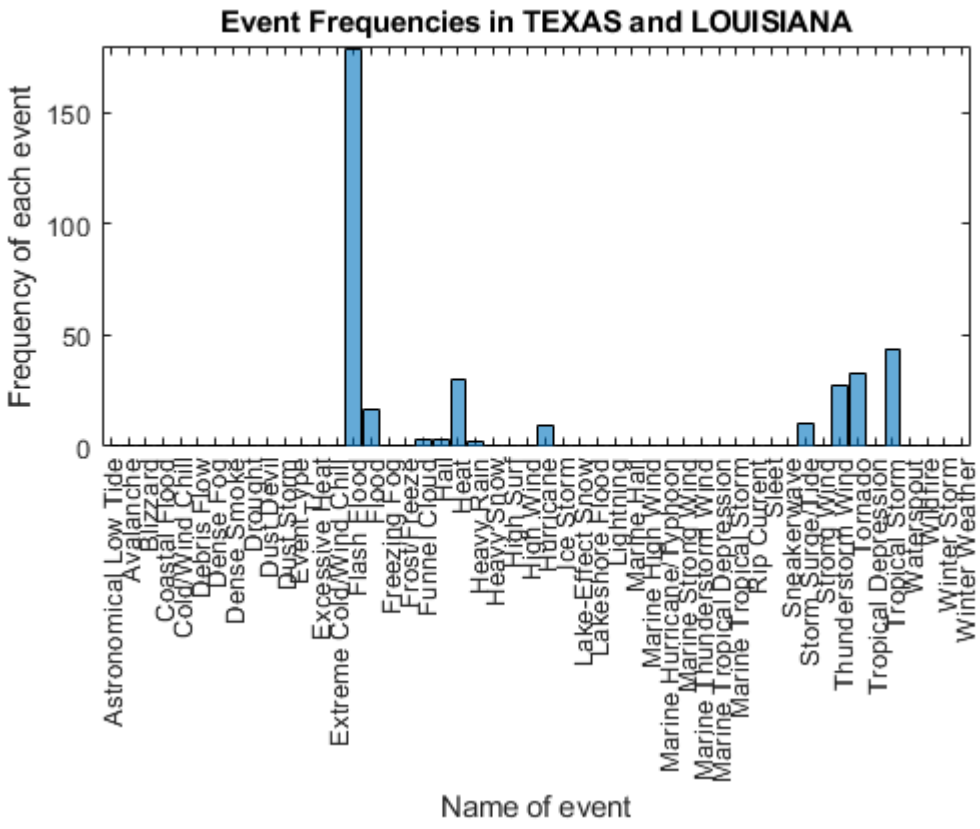
Visualizations

Figure of Event Types

First we will show a visualization for the event type and number of occurancies of events that occured in TEXAS and LOUISIANA.

TEXAS and LOUISIANA

```
T = StormEvents2017finalProject(StormEvents2017finalProject.State == "TEXAS" ...
    | StormEvents2017finalProject.State == 'LOUISIANA', :);
histogram(T.Event_Type)

title('Event Frequencies in TEXAS and LOUISIANA')
xlabel('Name of event')
ylabel('Frequency of each event')
```



Showing a table of frequencies to better interpret the data

```
T = groupsummary(T, 'Event_Type');
```

```
T = sortrows(T, 'GroupCount', 'descend');
T
```

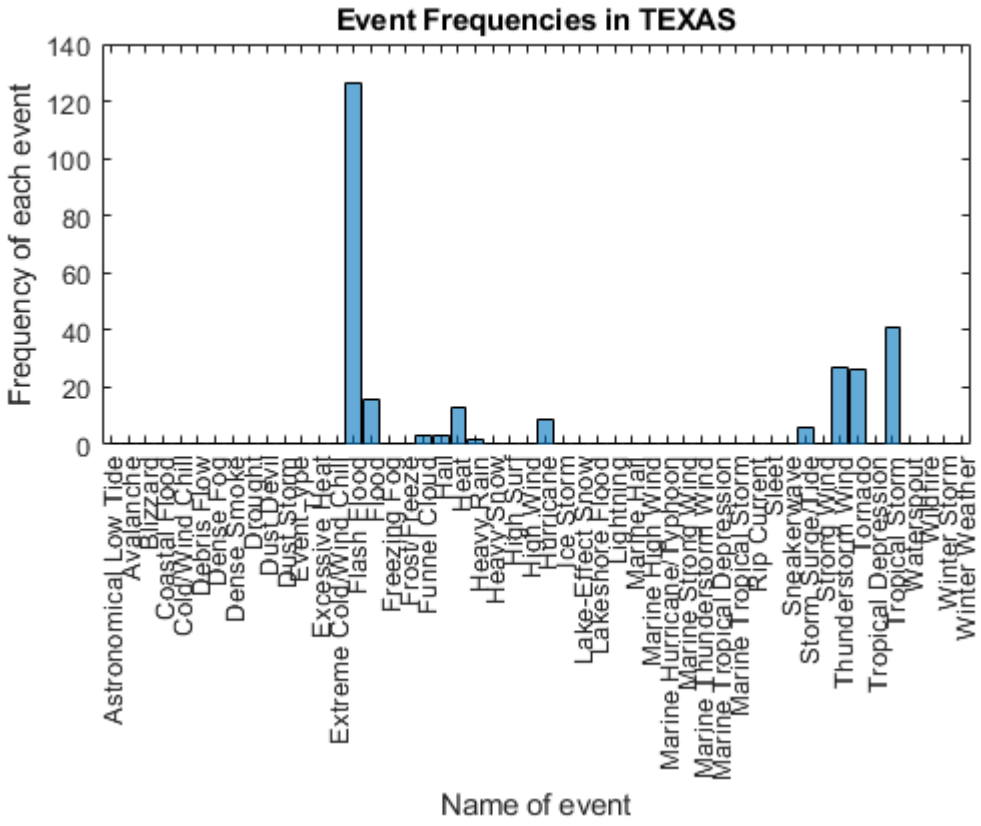
T = 11×2 table

	Event_Type	GroupCount
1	Flash Flood	179
2	Tropical Storm	44
3	Tornado	33
4	Heat	30
5	Thunderstorm Wind	27
6	Flood	17
7	Storm Surge/Tide	10
8	Hurricane	9
9	Funnel Cloud	3
10	Hail	3
11	Heavy Rain	2

TEXAS

TEXAS Histogram to show the frequencies

```
clear T
T = StormEvents2017finalProject(StormEvents2017finalProject.State == "TEXAS", :);
histogram(T.Event_Type)

title('Event Frequencies in TEXAS')
xlabel('Name of event')
ylabel('Frequency of each event')
```



Showing a table of frequencies to better interpret the data

```
T = groupsummary(T, 'Event_Type');
T = sortrows(T, 'GroupCount', 'descend');
T
```

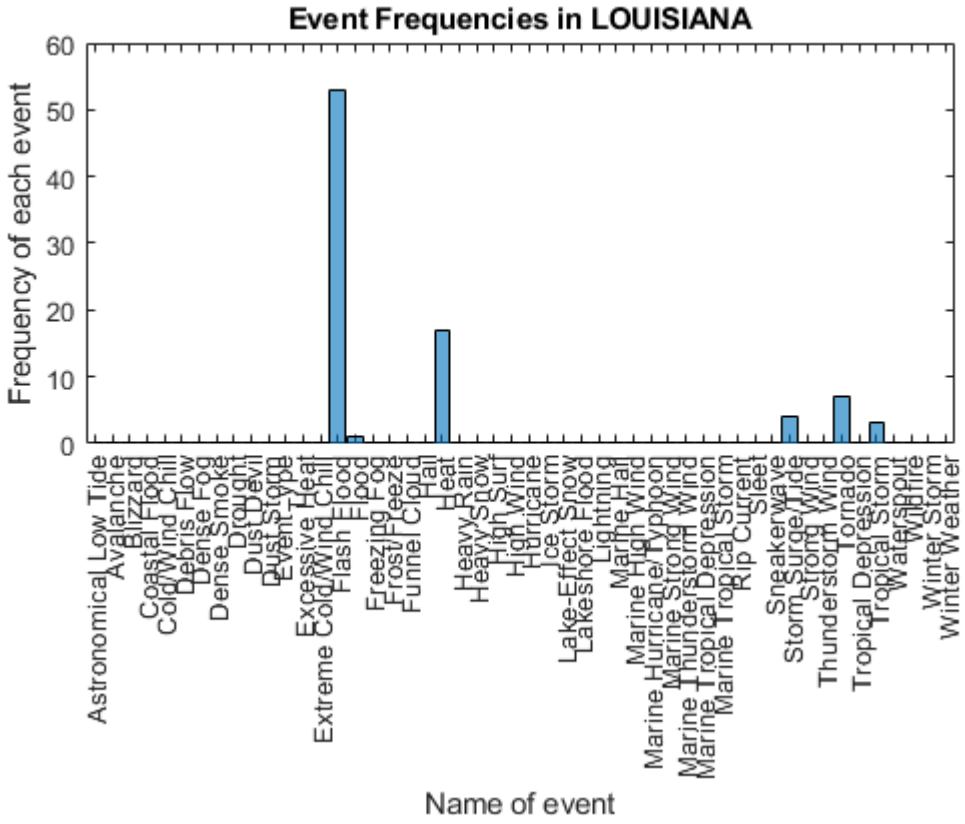
T = 11×2 table

	Event_Type	GroupCount
1	Flash Flood	126
2	Tropical Storm	41
3	Thunderstorm Wind	27
4	Tornado	26
5	Flood	16
6	Heat	13
7	Hurricane	9
8	Storm Surge/Tide	6
9	Funnel Cloud	3
10	Hail	3
11	Heavy Rain	2

LOUISIANA

LOUISIANA Histogram to show the frequencies

```
clear T
T = StormEvents2017finalProject(StormEvents2017finalProject.State == "LOUISIANA", :);
histogram(T.Event_Type)

title('Event Frequencies in LOUISIANA')
xlabel('Name of event')
ylabel('Frequency of each event')
```



Showing a table of frequencies to better interpret the data

```
T = groupsummary(T, 'Event_Type');
T = sortrows(T, 'GroupCount', 'descend');
T
```

T = 6×2 table

	Event_Type	GroupCount
1	Flash Flood	53
2	Heat	17
3	Tornado	7
4	Storm Surge/Tide	4

	Event_Type	GroupCount
5	Tropical Storm	3
6	Flood	1

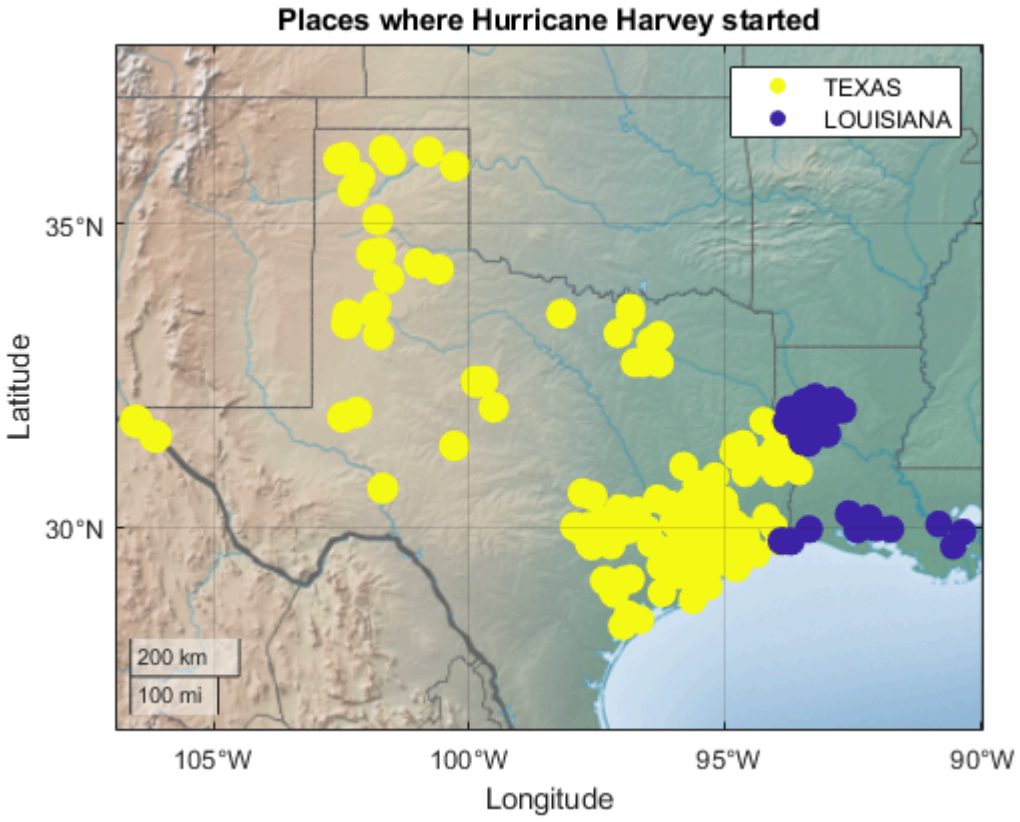
```
clear T
```

Figure of Event Locations

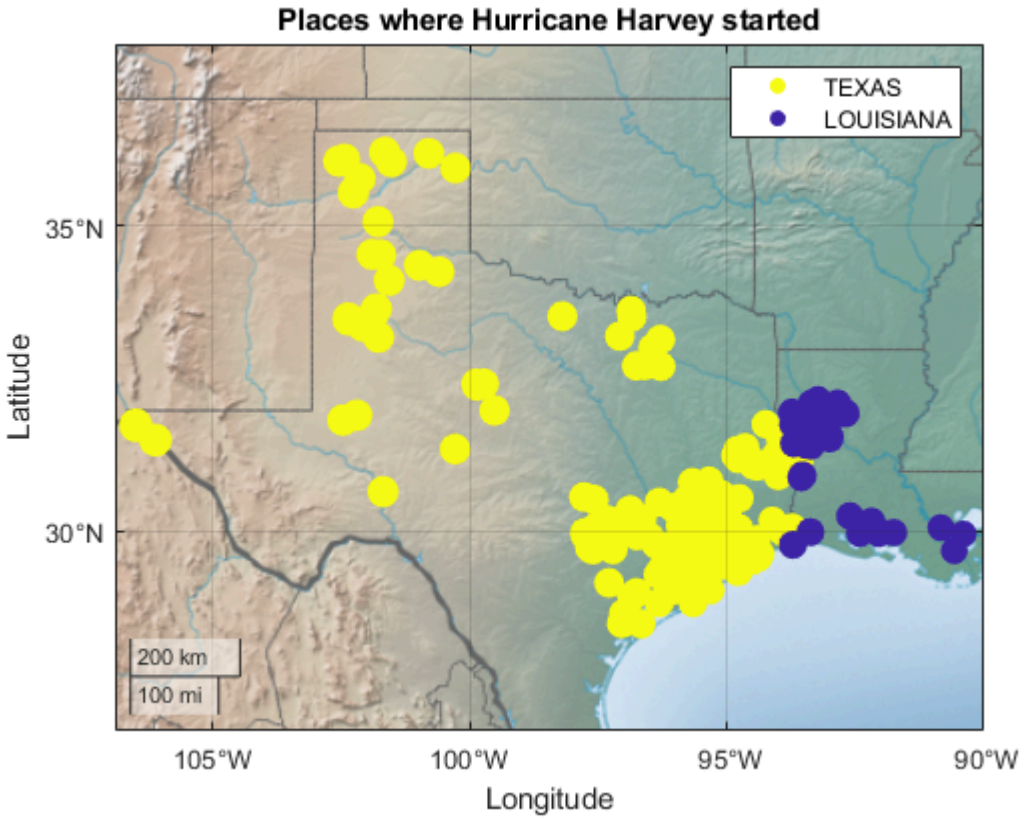
```
T = StormEvents2017finalProject(StormEvents2017finalProject.State == "TEXAS" ...
    | StormEvents2017finalProject.State == 'LOUISIANA', :);
T = T(~isnan(T.Begin_Lat), :);
T = T(~isnan(T.Begin_Lon), :);
T = T(~isnan(T.End_Lat), :);
T = T(~isnan(T.End_Lon), :);
```

To calculate the are of each marker I will use a calculation in one of the examples in the documentation

```
T.A_Begin = 101 + 100*(sind(2*T.Begin_Lon));
T.A_End = 101 + 100*(sind(2*T.End_Lon));

TEXAS = T(T.State == "TEXAS", :);
LOUISIANA = T(T.State == "LOUISIANA", :);

clear T

geoscatter(TEXAS.Begin_Lat,TEXAS.Begin_Lon, TEXAS.A_Begin, TEXAS.State, 'filled')
hold on
geoscatter(LOUISIANA.Begin_Lat,LOUISIANA.Begin_Lon, LOUISIANA.A_Begin, LOUISIANA.State, 'filled
hold off
title('Places where Hurricane Harvey started')
legend('TEXAS', 'LOUISIANA')
geobasemap colorterrain
```




```
geoscatter(TEXAS.End_Lat,TEXAS.End_Lon, TEXAS.A_End, TEXAS.State, 'filled')
hold on
geoscatter(LOUISIANA.End_Lat,LOUISIANA.End_Lon, LOUISIANA.A_End, LOUISIANA.State, 'filled')
hold off
title('Places where Hurricane Harvey started')
legend('TEXAS', 'LOUISIANA')
geobasemap colorterrain
```




```
clear TEXAS
clear LOUISIANA
```

Analysis

Three Counties with Most Events in TEXAS

Table of the Three Counties with Most Events

```
T = StormEvents2017finalProject(StormEvents2017finalProject.State == 'TEXAS', :);
T = groupsummary(T, 'CZ_Name');
T = sortrows(T, 'GroupCount', 'descend')
```

T = 95×2 table

	CZ_Name	GroupCount
1	HARRIS	21
2	GALVESTON	17
3	FORT BEND	13
4	ANGELINA	12
5	BRAZORIA	12
6	SABINE	12
7	BASTROP	9

	CZ_Name	GroupCount
8	CHAMBERS	8
9	CALDWELL	7
10	MONTGOMERY	6
11	MATAGORDA	5
12	WHARTON	5
13	CALHOUN	4
14	FAYETTE	4

⋮

```
T = T([1, 2, 3], :);
T
```

T = 3×2 table

	CZ_Name	GroupCount
1	HARRIS	21
2	GALVESTON	17
3	FORT BEND	13

```
clear T
```

Three Counties with Most Events in LOUISIANA

Table of the Three Counties with Most Events

```
T = StormEvents2017finalProject(StormEvents2017finalProject.State == 'LOUISIANA', :);
T = groupsummary(T, 'CZ_Name');
T = sortrows(T, 'GroupCount', 'descend')
```

T = 30×2 table

	CZ_Name	GroupCount
1	NATCHITOC...	21
2	SABINE	15
3	RED RIVER	9
4	WINN	6
5	VERMILION	4
6	CAMERON	3
7	DE SOTO	3
8	UNION	2
9	ACADIA	1
10	BEAUREGARD	1

	CZ_Name	GroupCount
11	BIENVILLE	1
12	BOSSIER	1
13	CADDO	1
14	CALCASIEU	1

⋮

```
T = T([1, 2, 3], :);
T
```

T = 3×2 table

	CZ_Name	GroupCount
1	NATCHITOC...	21
2	SABINE	15
3	RED RIVER	9

```
clear T
```

Three Counties with Highest Property Cost in TEXAS

Table of the Three Counties with Highest Property Cost

```
T = StormEvents2017finalProject(StormEvents2017finalProject.State == 'TEXAS', :);
T = groupsummary(T, 'CZ_Name', 'sum', 'Property_Cost');
T = sortrows(T, 'sum_Property_Cost', 'descend')
```

T = 95×3 table

	CZ_Name	GroupCount	sum_Property_Cost
1	GALVESTON	17	2.0000e+10
2	FORT BEND	13	1.6004e+10
3	MONTGOMERY	6	1.4000e+10
4	HARRIS	21	1.0001e+10
5	JEFFERSON	4	3.0000e+09
6	BRAZORIA	12	2.0008e+09
7	ARANSAS	2	1.9500e+09
8	ORANGE	2	1.5000e+09
9	NUECES	2	1.3000e+09
10	WALKER	4	1.2000e+09
11	LIBERTY	4	1.0000e+09
12	SAN JACINTO	3	700000000
13	HARDIN	1	600000000

	CZ_Name	GroupCount	sum_Property_Cost
14	POLK	2	600000000

⋮

```
T = T([1, 2, 3], :);
T
```

T = 3×3 table

	CZ_Name	GroupCount	sum_Property_Cost
1	GALVESTON	17	2.0000e+10
2	FORT BEND	13	1.6004e+10
3	MONTGOMERY	6	1.4000e+10

```
clear T
```

Three Counties with Highest Property Cost in LOUISIANA

Table of the Three Counties with Highest Property Cost

```
T = StormEvents2017finalProject(StormEvents2017finalProject.State == 'LOUISIANA', :);
T = groupsummary(T, 'CZ_Name', 'sum', 'Property_Cost');
T = sortrows(T, 'sum_Property_Cost', 'descend')
```

T = 30×3 table

	CZ_Name	GroupCount	sum_Property_Cost
1	CALCASIEU	1	60000000
2	BEAUREGARD	1	15000000
3	ACADIA	1	200000
4	CAMERON	3	72000
5	VERMILION	4	5000
6	BIENVILLE	1	0
7	BOSSIER	1	0
8	CADDO	1	0
9	CALDWELL	1	0
10	CLAIBORNE	1	0
11	DE SOTO	3	0
12	EAST CAME...	1	0
13	GRANT	1	0
14	IBERIA	1	0

```
T = T([1, 2, 3], :);
T
```

T = 3×3 table

	CZ_Name	GroupCount	sum_Property_Cost
1	CALCASIEU	1	60000000
2	BEAUREGARD	1	15000000
3	ACADIA	1	200000

```
clear T
```

Conclusions and Recommendations

Recommendations

If the people effected by the hurricane agreed to go to a different state then they should be sent to any state not in this table.

If the people did not agree to go to a different state then they should go to any countie not in this table if they are from TEXAS if it existed.

If the people did not agree to go to a different state then they should go to any countie not in this table if they are from LOUISIANA if it existed.

```
clear StormEvents2017finalProject
```