Allocating Resources After Hurricane Harvey

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Background and Scope

This report is generated to help an insurance company to decide where to send outside contractors to assist claim adjusters in the aftermath of the Hurricane Harvey.

Import the Data

After importing the storm events data file through a MATLAB generated import function called "importStormFile", I have filtered the data to only states which were directly affected by Hurricane Harvey. Some of these states are **Arkansas, Kentucky, Louisiana, Mississipi, North Carolina, Tennessee, and Texas.**

```
StormEvents_2017 = importStormFile("StormEvents_2017_finalProject.csv");
Harvey = StormEvents_2017(ismember(StormEvents_2017.State,{'ARKANSAS','KENTUCKY', ...
    'LOUISIANA','MISSISSIPPI','NORTH CAROLINA','TENNESSEE','TEXAS','ALABAMA', ...
    'FLORIDA','GEORGIA','SOUTH CAROLINA'}),:);
```

Since Hurricane Harvey related events occured only from the 17th of August to the 3rd of September, So we are analysing the data between these two dates, as shown in the Table.

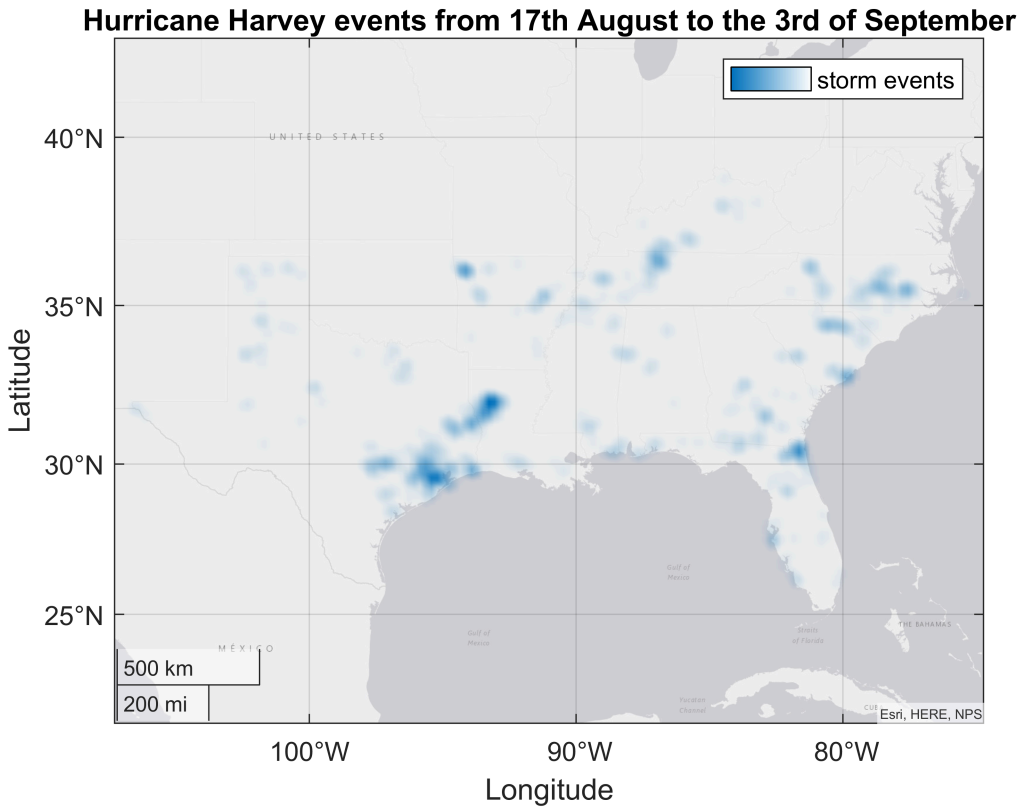
```
Harvey = Harvey(ismember(Harvey.Month,{'August','September'}),:);
Harvey = sortrows(Harvey,'Begin_Date_Time');

Harvey = Harvey(Harvey.Begin_Date_Time >= '17-Aug-17 00:00:00' & ...
    Harvey.Begin_Date_Time <= '03-Sep-17 00:00:01',:);
Harvey(1:5:30,3:1:9)
```

```
ans = 6×7 table
```

	State	Year	Month	Event_Type	CZ_Name	Begin_Date_Time	Timezone
1	TEXAS	2017	August	Flash Flood	GRAYSON	17-Aug-17 04:30:00	-6
2	TEXAS	2017	August	Flash Flood	DALLAS	17-Aug-17 06:50:00	-6
3	KENTUCKY	2017	August	Thunderstorm Wind	PENDLETON	17-Aug-17 14:54:00	-5
4	NORTH CA...	2017	August	Thunderstorm Wind	WILKES	17-Aug-17 18:28:00	-5
5	NORTH CA...	2017	August	Thunderstorm Wind	WILKES	17-Aug-17 18:53:00	-5
6	TEXAS	2017	August	Thunderstorm Wind	HEMPHILL	17-Aug-17 23:18:00	-6

The storm events from 17th August to the 3rd of September can be seen in the following geodensity plot.

```
geodensityplot(Harvey.Begin_Lat,Harvey.Begin_Lon)
legend('storm events')
title("Hurricane Harvey events from 17th August to the 3rd of September")
```



Two States Most Impacted by Harvey

The two states most impacted by Hurricane Harvey in term of total Property Cost estimated. 275 and 86 storm events occured in the states of Texas and Louisiana, respectively. Sum of property cost in these two states are $77427 Millions and $75.277 Millions for the states of Texas and Louisiana, respectively.

```
total_cost=groupsummary(Harvey,"State","sum","Property_Cost");
total_cost = sortrows(total_cost,'sum_Property_Cost','descend');
Impacted_states=total_cost(1:2,:)
```

Impacted_states = 2×3 table

	State	GroupCount	sum_Property_Cost
1	TEXAS	275	7.7427e+10
2	LOUISIANA	86	75277000

Table of Events for Two Most Impacted States

Few rows of the table of two most impacted states are shown below. This table includes only the states of Texas and Louisiana.

```
two_states = Harvey(ismember(Harvey.State,{'LOUISIANA','TEXAS'}),:);
two_states = sortrows(two_states,'Deaths_Direct','descend');
head(two_states)
```

ans = 8×24 table

...

	EpisodeID	Event_ID	State	Year	Month	Event_Type	CZ_Name
1	119753	720861	TEXAS	2017	August	Flash Flood	HARRIS
2	119746	719489	TEXAS	2017	August	Flash Flood	ORANGE
3	119746	719342	TEXAS	2017	August	Flash Flood	JEFFERSON
4	119753	723472	TEXAS	2017	August	Tropical Storm	MONTGOMERY
5	119753	723449	TEXAS	2017	August	Tropical Storm	GALVESTON
6	119753	723474	TEXAS	2017	August	Tropical Storm	SAN JACINTO
7	119753	723473	TEXAS	2017	August	Tropical Storm	FORT BEND
8	119753	720852	TEXAS	2017	August	Flash Flood	FORT BEND

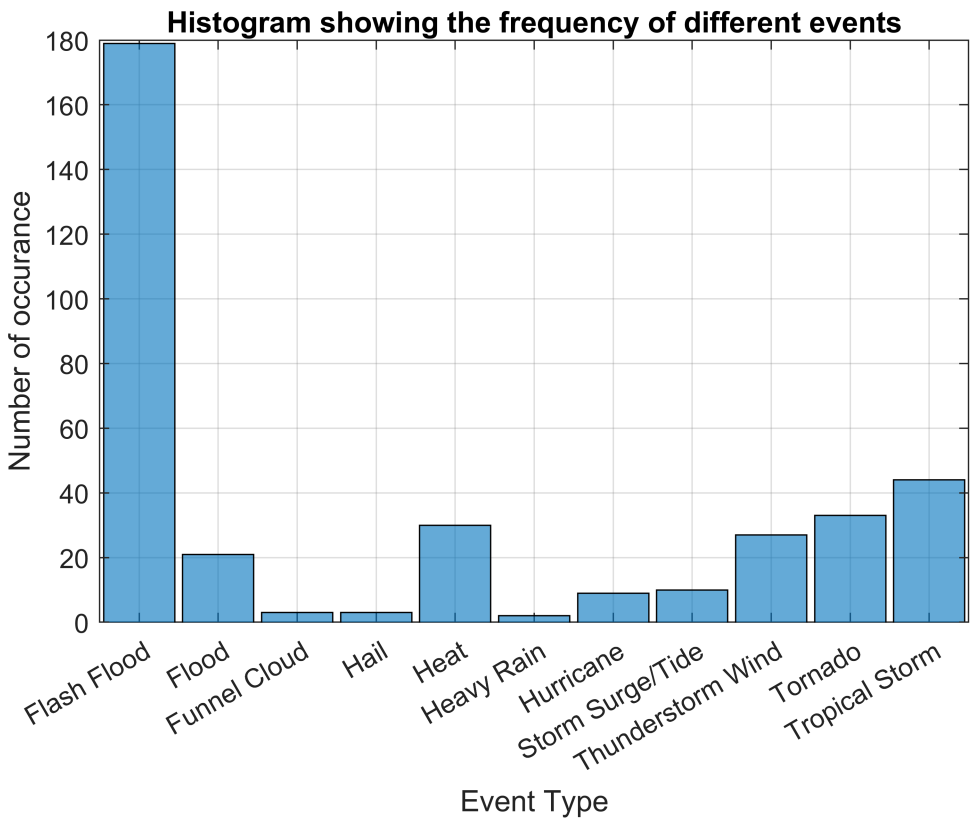
Visualizations

Figure of Event Types

The following Histogram shows the different types of events occured during hurricane Harvey in the most impacted states of Texas and Louisiana. The most frequent event was Flash Floods which occured 179 times.

```
%filtering the event types which didn't occure, or their frequency is 0.
two_states.Event_Type = removecats(two_states.Event_Type);
histogram(two_states.Event_Type)
grid on
title('Histogram showing the frequency of different events')
xlabel('Event Type')
```

```
ylabel('Number of occurance')
```



The following heatmap shows count of Event types vs States of Texas and Louisiana.

```
two_states.State=removecats(two_states.State);
heatmap(two_states,"State","Event_Type")
```

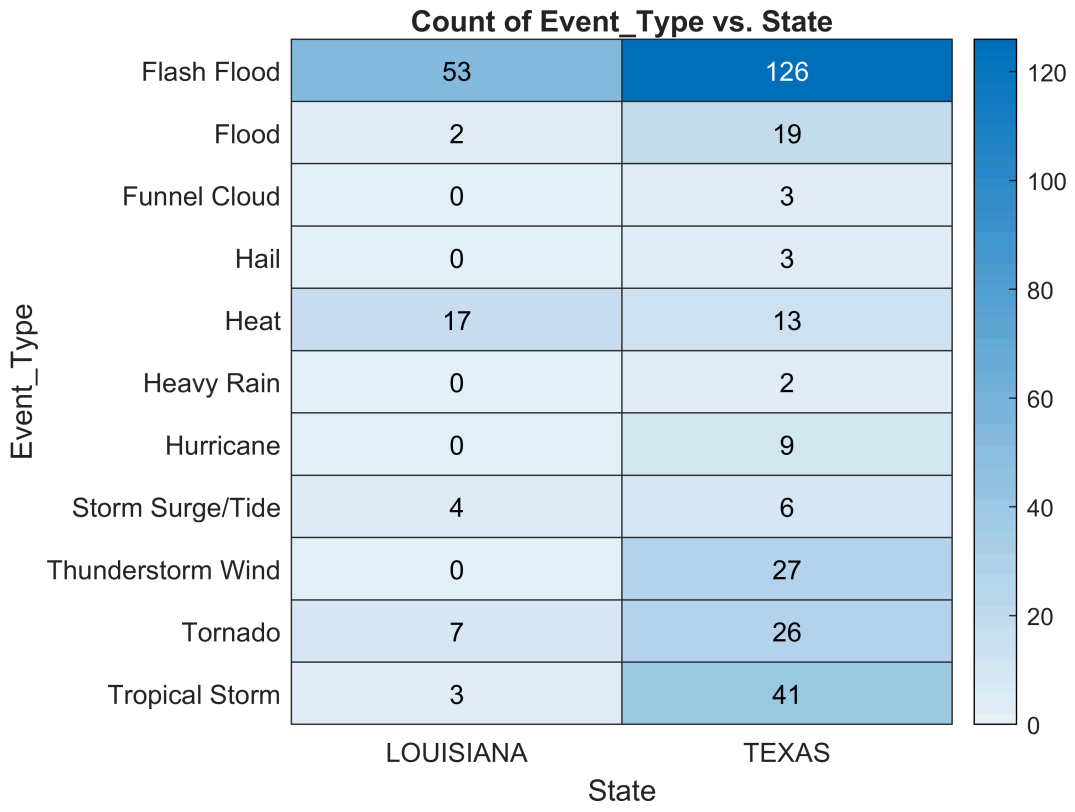
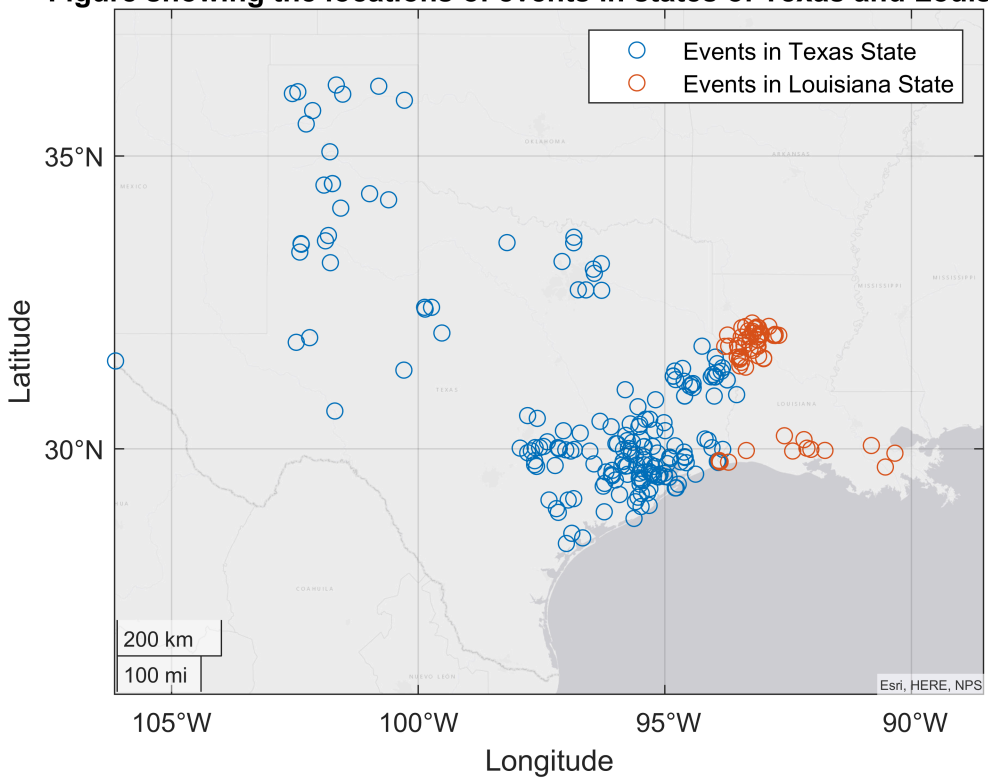


Figure of Event Locations

following is the geocatter plot to show the storm event locations in the states of Texas and Louisiana.

```
texas=two_states.State=="TEXAS";
geoscatter(two_states.Begin_Lat(texas),two_states.Begin_Lon(texas))
geolimits([25.6 37.4],[-106.09 -88.60])

hold on
lsiana=two_states.State=="LOUISIANA";
geoscatter(two_states.Begin_Lat(lsiana),two_states.Begin_Lon(lsiana))
legend({'Events in Texas State','Events in Louisiana State'})
hold off

title('Figure showing the locations of events in states of Texas and Louisiana')
```

Figure showing the locations of events in states of Texas and Louisiana



Analysis

Three Counties with Most Events in Texas State

The three counties with most events in Texas are shown in following table. The county **Harris** had the largest number of events which is 21.

```
state_1 = two_states(two_states.State == 'TEXAS',:);
state1_3count=groupcounts(state_1,"CZ_Name");
state1_3count = sortrows(state1_3count,'GroupCount','descend');
state1_3count=state1_3count(1:3,:)
```

```
state1_3count = 3×2 table
```

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

Three Counties with Most Events in Louisiana State

Natchitoches, Sabine and Red River are the counties with the most events in the state of Louisiana.

```
state_2 = two_states(two_states.State == 'LOUISIANA',:);
state2_3count=groupcounts(state_2,"CZ_Name");
state2_3count = sortrows(state2_3count,'GroupCount','descend');
state2_3count=state2_3count(1:3,:)
```

state2_3count = 3×2 table

	CZ_Name	GroupCount
1	NATCHITOCHES	21
2	SABINE	15
3	RED RIVER	9

Three Counties with Highest Property Cost in Texas State

The following table shows 3 counties with highest property cost in the Texas state. These counties are Galveston, Fort Bend and Montgomery with property cost of $20, $16.004 and $14 Billions, respectively. It is assumed that these costs are estimates from models.

```
Hproperty_s1=groupsummary(state_1,"CZ_Name","sum","Property_Cost");
Hproperty_s1 = sortrows(Hproperty_s1,'sum_Property_Cost','descend');
Hprop_s1c3=Hproperty_s1(1:3,:)
```

Hprop_s1c3 = 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

Three Counties with Highest Property Cost in Louisiana State

The following table shows 3 counties with highest property cost in the Louisiana state. These counties are Calcasieu, Beauregard and Acadia with property cost of $60, $15 and $0.2 Millions, respectively. It is assumed that these costs are estimates from models.

```
Hproperty_s2=groupsummary(state_2,"CZ_Name","sum","Property_Cost");
Hproperty_s2 = sortrows(Hproperty_s2,'sum_Property_Cost','descend');
Hprop_s2c3=Hproperty_s2(1:3,:)
```

Hprop_s2c3 = 3×3 table

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

Conclusions and Recommendations

Texas State

After analyzing the storm data, we know that the state of Texas is the most affected. a total of 275 events occured in the state during the hurricane Harvey. The number and Types of event can be seen in histogram in the visualization section. Most of the events occured in the Harris, Galveston, and Fort Bend counties.
In terms of property cost, Texas state has a property cost of around $77 billion. Galveston, Fort Bend, and Montgomery are the three counties in the Texas state with the highest property cost of $20, $16.004, and $14 Billion, respectively.

Louisiana State

The second most impacted state is the state of Louisiana. around 86 events occured in this state. Most of the events occured in the Natchitoches, Sabine, and Red River counties.In terms of property cost, this state has a property cost of around $75 million. Calcasieu, Beauregard, and Acadia are the three counties in the Louisiana state with the highest property cost of $60, $15, and $0.2 Million, respectively.

Recommendations

It is recommended that the priority for the insurance company should be the states of Texas and Louisiana, with the state of Texas at the top. The company should send most of outside contractors to the Texas state with the priority in the counties of Galveston, Fort Bend, and Montgomery. For the state of Louisiana, the company should send outside contractors to the counties of Calcasieu, Beauregard, and Acadia.