Allocating Resources after Hurricane Harvey

(in progress)

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Background and Scope

The data file contains a list of weather events that occurred in the United States in 2017. The events have been categorized by type and the state in which they occurred. There is also information about

• damage costs

• number of resulting injuries

• location of some of the events

Import the Data

```
clear
% import the data using a function generated by the Import Tool
events = import2017stormdata("StormEvents_2017_finalProject.csv");
```

Cleaning the data

Some Property Costs and Crop Costs are missing, with the value NaN. Replacing the missing data with $0 makes the data easier to work with. Since the insurance company is interested in the total damage cost, the property and crop costs can be added together. The data file contains many more weather events than the ones pertaining to Hurricane Harvey, so the results were filtered to show only the states that Harvey passed through.

```
% Set missing Property and Crop Cost to $0
events.Property_Cost(ismissing(events.Property_Cost)) = 0;
events.Crop_Cost(ismissing(events.Crop_Cost)) = 0;
% Add total damage to the table
events.Total_Damage = events.Property_Cost + events.Crop_Cost;
% Filter to Harvey-relevant States
harveystates = events(events.State =='TEXAS'|events.State == 'ARKANSAS' | events.State == 'KENT
```

Next, Harvey-related events lasted from August 17th to September 3rd.

```
% Filter to correct timeframe
harveydays = harveystates(isbetween(harveystates.Begin_Date_Time, '2017-08-17', '2017-09-03'),

% Hard remove states and event types that do not appear in the filtered
% table, so they do not affect later figures
harveydays.State = removecats(harveydays.State);
harveydays.Event_Type = removecats(harveydays.Event_Type);
```

Are all the events in this filtered table Harvey-related?

```
groupsummary(harveydays, "Event_Type")
```

ans = 12×2 table

|	Event_Type	GroupCount
1	Flash Flood	222
2	Flood	24
3	Funnel Cloud	3
4	Hail	12
5	Heat	47
6	Heavy Rain	10
7	Hurricane	9
8	Storm Surge/Tide	10
9	Strong Wind	12
10	Thunderstorm Wind	47
11	Tornado	40
12	Tropical Storm	44

Most of the categories above are hurricane-related, but "Heat" is most likely unrelated. (Checking the dates and locations on those events confirm that these heat events happened while Harvey was not in the area.)

```
% Remove heat from table
harveydays = harveydays(harveydays.Event_Type ~= 'Heat',:);
```

Two States Most Impacted by Harvey

```
% Group Total Damage Costs by State
   statecost = groupsummary(harveydays, "State", "sum", "Total_Damage");
% Order states by descending order of costs
   [S_Sorted,idx1] = sort(statecost.sum_Total_Damage,'descend');
   statecost.State = categorical(statecost.State(idx1));
   statecost.State = reordercats(statecost.State,string(statecost.State));
% View the results using a bar chart
   bar(statecost.State,S_Sorted);
% For better viewing, set y-axis to logarithmic scale
   set(gca,'YScale','log');
   title("Total damage cost by state")
```

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```
xlabel("State")
ylabel("Cost in dollars")
```

Total damage cost by state
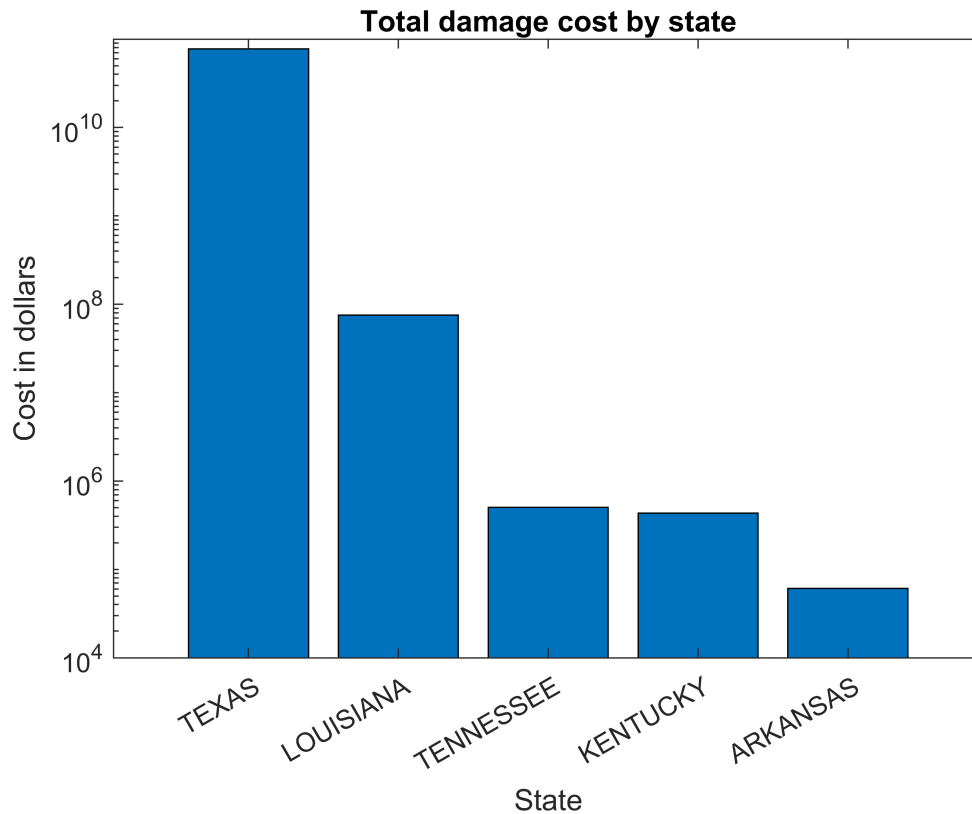
The two most impacted states were Texas and Louisiana!

Table of Events for Two Most Impacted States

```
txla = harveydays(harveydays.State == 'TEXAS'| harveydays.State == "LOUISIANA",:);
head(txla,25)
```
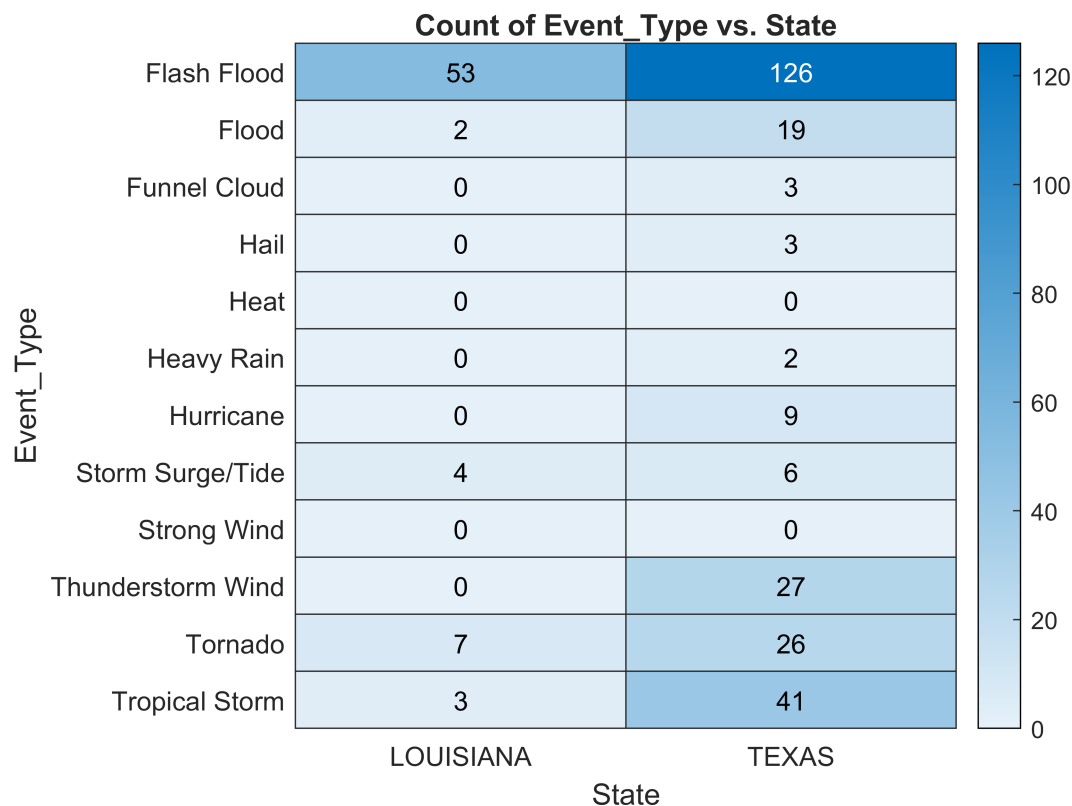
ans = 25×25 table

...

	EpisodeID	Event_ID	State	Year	Month	Event_Type	CZ_Name
1	119753	723472	TEXAS	2017	August	Tropical Storm	MONTGOMERY
2	119753	723473	TEXAS	2017	August	Tropical Storm	FORT BEND
3	119753	723449	TEXAS	2017	August	Tropical Storm	GALVESTON
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

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	EpisodeID	Event_ID	State	Year	Month	Event_Type	CZ_Name
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	119826	718436	TEXAS	2017	August	Thunderstorm Wind	MIDLAND
15	117836	708282	TEXAS	2017	August	Thunderstorm Wind	BRISCOE
16	119746	719740	TEXAS	2017	August	Thunderstorm Wind	JASPER
17	119746	720010	TEXAS	2017	August	Flood	ORANGE
18	119753	720464	TEXAS	2017	August	Flash Flood	MONTGOMERY
19	119853	718515	TEXAS	2017	August	Thunderstorm Wind	ECTOR
20	119746	719342	TEXAS	2017	August	Flash Flood	JEFFERSON
21	119753	720344	TEXAS	2017	August	Flash Flood	GALVESTON
22	118032	709519	TEXAS	2017	August	Thunderstorm Wind	SWISHER
23	118916	714375	LOUISIANA	2017	August	Tropical Storm	SABINE
24	118330	711050	TEXAS	2017	August	Flash Flood	ANGELINA
25	118330	711054	TEXAS	2017	August	Flash Flood	ANGELINA

Visualizations *(in progress)*

Figure of Event Types

```
topstates = harveydays(harveydays.State =='TEXAS'|harveydays.State == 'LOUISIANA',:);
topstates.State = removecats(topstates.State);
heatmap(topstates,"State","Event_Type")
```

Count of Event_Type vs. State

Event_Type	LOUISIANA	TEXAS
Flash Flood	53	126
Flood	2	19
Funnel Cloud	0	3
Hail	0	3
Heat	0	0
Heavy Rain	0	2
Hurricane	0	9
Storm Surge/Tide	4	6
Strong Wind	0	0
Thunderstorm Wind	0	27
Tornado	7	26
Tropical Storm	3	41

Flash flooding was the most frequent in both states, especially in Texas.

Analysis

Three Counties with Most Events in State 1

Texas and Louisiana had the most damage costs. Which specific counties were most affected?

```
% Texas events only
topstate1 = harveydays(harveydays.State =='TEXAS',:);
% remove empty categories
topstate1.CZ_Name = removecats(topstate1.CZ_Name);
% Group Total Damage Costs by County
txevents = groupsummary(topstate1, "CZ_Name", "sum", "Total_Damage");
% Order counties by number of events
txevents = sortrows(txevents,'GroupCount','descend');
head(txevents,3)
```

ans = 3×3 table

	CZ_Name	GroupCount	sum_Total_Damage
1	HARRIS	20	1.0001e+10
2	GALVESTON	17	2.0000e+10
3	FORT BEND	13	1.6004e+10

Harris, Galveston, and Fort Bend Counties had the most recorded events.

Three Counties with Highest Damage Cost in State 1

Using the same table, but reordering the rows, it can be seen that the most affected areas cost-wise are Galveston, Fort Bend, and Montgomery Counties.

```matlab
% Order counties by damage cost
txcountycost = sortrows(txcountycost,'sum_Total_Damage','descend');
head(txcountycost,3)
```

ans = 3×3 table

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