Data Visualization Project - Disasters in USA

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Introduction

FEMA Disaster Declarations Summary is a summarized dataset describing all federally declared disasters in the USA. This dataset lists all official FEMA Disaster Declarations, beginning with the first disaster declaration in 1953 and features all three disaster declaration types: major disaster, emergency, and fire management assistance. The dataset includes declared recovery programs and geographic areas that were affected by the disaster.

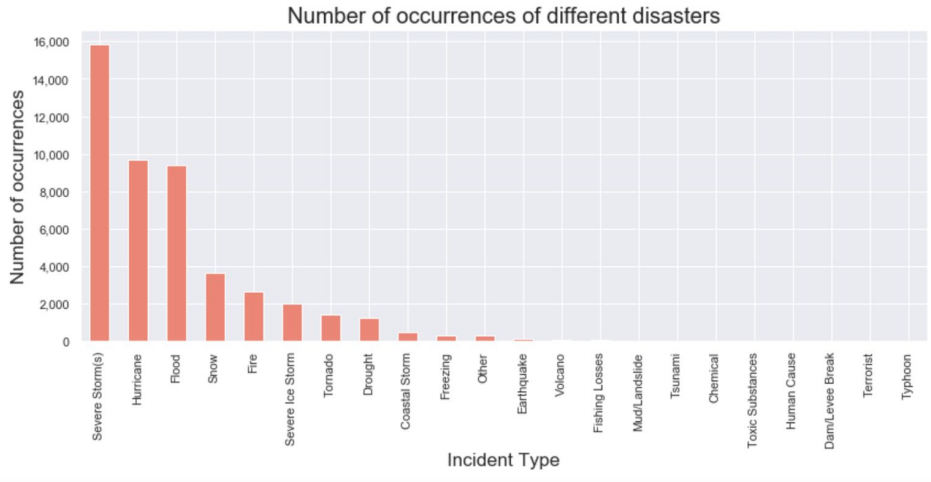
The dataset is made available by FEMA (Federal Emergency Management Agency), which is an agency of the United States Department of Homeland Security and its mission is to support the citizens and first responders to promote that as a nation we work together to build, sustain, and improve the capability to prepare for, protect against, respond to, recover from, and mitigate all hazards.
The dataset is available here: https://www.fema.gov/openfema-dataset-disaster-declarations-summaries-v1

According to The Economist, the number of weather-related natural disasters increased significantly since 1970 [1], whereas based on data compiled by Munich Re, the costs and magnitude of the hydrological phenomenon have grown by more than 600% since 1980 [2]. Natural disasters differ in type, magnitude, and amount of damage that can affect global economic indicators. For example, the 2011 tsunami and the subsequent earthquake resulted in a 3% reduction in Japan's economic output, which affected global economies due to Japan's prominence in global supply chains and manufacturing [3]. In the U.S., Hurricanes Harvey, Irving, and Irma, along with wildfires and other smaller disasters, resulted in $306 billion in damages over several years, shaking financial Markets [4]. Hence it is important to understand the patterns in disaster occurrences, their frequency and identify states and regions who are most likely to get affected. This motivated me to choose this dataset.

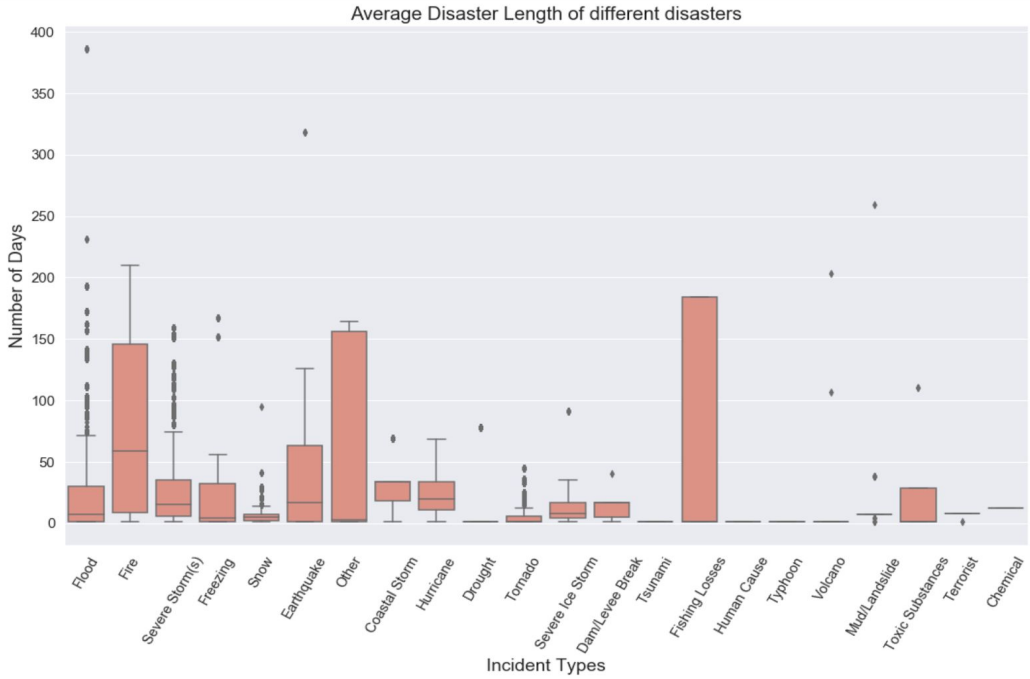
The key questions we are trying to answer here are if disasters are increasingly becoming frequent over time. We want to identify states that constantly face disaster threats, duration of such disasters and understand deeper into the pattern of occurrence. Also, we want to assess the magnitude of relief programs provided by federal and state authorities to help overcome these disasters.

Summary of Data

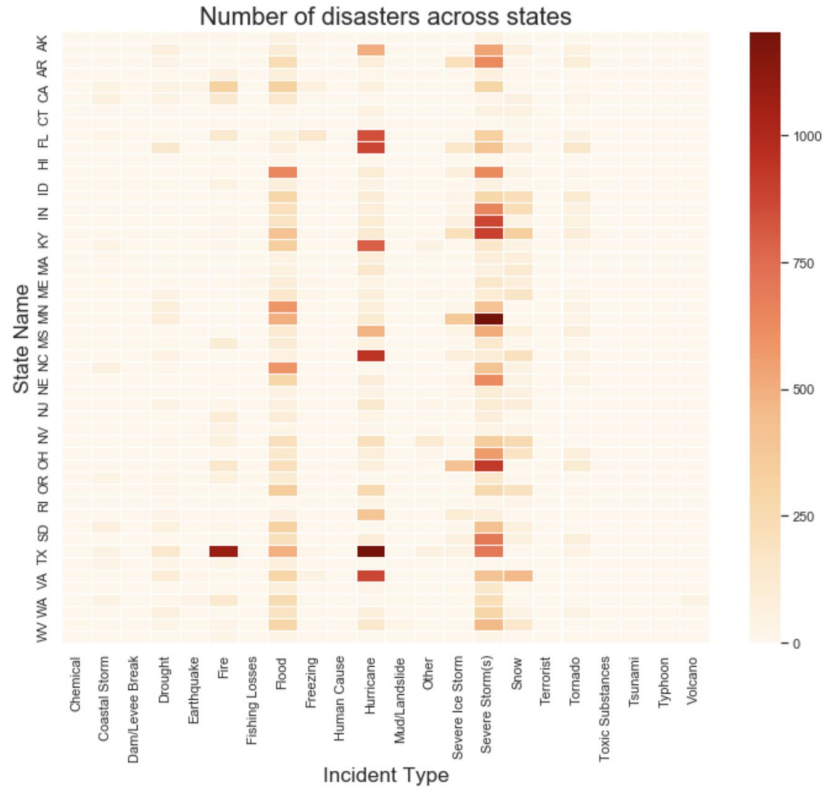
From the data, we can look into the total occurrences of different types of disasters (or incidents), and observed that storms, hurricanes, and floods occur very frequently.



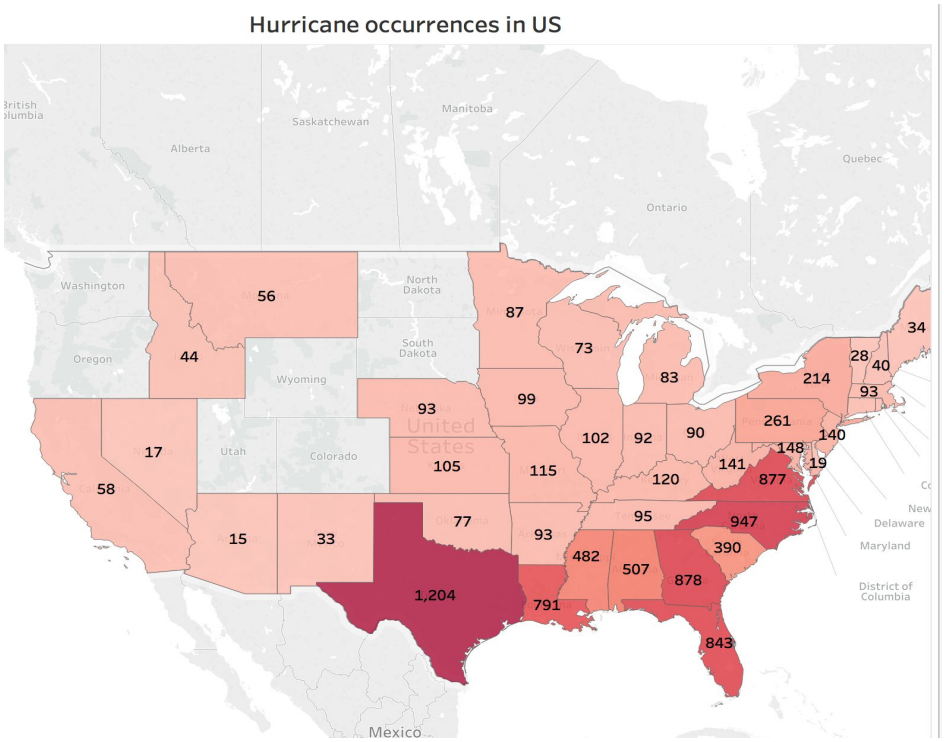
Also, we can understand how many days on average does a disaster (or incident) effect lasts, with disasters like Fire, Fishing Loses, and Earthquakes causing damage lasting longer than others.



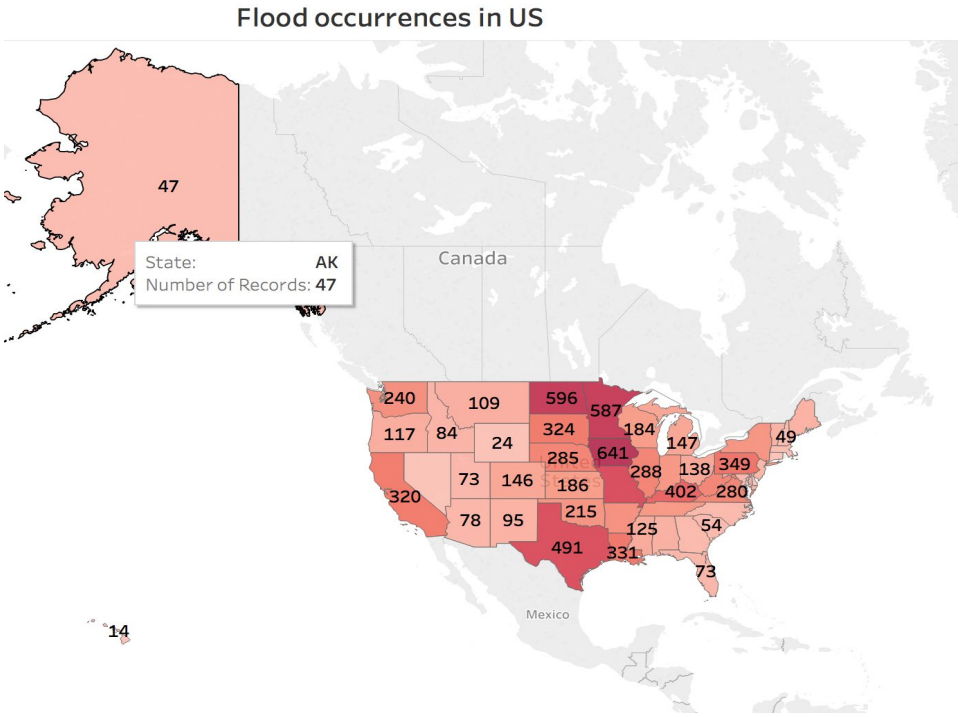
From the data, we can also get a view of which states are most affected by disasters and deep dive on the type of disasters affecting that state. We can see that Texas is affected by hurricanes and fires, Virginia by hurricanes and Minnesota by Severe Storms.



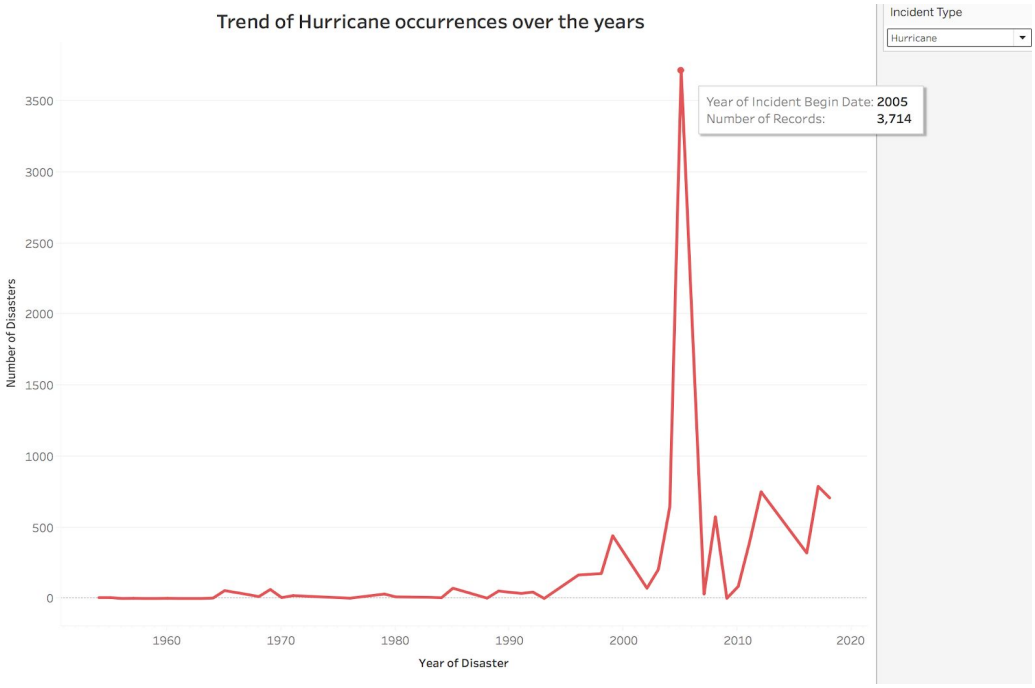
Using an interactive plot wherein we can select the type of disaster and understand the states most affected by it - states like Texas, Virginia, North Carolina are most affected by hurricane occurrences.



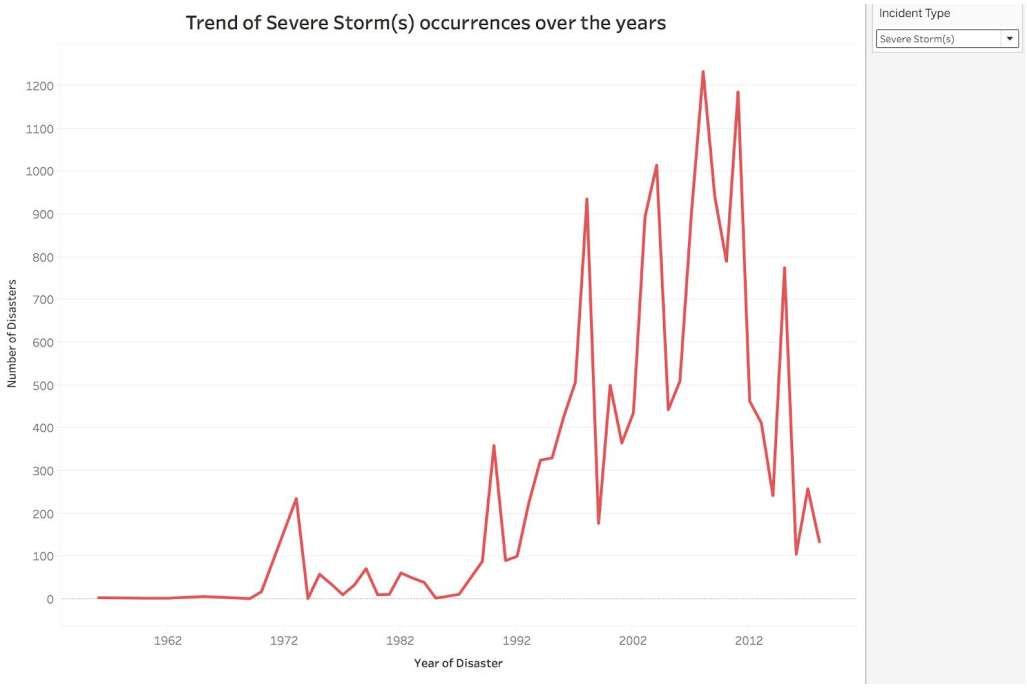
Almost all states are affected by flooding, with the Minnesota, Iowa and North Dakota facing the maximum brunt



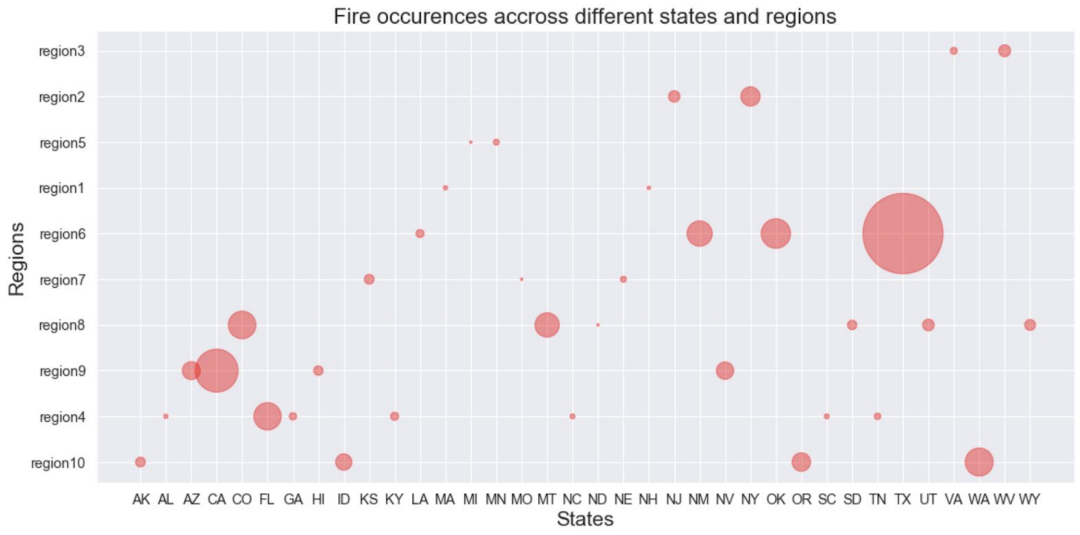
Using an interactive plot to understand the temporal trend of different disasters, we can gauge how frequent/infrequent disasters are becoming in recent times. We can observe that the peak in hurricane activity was in 2005 when four hurricanes - Dennis, Katrina, Rita, and Wilma caused significant amounts of damage in the US.



From the trend of severe storms, we see that there is an increasing trend in occurrences in recent times, a direct effect of increasing global warming.

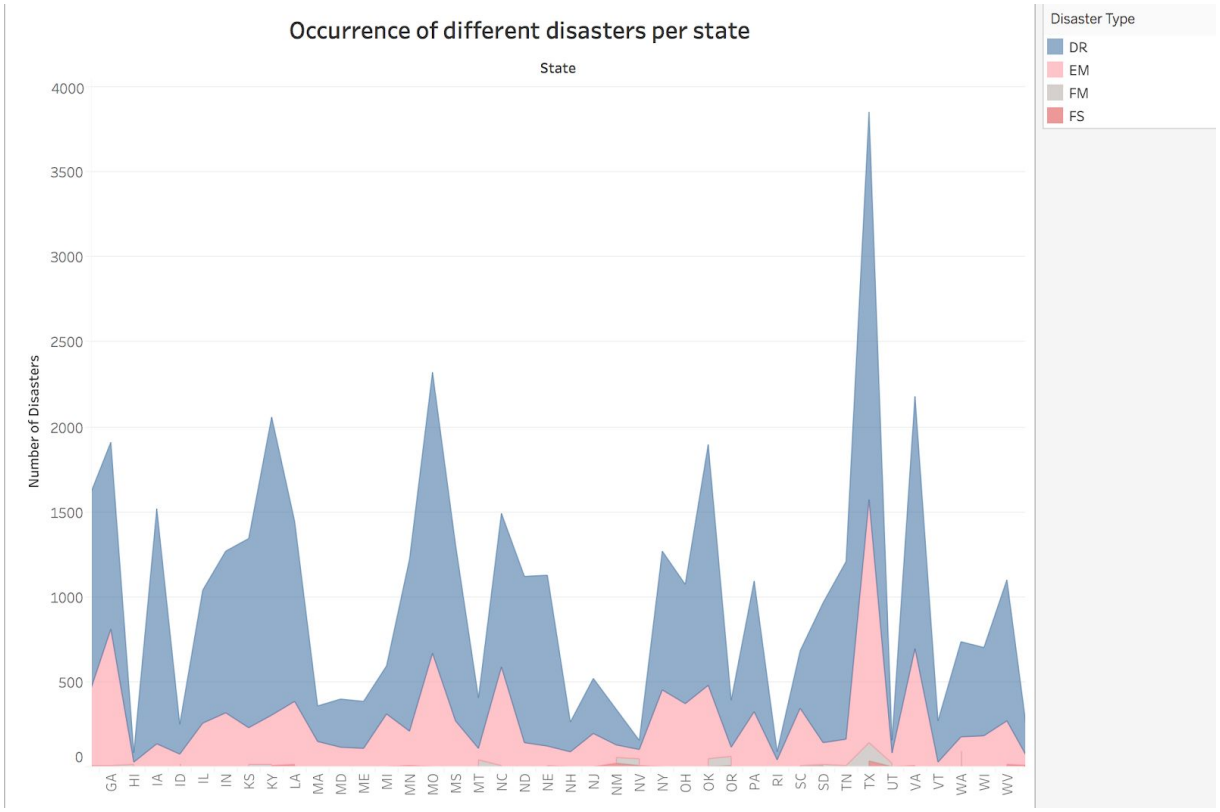


Deep dive across different regions (a region is a cluster of states). Fire occurrences were highest in Region 6 which constitutes of states like Texas, New Mexico, and Oklahoma.

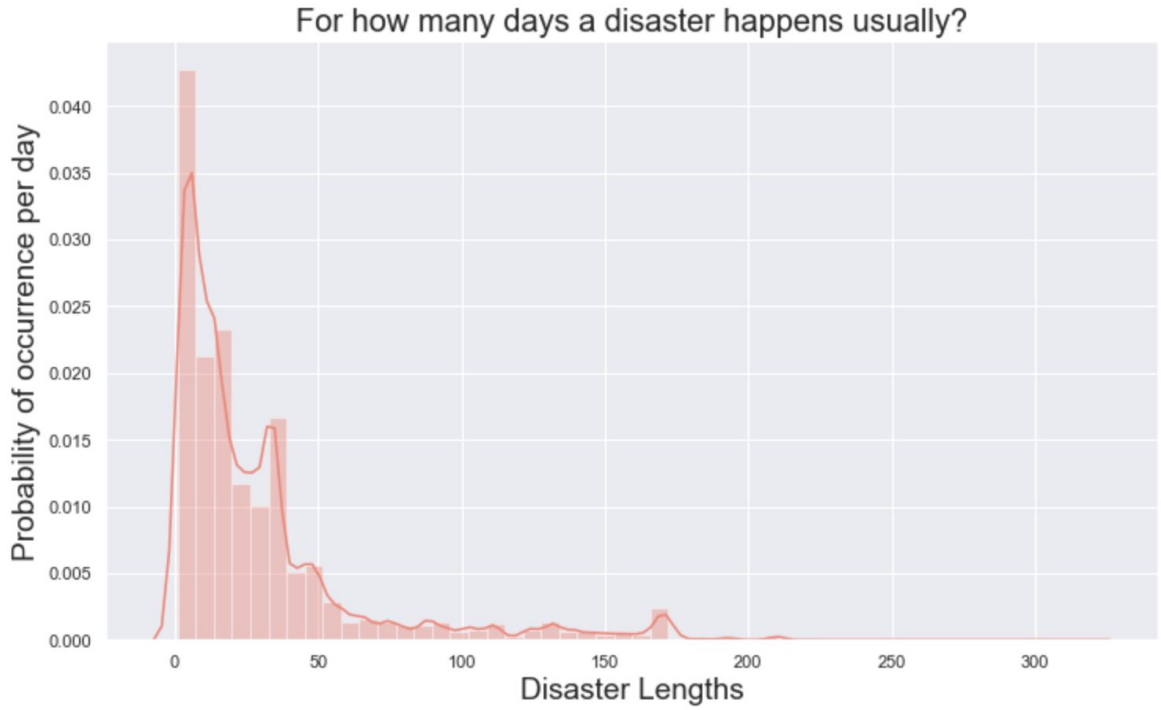


Looking at the aggregated view of different types of disasters, we can see that states like Texas, Virginia, Kentucky, and Missouri suffer from the most number of disasters.

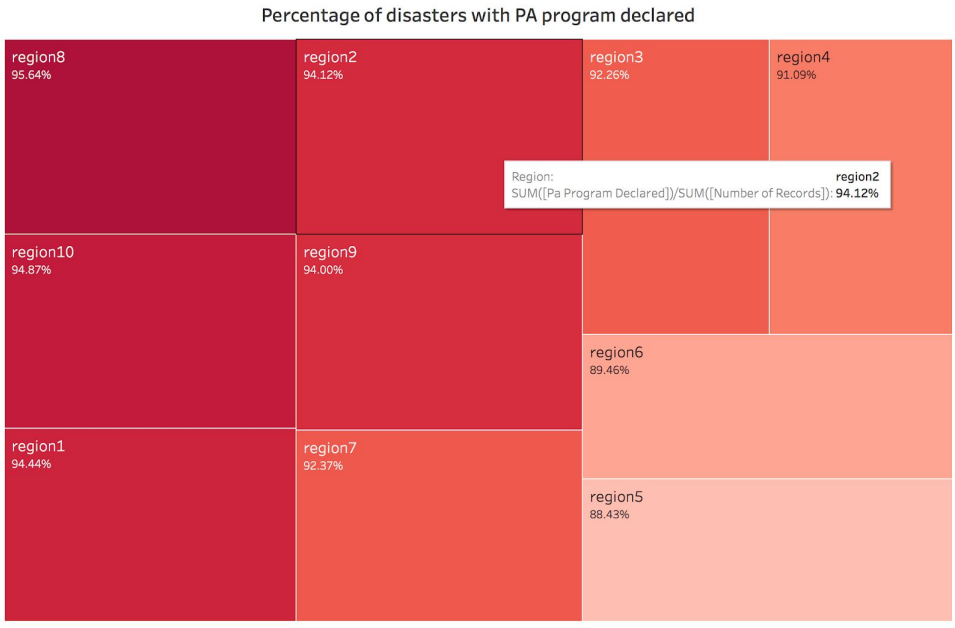
Note: Major Disaster Declaration (DR), Emergency Declaration (EM), Fire Management Assistance Declaration (FM), or Fire Suppression Authorization (FS)



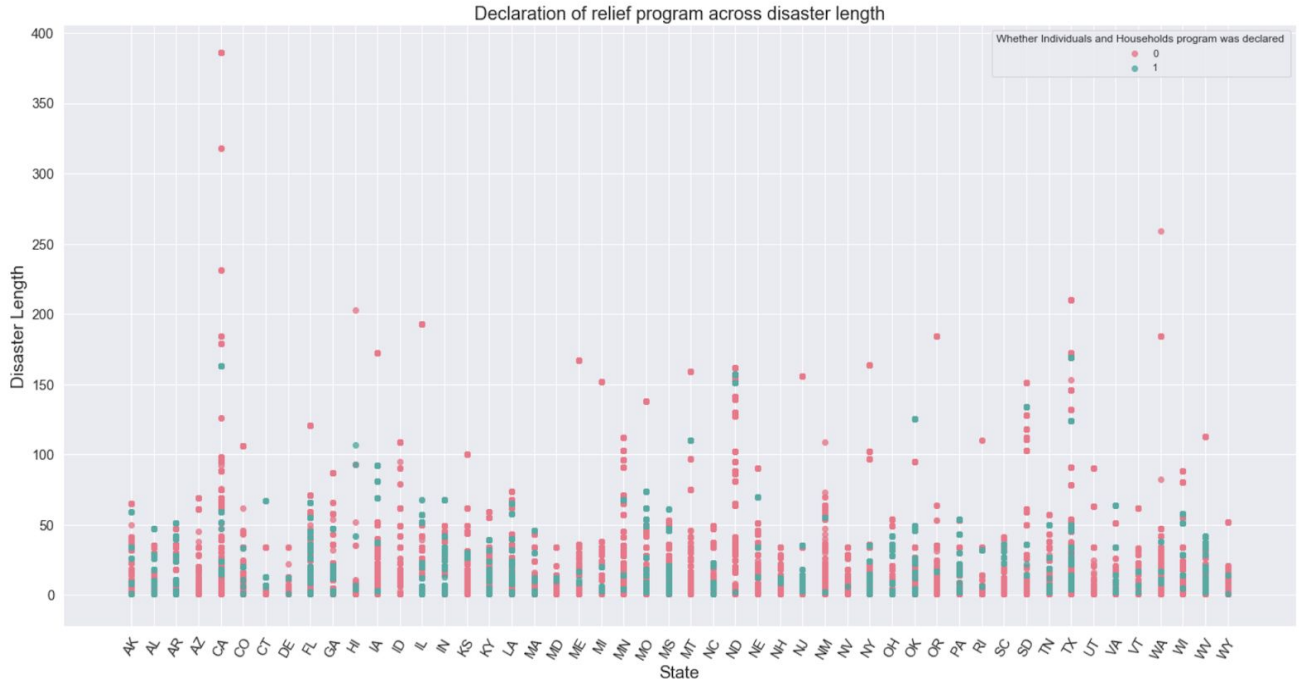
It’s important to answer the question about how many days a disaster will last on average, while generally, the disaster happens over 0 - 15 days time frame, some specific ones like Volcano and Forest Fires and span over hundreds of days.



Now coming onto relief programs declared by the federal and state government, we have data on whether Individuals and Households program or Public Assistance program was declared. For e.g. in Region 8 is at the top with the most coverage of Public Assistance programs declared across its disasters occurrences.

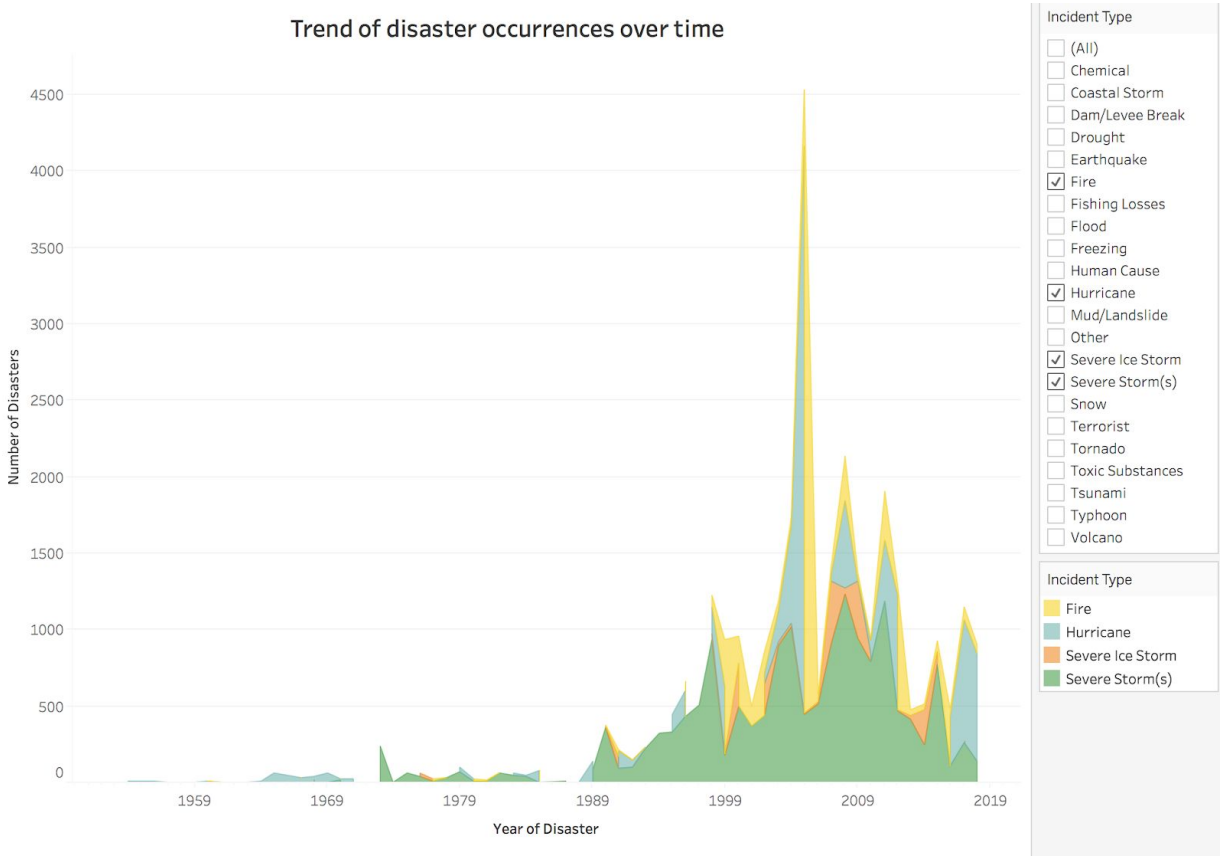


Also, looking at disaster lengths and relief provided, we can observe that for almost all disasters more than 100 days the Individual and Household program relief was provided. Also for some states like Idaho - all disasters have been covered under the program.



Storyline

While there are multiple storylines that can emerge from this data, including states affected, the relief provided, etc. but the main alarming trend is the significant increase in disasters in the recent past - especially weather and climate-related. As you can note, the last 15 - 20 years have seen the highest number of hurricanes, severe storms, severe ice storms, and fire incidents. While this could partially be attributed to better data reporting and weather measurements, it's also a grim reminder to the effects of climate change. Hence, we can conclude that the data clearly shows the need to have better climate change awareness and disaster mitigation plans.



Conclusion

Visualizing the historical disasters occurrence data patterns helps us conclude that disasters like fires, hurricanes, severe ice storms, and severe storms are increasingly becoming frequent over time. We also saw that states like Texas, Virginia, North Carolina, Minnesota, North and South Dakota are increasingly affected by various kinds of disasters. Data revealed that 2005 especially was a very devastating time in terms of disasters wherein four hurricane incidents occurred. We identified a few regions (i.e. state clusters) who are more at risk from being affected by these disasters. Also, we analyzed the relief programs that government authorities provide for these disasters and which states are more proactive in providing these assistance programs. In closure, we also highlighted the need to create awareness about climate change and disaster mitigation.

Appendix Containing All Code:

https://github.com/ntevathia/Visulaization-of-Disaster-history-in-US/blob/master/Plot_Codes.ipynb

Link to your GitHub page with this analysis:

https://github.com/ntevathia/Visulaization-of-Disaster-history-in-US

Citations:

1. "Weather-related disasters are increasing - Daily chart - The Economist." 29 Aug. 2017, https://www.economist.com/graphic-detail/2017/08/29/weather-related-disasters-are-increasing Accessed May 2019.
2. "Natural Disasters Overview | Munich Re." https://www.munichre.com/topics-online/en/climate-change-and-natural-disasters/natural-disasters/ Accessed May 2019.
3. "Congressional Research Service Reports." https://fas.org/sgp/crs/ Accessed May 2019.
4. "The Financial Effects of a Natural Disaster - Investopedia." 12 Feb. 2018, https://www.investopedia.com/financial-edge/0311/the-financial-effects-of-a-natural-disaster.aspx Accessed May 2019.