# Tornado Data Science Project

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# Purpose:

The purpose of us choosing this data science project was to map the occurrence of tornadoes in the United States and select 3 points to focus the results of our data on.

1. How insurance can use this information to better adjust home insurance rates.
2. Why some states have higher sums of damage compared to others.
3. What entails better building codes and where.

Through our data and online research we were able to answer these questions. Other supporting data visuals include.

1. Tornadoes per state
2. Tornadoes per year
3. Tornadoes per month
4. Tornadoes 2002-17 (by F/EF Category)
5. Tornadoes by Fscale per state​
6. Tornadoes per month
7. Tornado property damage

and more…

## Data Approach:

We used a public dataset off <http://ftp.ncdc.noaa.gov/pub/data/swdi/stormevents/csvfiles/> that came with many storm events that included hurricanes, thunderstorms, and the like.

* Original Approach: We originally were using all data from 1950 – 2017. We combined all CSV files of our public dataset source resulting in a single 1.1GB csv file. From there we attempted to load the data in excel and Tableau resulting in sluggish performance from both pcs and programs. Even when it did load, we were not given all the data points that could’ve been provided, as such, we had incomplete data using this approach. We had to revise our approach from here.
* Revised Approach: We reduced our scope from 1950-2017 to 2002 – 2017, which dropped the size to around 900 MB, then filtered out the data to just include tornadoes, giving us 22313 data points to work with. This helped our programs run more efficiently while still providing lots of data on just tornadoes. We decided on 2002, since the NOAA csv files started getting much larger during that time period, indicating they were collecting more data on these events. We also had to standardise the damage numbers to allow Tableau and Python to read them as numbers.

## Data Columns:

BEGIN\_YEARMONTH BEGIN\_DAY BEGIN\_TIME END\_YEARMONTH END\_DAY END\_TIME EPISODE\_ID EVENT\_ID STATE STATE\_FIPS YEAR MONTH\_NAME EVENT\_TYPE CZ\_TYPE CZ\_FIPS CZ\_NAME WFO BEGIN\_DATE\_TIME CZ\_TIMEZONE END\_DATE\_TIME INJURIES\_DIRECT INJURIES\_INDIRECT DEATHS\_DIRECT DEATHS\_INDIRECT DAMAGE\_PROPERTY DAMAGE\_CROPS SOURCE TOR\_F\_SCALE TOR\_LENGTH TOR\_WIDTH BEGIN\_RANGE BEGIN\_AZIMUTH BEGIN\_LOCATION END\_RANGE END\_AZIMUTH END\_LOCATION BEGIN\_LAT BEGIN\_LON END\_LAT END\_LON EPISODE\_NARRATIVE EVENT\_NARRATIVE DATA\_SOURCE

## Tools:

* Tableau
* Excel
* Jupyter notebook (Python)
* Web (Research)
* MS PowerPoint

# Finding: Damage Comparison per State

Top 5 states for damage:

1. AL
2. MO
3. OK
4. MS
5. TX

Top 5 states for Tornadoes:

1. TX
2. KS
3. AL
4. OK
5. MS

Top 5 States with highest death count:

1. AL
2. MO
3. TN
4. MS
5. OK

  From this we recognized Alabama led the charts for total damage per state from tornadoes. Even though Texas is the state with the most events (tornadoes) recorded, Alabama ranks just 3rd right after Kansas. From this we concluded that number of events doesn’t exactly correlate with damage done. We also found damage is highest in the Southern-Midwest and east of there.

# Finding: Why some states have higher sums of damage compared to others.

### Problem:

States like Alabama and Missouri lead in the total sum of damage based on a variety of reasons.

1. Building Codes
2. Most violent (F5/EF5)
3. Areas with high populations being struck the most such as Tuscaloosa, and Dekalb.

### Approach:

Using charts to map data we found the this from the above key finding. From this we did online research and came to the above 3 conclusions.

### Solutions:

Strengthened building codes might include:

Sources: <http://www.air-worldwide.com/Blog/Reducing-Tornado-Damage-with-Building-Codes/>

<http://disastersafehomes.com/put-together.php>

<http://www.natureworldnews.com/articles/18697/20151210/new-building-codes-aim-protect-u-s-devastating-tornadoes.htm>

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1. Stronger roof sheathing
   1. Or Insulated Reinforced Concrete Roof Decks
   2. Ridge And Valley Beams
2. Hurricane clips
   1. 
   2. ($2400 to secure a single-story home)
   3. Example: In Harbor Terrance, Hawaii, home insurance doubled because of Katrina. Residents installed Hurricane Clips and received a state credit of $800.
   4. By screwing in one hundred of these clips, it is the equivalent of adding a 40-thousand-pound weight to your roof in the face of a storm.
   5. One of the problem comes when the wind rips your roof off. Once your roof is gone it's just all gone.
3. Wind-Resistant garage doors
   1. Garage doors must be insulated and storm resistant
4. Reinforced concrete shells
   1. Construction requires that the entire exterior shell (walls, floors, and roofs) of the house be monolithic reinforced concrete in character.
      1. Examples: Aircraft fuselages and ship hulls
      2. Concrete shells on Guam have performed without damage for fifty years

**Problems to get better building codes in place:**

“One hold-up appears to be in the state legislature, where lawmakers have been bickering over funding tornado protection.

One Democratic lawmaker proposed using funds from the state's franchise tax, a levy suspended in 2011, to pay for tornado and storm shelters for most of schools in the state without them. Republican lawmakers, who dominate the legislature, have balked at the proposal, saying they want to eliminate the tax altogether.”

“Changing laws to make sure you aren’t sued if you open up your doors to people in need and they get hurt during the storm”

**What government organization approves building codes and standards?**

* **National Institute of Standards and Technology (NIST)**
* **International Coded Council (ICC)**

# Finding: How insurance and government can use this data

1. Insurance companies can use our data to determine places to raise housing insurance rates and maybe incentivize better building codes. Focus on certain counties maybe?
2. Lobbying for better buildings codes in high risk states like Alabama. These building codes can also help reduce damage from other weather events like hurricanes, thunderstorms, and other weather with high wind speeds too.
3. Encourage living in safer areas for lower premiums.
4. Help other insurances like car or health insurance because houses aren’t the only thing damaged during a tornado.
5. Government watch organizations can make further policy adjustment. Possibly these organizations can push for more state or federal laws on building codes.

# Conclusion

From our data set we were able to visualize where tornadoes have occurred and the amount of damage they caused. We came up with answers to questions we had about why states like Alabama have large amounts of damage compared to states like Texas that has the most tornadoes. From this we dove deeper in to our research and found variables that correlate with the problems and solutions. We hope insurance companies and states can look at our data and take the appropriate sets to help resolve some of these issues.

Our presumptions about tornadoes before we started this project were very much changed by the end of the project. The amount of data about not one but many states and events opened our eyes to the damaging nature and range of tornadoes.

# Sources

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Drawing lines between multiple x and y values  
<https://community.tableau.com/thread/255561>   
  
Council eyes changes to river, tornado-zone building codes  
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