

EXAMINATION OF HURRICANE- RELATIVE TORNADO LOCATION

GEOG 596A CAPSTONE PROPOSAL

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Cover animation by NOAA

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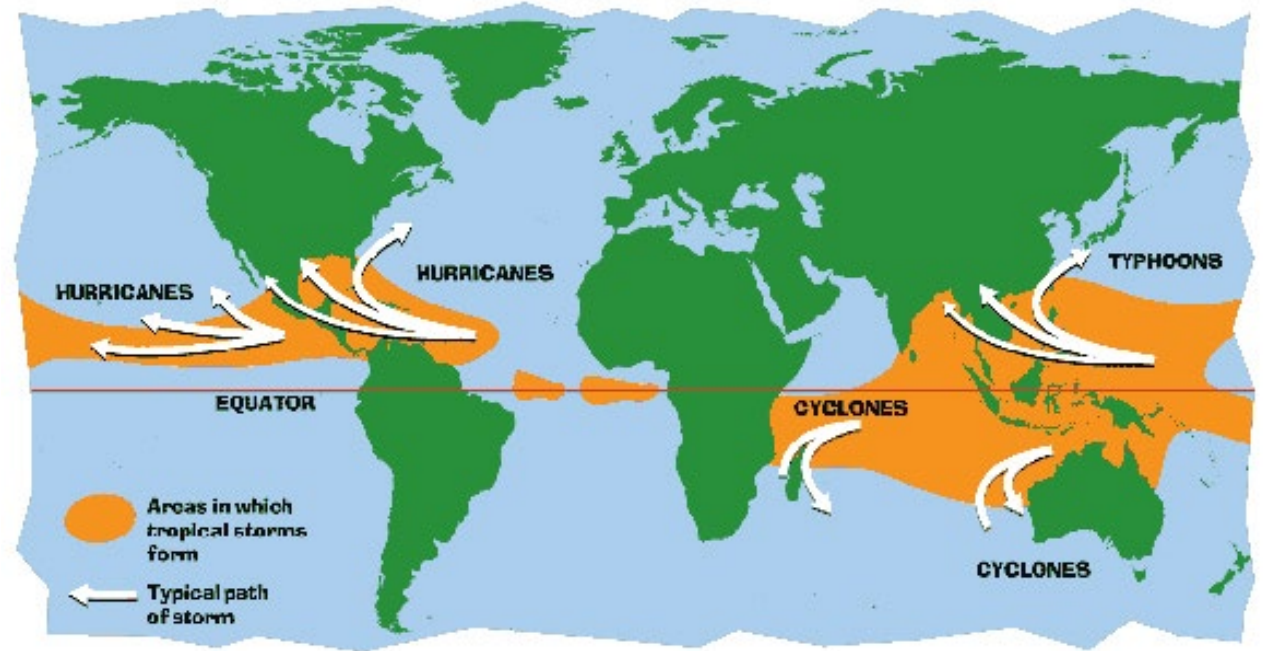
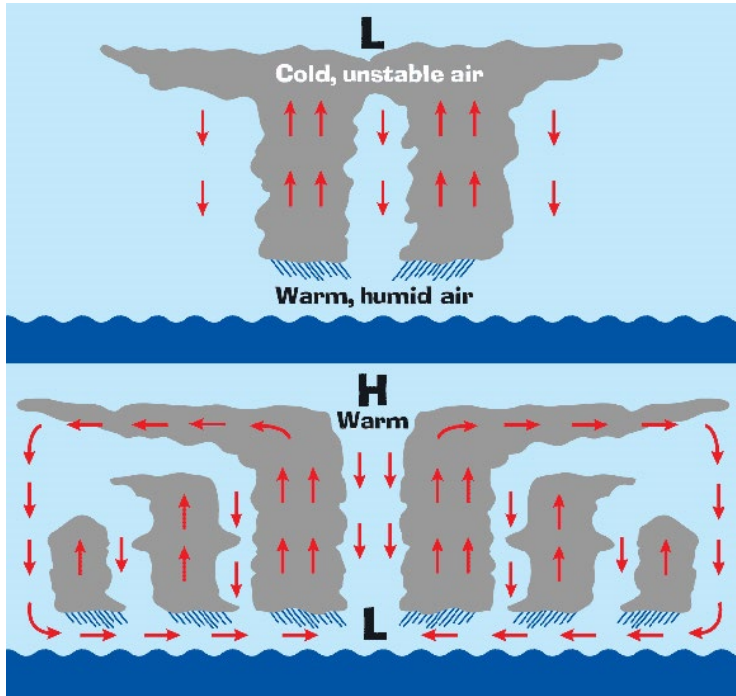


<https://giphy.com/gifs/mRTXRsd3sL9Mk>



BACKGROUND





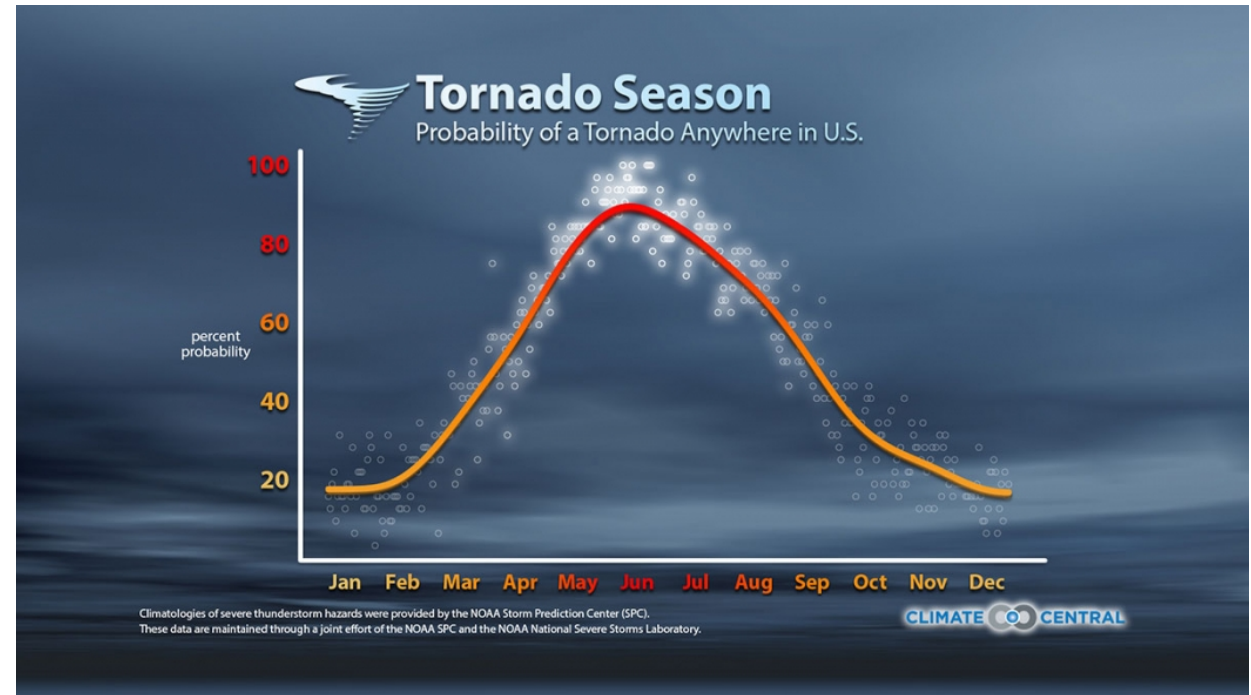
Category	Wind Speed (mph)	Damage at Landfall	Storm Surge (feet)
1	74-95	Minimal	4-5
2	96-110	Moderate	6-8
3	111-129	Extensive	9-12
4	130-156	Extreme	13-18
5	157 or higher	Catastrophic	19+

WHAT CAUSES HURRICANES

- Warm, moist air
- This is why they form only over warm ocean waters near the equator, but not too close
- Moist air rises and condenses
- Air converges near the Earth's surface
- Air continues to rise; the converging air begins to rotate (spin)



(Satellite image ©2020 Maxar Technologies)



Enhanced Fujita Scale

EF-0	65-85 mph
EF-1	86-110 mph
EF-2	111-135 mph
EF-3	136-165 mph
EF-4	166-200 mph
EF-5	200+ mph

WHAT CAUSES TORNADOES

- Supercell (Large Thunderstorms)
- Warm, humid air rises forming a strong updraft
- Mesocycle – The updraft gets rotation from the wind changes (Jet Stream) in the environment
- Processes within the storm outflow create rotation near the ground
- This rotation near the ground is amplified when it converges beneath the updraft



OBJECTIVES



LOCATIONAL RELATIONSHIP

- How far from the hurricane
- Which side of the hurricane
- When does this happen
- Strength of tornadoes





METHODOLOGY



DATA (GIS)

- International Best Track Archive for Climate Stewardship (IBTrACS) Version 4 (.shp) (Hurricane)
- Storm Prediction Center 1950-2018 All Tornadoes Initial Points and Tracks (.CSV)
- U.S. Census Bureau 2019 TIGER/Line® Shapefiles: States (and equivalent)



<https://www.ncdc.noaa.gov/ibtracs/index.php?name=ib-v4-access>

Storm Prediction Center WCM Page

U.S. TORNADOES* (1950-2018) *Read format description document!

[Change Log](#)

Last Update: 30 September 2019

[1950-2018_all_tornadoes.csv \(6.9 mb\)](#) Raw database dump includes all state and continuing county segments.

[1950-2018_actual_tornadoes.csv \(6.7 mb\)](#) Single tracks. No state segments or continuing county info (e.g. sg="1").

[2014-2015-onetor-dat.csv \(2.9 mb\)](#) SPC Tornado Database with identifier to connect back to DAT data.

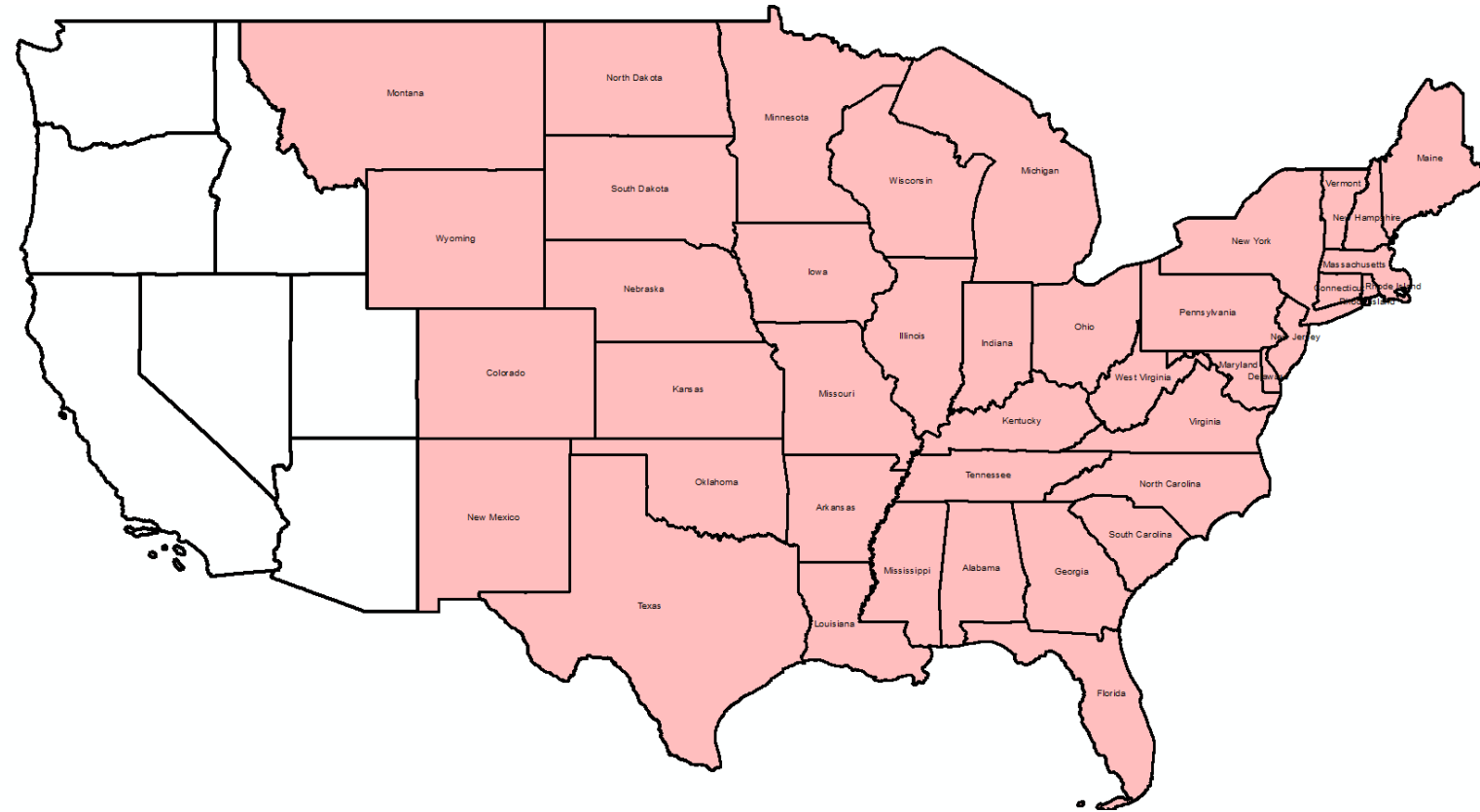
<https://www.spc.noaa.gov/wcm/>



<https://www.census.gov/cgi-bin/geo/shapefiles/index.php?year=2019&layergroup=States+%28and+equivalent%29>

PROJECT BOUNDARY

- Focuses on the area known as Tornado Alley
- Historical Hurricane events have gone through the Gulf of Mexico and along the Eastern Seaboard of the United States.

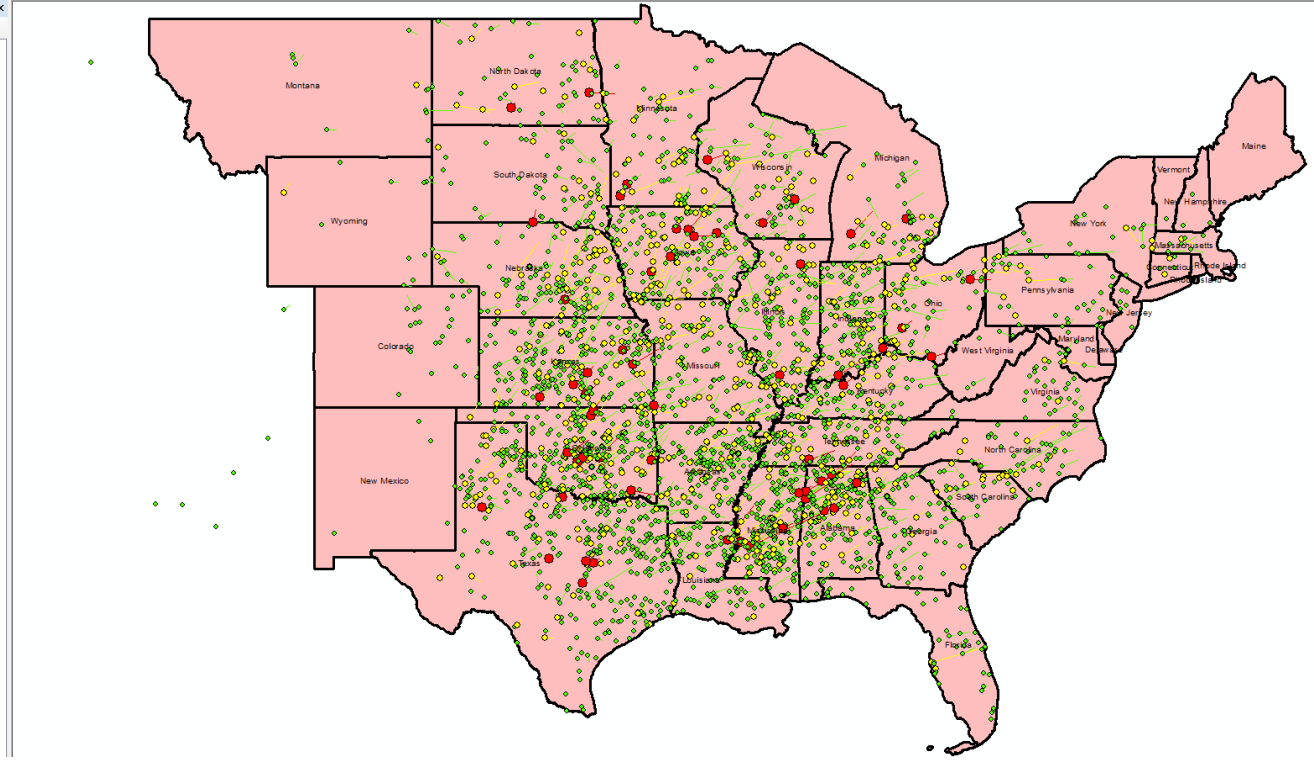




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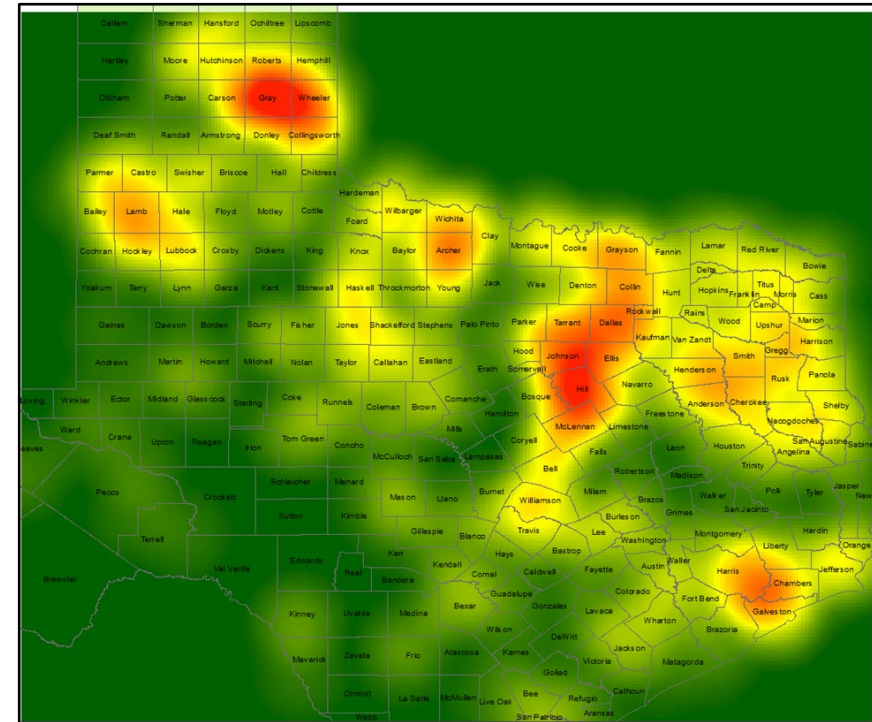
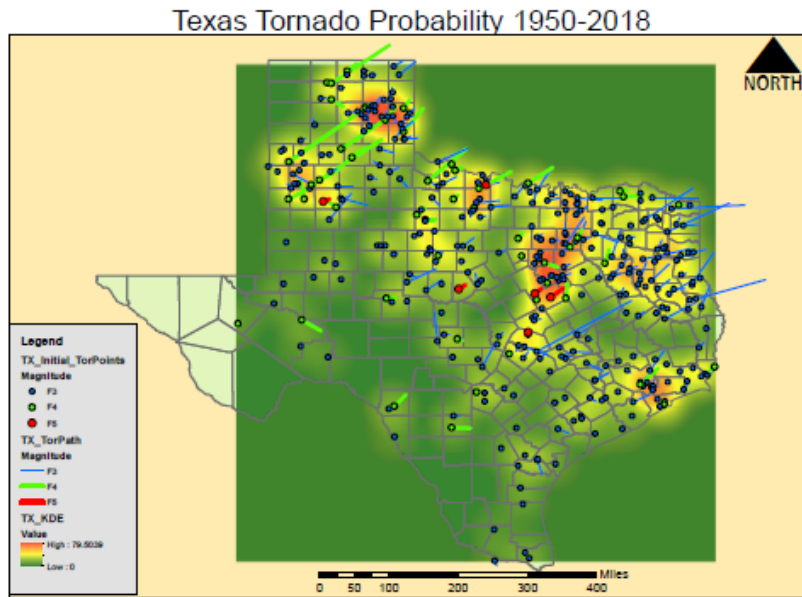
Table Of Contents

- Layers
 - Katrina_Multi_buffer
 - 2005_Katrina_Lines
 - Initpoints_20050821_20050831
 - F3_F5_Tornadoes
 - <all other values>
 - mag
 - 3
 - 4
 - 5
 - F3_F5_Tornadoes2_Paths
 - <all other values>
 - mag
 - 3
 - 4
 - 5
 - 2005_Katrina_Points
 - 1980_CS_Hurricanes_points
 - 1980_GM_Hurricanes_points
 - 1980_NA_Hurricanes_points
 - IBTrACS.since1980.list.v04r00.points
 - 1980_GM_Hurricanes_Lines
 - 1980_CS_Hurricanes_Lines
 - 1980_NA_Hurricanes_Lines
 - IBTrACS.since1980.list.v04r00.lines
 - Katrina_800K_buffer
 - State_Outlines
 - tl_2017_us_state
 - 1950-2017-torn-initpoint
 - 1950-2017-torn-aspath
 - tl_2016_us_county



SOFTWARE

- ESRI (Environmental Systems Research Institute) Product Suite
 - ArcMap
 - ArcGIS Pro



ANALYSIS

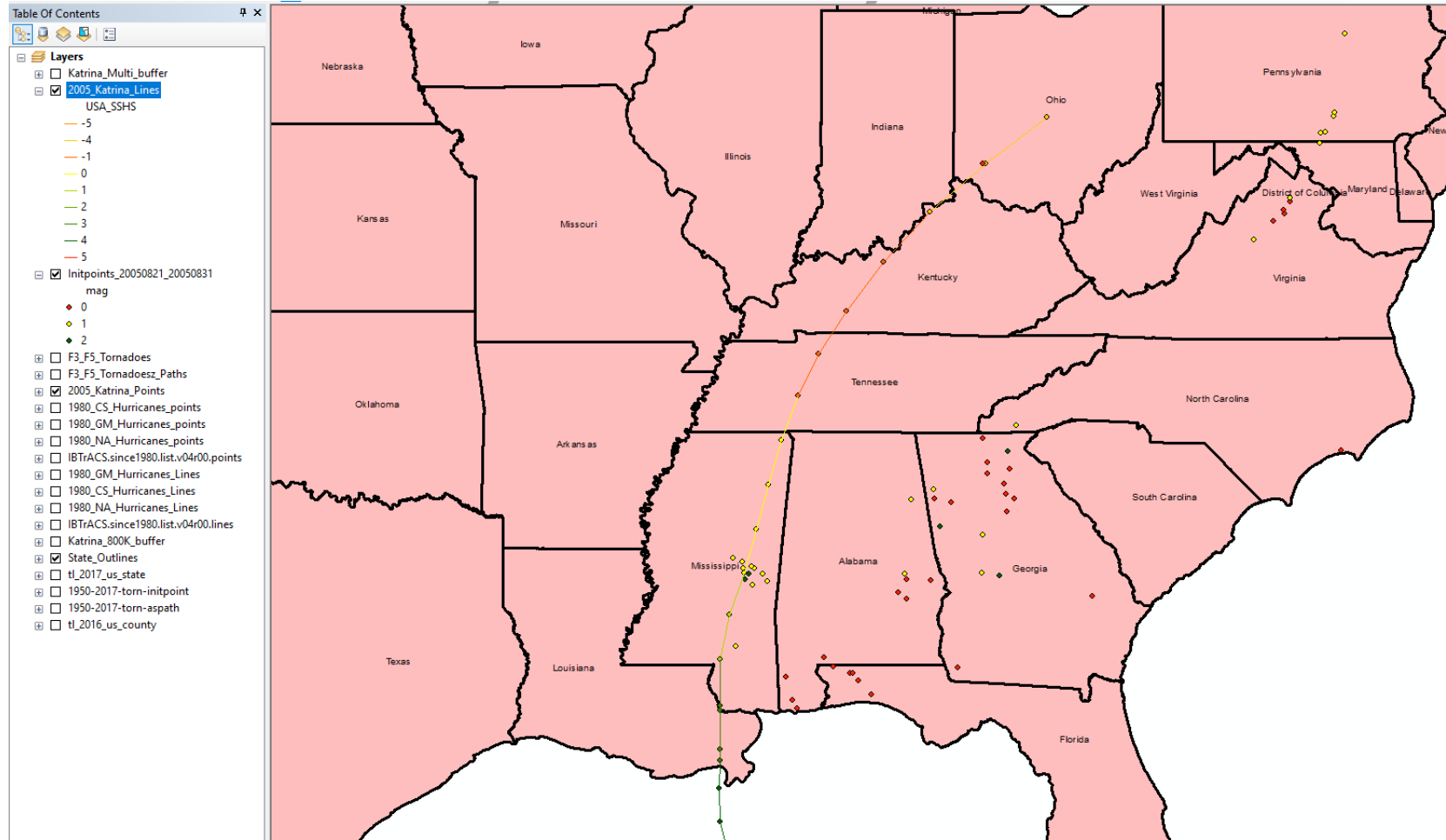
- Breaking down the raw datasets
- Organize Hurricane data by events and match up the timelines with the Tornado data (create .shp)
- Identify patterns of tornado clusters along the hurricane paths.
- Create Buffers
- Kernel Density Estimation on points and lines. (locations and strength)



ANTICIPATED RESULTS



2005 HURRICANE KATRINA

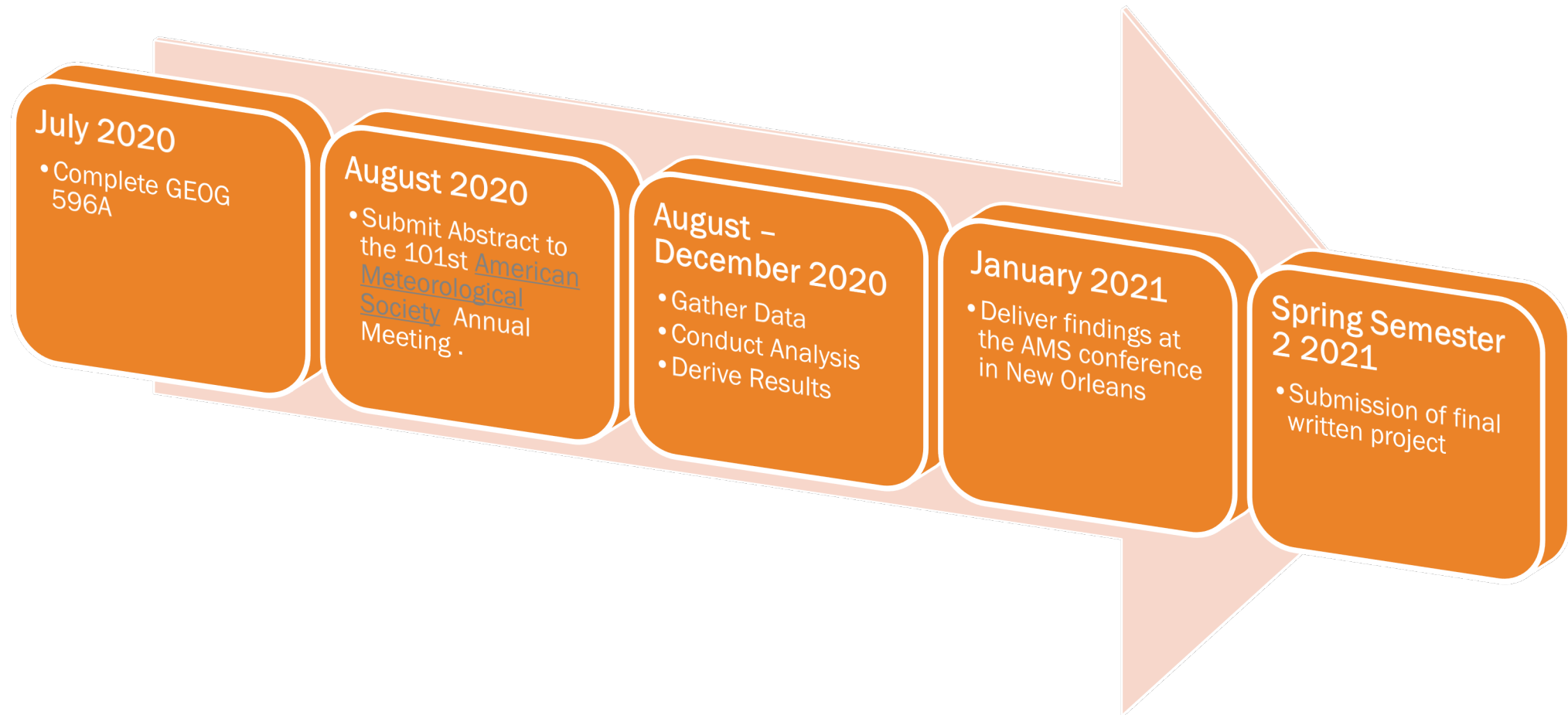




PROJECT TIMELINE



CAPSTONE TIMELINE

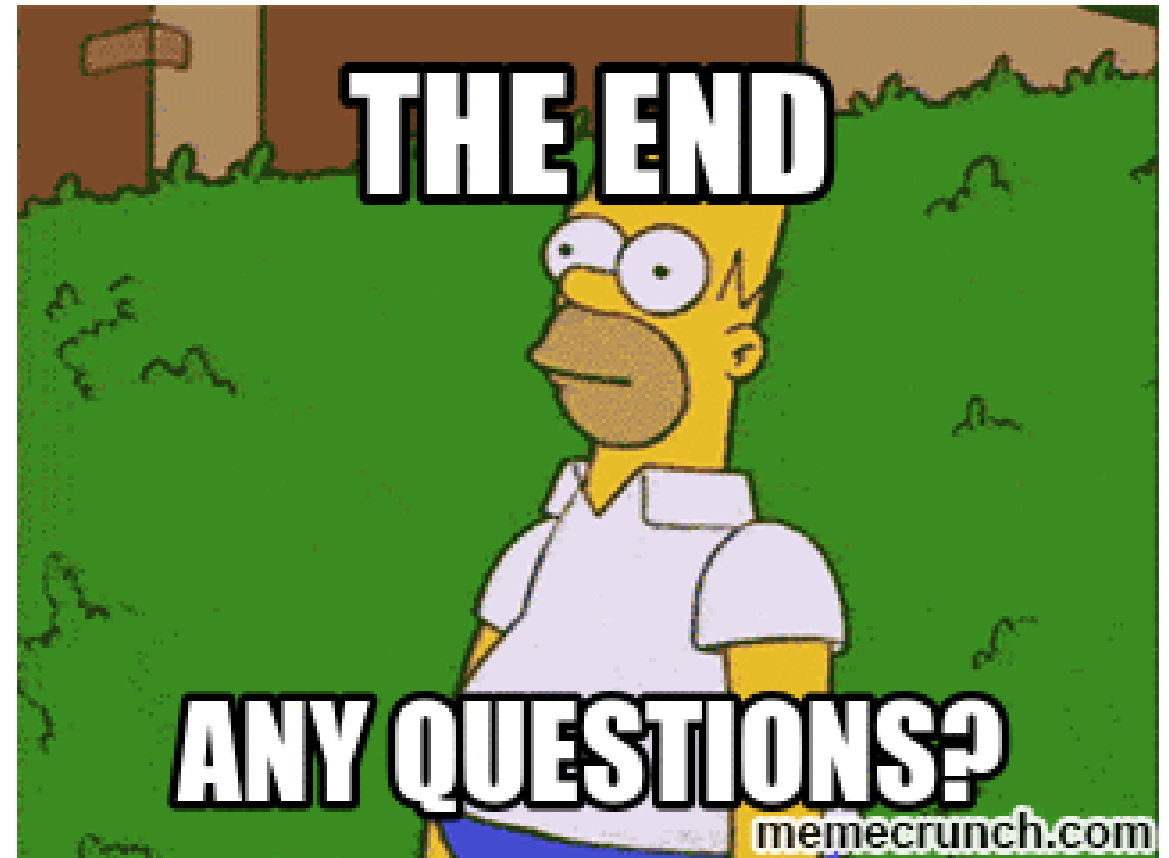


POSSIBLE PRESENTATION VENUE

101ST AMERICAN METEOROLOGICAL SOCIETY
ANNUAL MEETING, NEW ORLEANS
10 TO 14 JANUARY 2021
(STUDENT CONFERENCE)



QUESTIONS



REFERENCES

- Content Slide received from: [www.giphy.com \(https://giphy.com/gifs/mRTXRsd3sL9Mk\)](https://www.giphy.com/gifs/mRTXRsd3sL9Mk)
- ©2020 Maxar Technologies (<https://weather.com/storms/tornado/news/2020-04-15-easter-tornado-outbreak-before-and-after-satellite-images>)
- Acclimatise News. (2018, January 11). *2017: the year in extreme weather | Acclimatise – Building climate resilience*. [Www.Acclimatise.Uk.Com. https://www.acclimatise.uk.com/2018/01/11/2017-the-year-in-extreme-weather/](https://www.acclimatise.uk.com/2018/01/11/2017-the-year-in-extreme-weather/)
- *How Does a Hurricane Form?* (2020, June 24). NOAA SciJinks – All About Weather. <https://scijinks.gov/hurricane/>
- Markowski, P., & Richardson, Y. (2017, May 19). *Understanding tornadoes: 5 questions answered*. The Conversation. <https://theconversation.com/understanding-tornadoes-5-questions-answered-77448>
- *Tornadoes, explained*. (2019, August 28). [Www.Nationalgeographic.Com. https://www.nationalgeographic.com/environment/natural-disasters/tornadoes/#:%7E:text=Tornadoes%20form%20when%20warm%2C%20humid,colder%20air%2C%20causing%20an%20updraft.&text=When%20it%20touches%20the%20ground%2C%20it%20becomes%20a%20tornado](https://www.nationalgeographic.com/environment/natural-disasters/tornadoes/#:%7E:text=Tornadoes%20form%20when%20warm%2C%20humid,colder%20air%2C%20causing%20an%20updraft.&text=When%20it%20touches%20the%20ground%2C%20it%20becomes%20a%20tornado)