Can Atmospheric Measurements Explain the Damage from Hurricanes Zeta and Katrina

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Abstract

Humidity, wind speed and water temperature are some of the main components in severe weather events. Hurricanes are a major concern of tropical and subtropical coastal communities. Low pressure systems over warm water can create strong hurricanes. The Atlantic hurricane season occurs from June first to November thirtieth each year. A hurricane begins with a tropical depression which is a tropical cyclone with winds of 38 mph or less. The next stage is a tropical storm which has a wind speed of 39-73 mph which can intensify into a hurricane with wind speeds of 74 mph or more. Hurricanes can become major hurricanes once their wind speed increases to 111 mph or higher. Looking at the damage to the Mississippi Gulf coast from Hurricane Katrina and 2020's Hurricane Zeta, our team wanted to see if atmospheric measurements could help to predict the damage seen in these storms and other storms. Once a hurricane forms, the Saffir-Simpson Wind Scale helps to predict damage and rate the storm by wind speed into a category (NOAA, n.d.). While damage can be estimated or anticipated, atmospheric measurements alone cannot fully predict the damage in major storms like Katrina and Zeta. Since Hurricane Katrina, better tools have made narrowing the cone of impact better. These tools include better satellites with more frequent photos and supercomputers to better predict and model storm intensity, behavior and track (Prociv, 2015).

Research Question

Research Question: Can atmospheric measurements predict and explain damage from Hurricane Katrina and Hurricane Zeta?

Hypothesis: That atmospheric measurements will be able to explain and help people predict the type of damage seen in both Hurricane Katrina and Hurricane Zeta.

Introduction

Hurricane Katrina hit Louisiana and Mississippi on August 29, 2005. With wind speeds of 120 mph, it was a category 3 hurricane that resulted in a high death toll and catastrophic property damage. The storm surge from Katrina was a big problem and significant flooding was caused not only by the storm surge but also by a breech in the levee system for New Orleans (Gibbens, 2019). The driving factors behind the damage from Katrina are storm surge, wind, tornadoes, and rainfall. This hurricane caused an estimated 1833 deaths and a cost of 161 billion dollars.

Hurricane Zeta left a lot of damage in Mississippi on October 28, 2020. The damage from the 110 mph winds looked a lot like tornado damage. Some people further north of the coast said that the storm caused more damage than Hurricane Katrina further north (Jeansonne, 2020). While weather reports do not confirm tornados, the hurricane force winds were strong enough and created a path that was much like a tornado path (Jeansonne, 2020). The damage seen can be explained by the wind speed using the Saffir-Simpson Hurricane Wind Scale which uses wind speed to give the storm a category of 1 to 5. According to weather reports and the Saffir-Simpson Hurricane Wind Scale, Hurricane Zeta was a category 2 storm at landfall but there is some dispute that it actually had 112 mph winds making it a category 3 storm. A category 3 storm would cause devastating damage according to the scale (NOAA, n.d.).

Research Methods

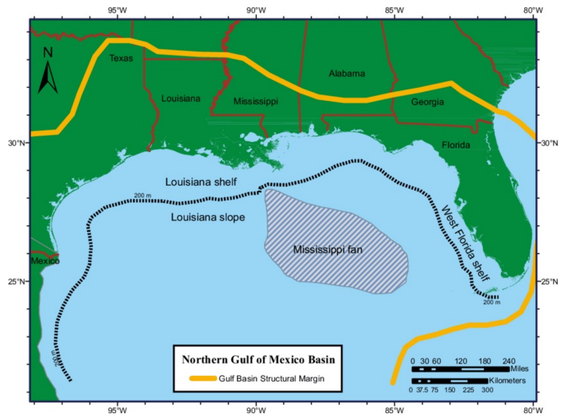
Planning Investigations

- Our team started the project by learning the GLOBE program's atmosphere protocol.
- Once we learned the atmosphere protocol, we chose a topic that was relevant to where we live which is the Gulf Coast of Mississippi.
- A literature review was conducted to learn about hurricanes which included how they form, what factors make them stronger, and how they are predicted.

Carrying Out Investigations

- The literature review provided the information needed to understand hurricanes and what atmospheric measurements are used to predict their strength.
- A data set for INFINITY Science Center was used that covered 2018 to 2021. The wide date range allowed us to look at low pressure systems and to look for intense storms related to the low-pressure system.
- One low pressure system on 5/13/19 was evidenced by a low barometric pressure reading of 780 mbar with a rainfall of 76mm according to INFINITY Science Centers GLOBE atmosphere data.
- Our team collected data several times a week at our school so that we would be able to learn the protocol and what each part of the data would tell us about weather.

Figure #1 Map of Northern Gulf of Mexico. Map credit: Kulp et al., 2005



Results

Our results show that severe weather and storm damage can be predicted by atmospheric measurements but that the full extent of damage from a major storm cannot be fully predicted .

Advanced tools for better predicting the cone of a hurricane have been helpful but do not fully solve the problem of fully predicting storm damage.

Figure #2 – Barometric Pressure readings showing low pressure readings

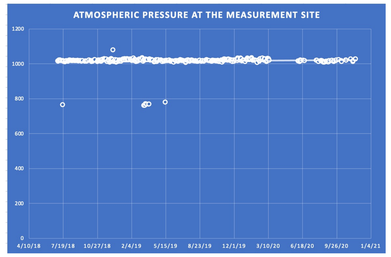
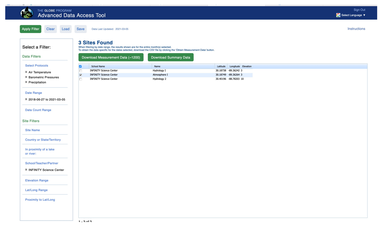


Figure #3 – Saffir-Simpson Hurricane Wind Scale. Photo Credit: Holt, 2020

Figure #4 GLOBE data retrieval tool



Discussion

- **The data shows that storm intensity and potential damage can be predicted but not fully predicted.**
- **Narrowing the cone of the storm can help better prepare communities to evacuate and to respond to major hurricanes like Katrina and Zeta.**
- **Nothing can be done to stop the damage but preparations to reduce damage and save lives can be done.**

Figure #5 Photo Credit: ABC 13, 2020

Conclusions

Once a hurricane forms, the Saffir-Simpson Wind Scale helps to predict damage and rate the storm by wind speed into a category (NOAA, n.d.). While damage can be estimated or anticipated, atmospheric measurements alone cannot fully predict the damage in major storms like Katrina and Zeta. Since Hurricane Katrina, better tools have made narrowing the cone of impact better. These tools include better satellites with more frequent photos and supercomputers to better predict and model storm intensity, behavior and track (Prociv, 2015).

In conclusion, better forecasts using better tools have helped to predict damage that will come from hurricanes but being able to fully predict the outcome in dollars and loss of life is not an exact science.

References

Floodlist. (2019, May 13). USA – *Flooding prompts Mississippi and Louisiana to declare state of emergency*. http://floodlist.com/america/usa/mississippi-louisiana-may-2019

Gibbens, S. (2019, January 16). *Hurricane Katrina, explained.* National Geographic. https://www.nationalgeographic.com/environment/article/hurricane-katrina

Jeansonne, E. (2020, November 2). Hurricane Zeta's winds caused tornado-like damage: where the strongest winds occurred and why. WLOX. https://www.wlox.com/2020/11/02/hurricane-zetas-winds-caused-tornado-like-damage-where-strongest-winds-occurred-why/

Holt, A. (2020, May 20). *Hurricane: Tropics Topics: The Saffir-Simpson Wind Scale*. 3 News. https://www.kiiitv.com/article/weather/hurricane/tropics-topics-the-saffir-simpson-wind-scale/503-7ac121bf-ef3e-43ad-8492-aaf7c2912511

NOAA. (n.d.). Saffir-Simpson Hurricane Wind Scale. National Hurricane Center and Central Pacific Hurricane Center. https://www.nhc.noaa.gov/aboutsshws.php