Forecasting Hurricane Name Retirements in the 21st Century

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Introduction

Hurricanes are among the most destructive natural disasters on Earth, often resulting in significant loss of life and billions in damages. When a particularly devastating storm strikes the U.S., Mexico, or the Caribbean, its name is often retired to avoid future confusion and honor those affected. But what makes a storm notorious enough for retirement—and can such retirements be predicted?

Methods

- To explore this, a list of all Atlantic hurricane names retired between 2000 and 2022 was compiled.
- Data on economic damages, fatalities, peak wind speed, and minimum pressure were gathered from NOAA's Billion-Dollar Disaster database and National Hurricane Center Cyclone Reports.
- Median values—adjusted for inflation—were calculated for the entire period and by decade, with medians preferred over means to reduce skew from outliers.
- These values were then used to assess three major hurricanes from the 2024 season: Beryl, Helene, and Milton.

Results

- Case Study: Hurricane Helene made a devastating landfall in the Big Bend region of Florida in September of 2024. It killed 249 people, making it the deadliest United States Hurricane since Hurricane Katrina (2005) (Fig. 1)
- The median cost of retired storms rose over time—from $6.4 billion in the 2000s to $9.8 billion in the 2010s, and $18.6 billion overall (Fig. 2).
- Helene and Milton far exceeded this benchmark, causing $78.7 billion and $34.3 billion in damages, respectively. These values are similar to the damages caused by other retired storms in the past few years, like Hurricane Laura (2020) and Hurricane Ian (2022) (Fig 3).
- Though Beryl's $7.2 billion in damages was below the median, it broke multiple records, becoming both the strongest June hurricane and the earliest Category 5 on record (Fig. 3).

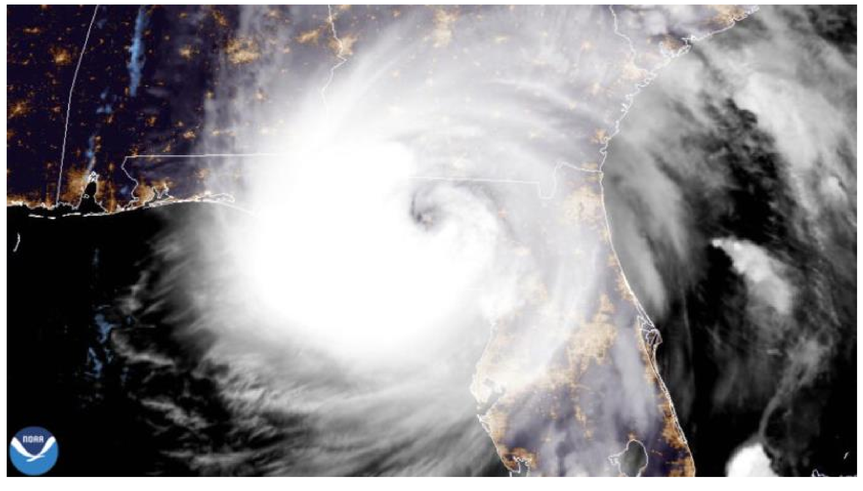

Figure 1- Satellite imagery of Hurricane Helene as it was about to make a Category 4 landfall in the Big Bend Region of Florida on September 26, 2024. Source: NOAA

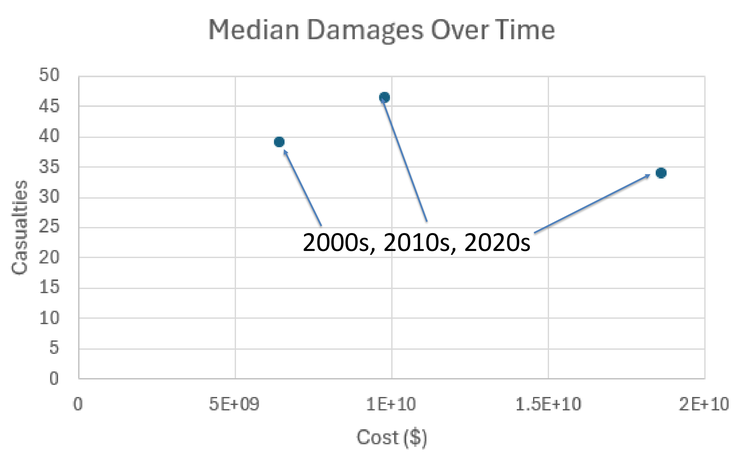

Figure 2- While the median number of deaths has fluctuated over time, the median cost of retired hurricanes each decade has increased with time.

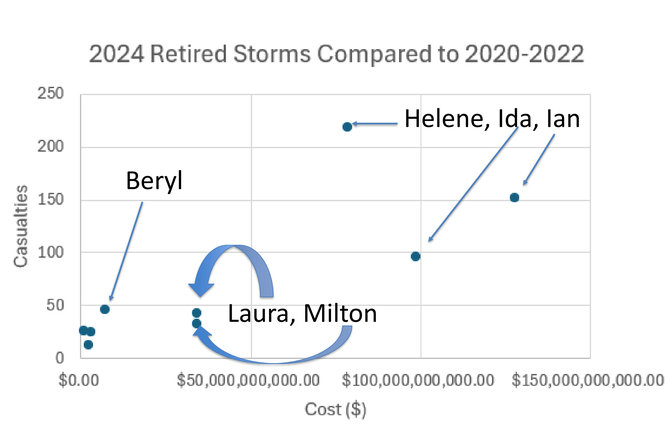

Figure 3- Each dot represents the damages caused by a retired storm. The three most destructive storms from the 2024 season are shown to be comparable to other extremely destructive storms from prior seasons.

Conclusion

Based on these findings, it was predicted that Beryl, Helene, and Milton would be retired. The World Meteorological Organization's April 2025 announcement confirmed this outcome, replacing the names with Brianna, Holly, and Miguel. This announcement from the WMO highlights the potential of statistical analysis in forecasting hurricane name retirements, as the prediction matched what was announced.

Acknowledgements

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