For the purpose of hazard modeling, we focused on the wind hazard associated with historical major Hurricanes (Cat 3+) from 2000-2021. There has been a total number of 11 major storms, listed below:

|  |  |  |
| --- | --- | --- |
| **Name of Major Hurricanes** | **Date** | **Maximum Category** |
| Ivan | Sep, 2004 | 3 |
| Jeanne | Sep, 2004 | 3 |
| Dennis | Jul, 2005 | 3 |
| Katrina | Aug, 2005 | 3 |
| Rita | Sep, 2005 | 3 |
| Wilma | Oct, 2005 | 3 |
| Harvey | Aug, 2017 | 4 |
| Irma | Sep, 2017 | 4 |
| Michael | Oct, 2018 | 5 |
| Laura | Aug, 2020 | 4 |
| Zeta | Oct, 2020 | 3 |
| Ida | Aug, 2021 | 4 |

Accordingly, we performed the analysis using HAZUS Hurricane Model. The HAZUS Hurricane Model, developed by FEMA, is a powerful tool used to estimate potential losses from hurricane events. It integrates data on local geography, infrastructure, and building stock with advanced modeling of hurricane dynamics, including wind speed, storm surge, and rainfall. The model assesses both physical damage to buildings and infrastructure and the associated economic losses, allowing users to simulate various hurricane scenarios for risk assessment and mitigation planning. By providing detailed projections of potential impacts, HAZUS helps emergency managers, policymakers, and planners make informed decisions to improve community resilience against future hurricanes.

The loss estimation methodology in the HAZUS Hurricane Model follows a systematic process to assess the potential impacts of a hurricane event. It combines hazard data (such as wind speed, storm surge, and rainfall) with local inventory data (buildings, infrastructure, and population) to estimate losses. Here's how it works:

**1. Hazard Simulation:** The model first simulates the hurricane’s characteristics, including wind speed, pressure, storm surge, and rainfall patterns. These factors are influenced by the hurricane’s intensity, path, and size.

**2. Exposure Inventory:** The model uses detailed data on local building types, infrastructure, population, and essential facilities (such as hospitals and schools) that could be affected by the storm.

**3. Vulnerability Assessment:** Based on the building types and structural characteristics, the model estimates the vulnerability of structures to hurricane hazards. For example, buildings with specific construction materials or design standards may be more or less vulnerable to wind damage.

**4. Damage Estimation:** Using the hazard intensity and vulnerability data, the model calculates physical damage to buildings, infrastructure, and lifelines. It assesses both structural and non-structural damage.

**5. Loss Estimation:** The model then translates the estimated damage into economic losses, which includes:

- Direct Losses: Repair and replacement costs for damaged buildings and infrastructure.

- Indirect Losses: Secondary effects such as business interruption, lost wages, and the economic impact on essential services.

**6. Casualty and Shelter Needs:** The model also estimates potential casualties and the number of people who may need emergency shelter, based on the storm’s intensity and population exposure.

**7. Results and Reports:** The HAZUS Hurricane Model generates detailed reports and maps, showing the geographic distribution of damage and losses. These outputs help users understand the potential impact and inform mitigation, preparedness, and response strategies.

A diagram of a hurricane model

Description automatically generated

Hazus hurricane model provides a wide range of outputs presented as below:

**A table of hurricane loss calculation methodology output

Description automatically generated**

A few points about the analysis:

* To simplify the analysis and migration model, we focused on a few key variables: wind footprint (in mph), total losses (in $1,000), residential losses (in $1,000), and employment losses (in $1,000).
* All data were collected at the track level for the coastal states around the landfall area. As the counties.
* We considered the first landfall of this storms on the coastline counties. These includes counties from TX, LA, MS, AL, and FL.