

Calculating Storm Surge Return Periods for Coastal Locations on the Gulf of Mexico

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Coastal flooding from storm surge creates natural disasters that are among the most deadly and costly to impact the United States. The most extreme of these events have occurred along the Gulf of Mexico. Examples of such disasters include the 1900 Galveston Hurricane, which claimed more than 6,000 lives, and Hurricane Katrina, the damage from which totaled more than 80 billion U.S. dollars.

Storm surge, however, remains poorly understood by both coastal populations and the scientific research community. Lives and property of coastal populations are endangered as people underestimate flooding potential by confusing storm surge levels with wave heights, or predicting surge based on Saffir-Simpson wind speed category. Meanwhile, storm surge modeling remains a frontier in meteorology and oceanography, as surge forecasting models are commonly inaccurate. A noticeable lack of research on storm surge statistical frequencies hinders the improvement of both public education and scientific research.

This research provides crucial storm surge statistical information by calculating the return period of storm surge levels for 2-year, 5-year, 10-year, 20-year, 50-year and 100-year flood levels along the Gulf Coast. Both instrumental datasets, such as data from USGS water gages, and anecdotal data from newspapers, books, diaries, journals and photographs, are utilized to calculate storm surge recurrence intervals. These varied sources will produce a broad picture of storm surge in the Gulf of Mexico.

The research has already identified 54 USGS coastal water gages with at least 30 years of data. Coastal gages are defined as those instruments located within 30 kilometers (18 miles) of the Gulf of Mexico, with an elevation of 5 meters (16.4 feet) or less, because these gages are closest to the coast and are impacted by salt water intrusion to the greatest extent. Only gages with records through the active 2005 hurricane season are utilized.

This study also considers historical records from 1880- present, to construct an anecdotal history of storm surges. The location and maximum surge height are identified for as many storms as possible, as well as the number of fatalities and cost of damage. A database compiled by the Atlantic Oceanographic and Meteorological Laboratory is used as a skeleton upon which surge information is added. This database contains the names, locations and meteorological characteristics of 154 landfalling hurricanes along the Gulf Coast during the period of record.

This research project has already identified 72 surges greater than or equal to 4 feet (1.22 meters). A preliminary overview of the historical record reveals the majority of major surges, 12 feet (3.66 meters) or higher, have occurred in the western Gulf of Mexico. Of these 27 major surges, 20 of them occurred on the coast of Texas, Louisiana or Mississippi.