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Storm Surge: A Hurricane's Trump Card

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When we think about hurricanes, we think about winds, lightning, floods, and even tornadoes. People are often most scared about wind damage, but it is the storm surge caused by the water from the ocean that is most dangerous. The volume of water that a hurricane brings is most similar to the December 2004 tsunamis that struck Asia. The main difference between a tsunami and a hurricane's storm surge is that while a tsunami is a fast-moving wall of water caused by underwater earthquakes, a storm surge is steady onslaught of water caused by the hurricane's cyclic winds. The winds keep piling up water so humps of water occur over the ocean surface, which converge together as the hurricane moves forward. This surge of water normally has little to no effect out on the open ocean due to the enormous depth of the water and its large, unrestricted surface area. However, if these humps of water reach the coastline, catastrophe can occur. The depth of water decreases as the hurricane gets closer and closer to the shoreline. The water can no longer go down or spread outward due to restrictions in surface area imposed by the approaching coastline. The storm surge can only go up and forward, spilling over the coast.

The resulting damage is not the same for all coastlines; the way water from the storm surge impacts upon landfall depends upon the characteristics and relationship to the coast. First of all, the steepness of the shoreline is most vital to how hard land residents get hit by the storm surge. If the shore is shallow with the ocean, it is much easier for the water to come over and cause damage. However, if the shore is relatively steep, it is harder for the water to climb over. In low-lying areas like Galveston or New Orleans, where the shores have gentle slopes, the storm surges can climb as high as 20 feet on land. The following images show how the slopes of shores have an effect on the storm surge's impact (assuming all other factors remain the same).

Another important factor relating to storm surge impact is the angle of approach of the hurricane with respect to the shoreline. If the hurricane's path is perpendicular to the coast, more damage is possible due to the storm surge hitting the coast in a head-on fashion. If a hurricane brushes past the coast at an angle, or travel's parallel to the coast, the water won't have as much of an impact on the shoreline.

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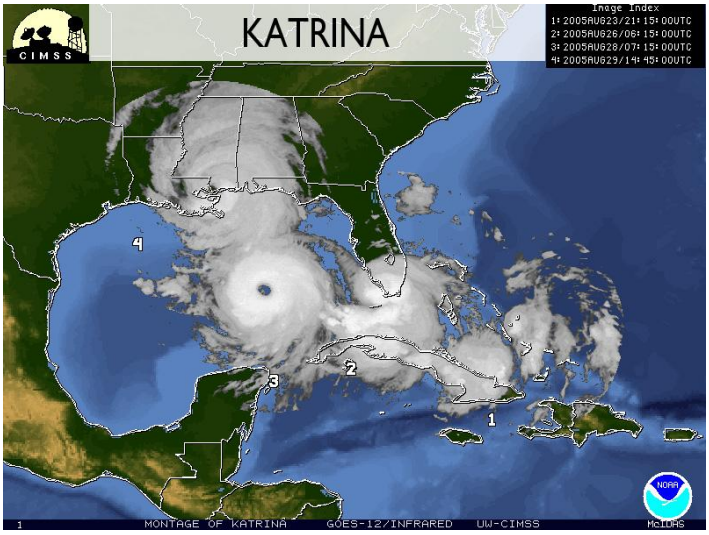
Therefore, a wide coast whose land is perpendicular to the hurricane's path will suffer the most damage, while a narrow shoreline whose shore is along the hurricane's path won't be heavily afflicted.

In the following image, the angle of approach was is important to the damage inflicted by storm surge. Cuba, whose coast is parallel to Hurricane Katrina's path, did not incur as much damage from storm surge as Louisiana or Mississippi, where the coastlines were directly perpendicular to Katrina's path. It was this direct hit that resulted in a storm surge of over 25 feet, which completely flooded almost all of New Orleans, and completely destroyed many structures such as bridges and buildings.



SOURCES AND RESOURCES:

- Storm Surge Overview
  http://www.nhc.noaa.gov/surge/
- Storm Surges Simulation by Carol McRight
  http://www.create.cett.msstate.edu/cosee/cosee-lplan_view.asp?articleID=18
- Storm Surge: Information, Facts, and Resources
  http://www.thefreeresource.com/storm-surge-information-facts-and-resources
- Kerry Emanuel: Hurricanes in the Gulf of Mexico: The History and Future of the Texas Coast
  http://www.esi.utexas.edu/k-12-a-the-community/hot-science-cool-talks/gulf-hurricanes-our-history-and-future
- Highlights From the 2005 Atlantic Hurricane Season
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