The Influence of Climate Change on Hurricane Wind Retrofits to Buildings

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Background/Objectives. Numerous studies have evaluated the increased risk to buildings from hurricane storm surge due to climate change, but little has been done to evaluate the increased risk from hurricane wind. Studies have suggested that hurricane wind speeds are predicted to increase due to climate change, but the percent increase in wind speed does not indicate the increase in building damage. This problem is further complicated since the cost-effectiveness of incorporating retrofits into buildings is influenced by the time-value of money. An analysis was performed to evaluate wind retrofits to both non-residential and residential buildings in approximately 52 locations around the United States to understand the influence of climate change on the cost-effectiveness of incorporating wind retrofits.

This presentation will include an overview of the analysis, trends in the output data, and recommendations on ways that building owners, the design community, and government agencies can respond to the change in wind risk to make communities more resilient.

Approach/Activities. This study used existing FEMA Hazus wind damage functions, ASCE 7-16 wind data, and studies on the influence of climate change on wind speeds to determine the increased wind risk due to climate change. A model was developed to evaluate the climate change induced adjustment in the probabilistic risk of wind speeds. This was compared to the current wind conditions and correlated with existing wind damage functions that allowed the team to calculate damage to both residential and non-residential buildings along the U.S. coastline at 52 locations. An analysis was conducted to determine the influence of climate change in damage to example buildings and evaluate the effectiveness of common hurricane wind retrofits to buildings. Over 35,000 scenarios were evaluated to help the team understand the influence that different combinations of retrofits, wind exposures, and locations have on the cost-effectiveness of implementing retrofits. Additional analyses will provide a stronger understanding of the sensitivity when adjusting the discount rate, the average global temperature rise, and the influence of temperature on wind speed increases.

Results/Lessons Learned. The analysis indicates that there is a significant need to increase the number of wind retrofits to both residential and non-residential buildings that are subject to hurricane winds. Initial results indicate that inland hurricane-prone cities and regions with a historically low wind risk, such as New England that were typically not considered for wind retrofits, have the largest increase in cost-effectiveness. This is likely because the buildings that were not damaged during more frequent/less severe events will experience increased damage during these more frequent events caused by the increases in wind speeds.