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Society for Risk Analysis

Researchers Develop Improved Analysis for Predicting Hurricane Power Outages
Study to help utility companies speed repairs

As the hurricane season shifts into fall a new study presents an improved analytical tool for predicting potential power outages and helping utility companies deploy repair crews in advance of hurricanes and other storm events.

"Hurricanes have caused severe damage to electric power systems throughout the world, and electric power is critical to post hurricane disaster response as well as to long-term recovery for impacted areas," said study co-author Seth Guikema of The Johns Hopkins University. "Effectively predicting and managing power outage risk can dramatically improve the resilience of infrastructure systems and speed up restoration of electric power."

Based on data from power outages following Hurricanes Katrina (10,105 outages), Ivan (13,568 outages), Dennis (4,840 outages), and other events in the U.S. Gulf Coast region since the mid-1990s, the new statistical modeling approach is detailed in the article "Improving the Predictive Accuracy of Hurricane Power Outage Forecasts Using Generalized Additive Models" which appears in the October issue of the journal *Risk Analysis*, published by the Society for Risk Analysis. Outages are defined as prolonged lack of access to electric power. According to Guikema and fellow researchers Seung-Ryong Han of Korea University, and Steven Quiring of Texas A&M, their new modeling approach takes into account more environmental and power system infrastructure factors than previous analyses, which may have implications beyond hurricanes to other storms. The more comprehensive modeling "can provide more accurate predictions of the number of power outages in each geographic area of a utility company's service area and a better understanding of the response of the [utility company's] system." Using study data, the Generalized Additive Model (GAM) developed for the study outperformed previous models, which tended to overestimate outages in urban zones and underestimate them in rural areas.

The analysis, based in part on detailed geographical power outage records from a number of severe hurricanes, pooled a broad set of factors that influence the vulnerability of electric power systems to outages. It included information about: (1) winds experienced; (2) long-term precipitation and soil moisture levels at the time of the hurricane; (3) the power system components, including amount and location of infrastructure and technology capabilities; and (4) land use and land cover in each area. Soil moisture and land use/cover information were new

elements added to the model to help determine the stability of the foundation of utility poles and trees that might fall onto power lines and poles in wet conditions.

For determining winds experienced, scientists crafted a model linked more directly to actual hurricane data such as wind speed, central pressure difference, landfall timing, and the radius of maximum wind speed of each hurricane.

The team wrote, "While there is still error in the predictions, the results provide a much better basis for allocating repair crews among the different geographic portions of the service area." The analysis is designed to help utility companies develop better power outage estimates and make more effective pre-storm decisions about the number of crews to request through mutual aid agreements, as well as the locations at which crews and materials should be staged in preparation for a recovery effort. The study notes, "Requesting extra crews is costly, and placing them as near as possible to the locations where the worst damage will occur is critical to the rapid restoration of electric power." Data were provided by an anonymous utility company in the U.S. Gulf Coast region, which was also a funder of the study.

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Note to editors: The complete study is available upon request from Lisa Pellegrin/Steve Gibb or at: http://www3.interscience.wiley.com/cgi-bin/fulltext/122542675/HTMLSTART

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