The Weather Company
An IBM Business

Rapid Response

How outage prediction models help utilities get power back on quickly and save money after a storm

IBM

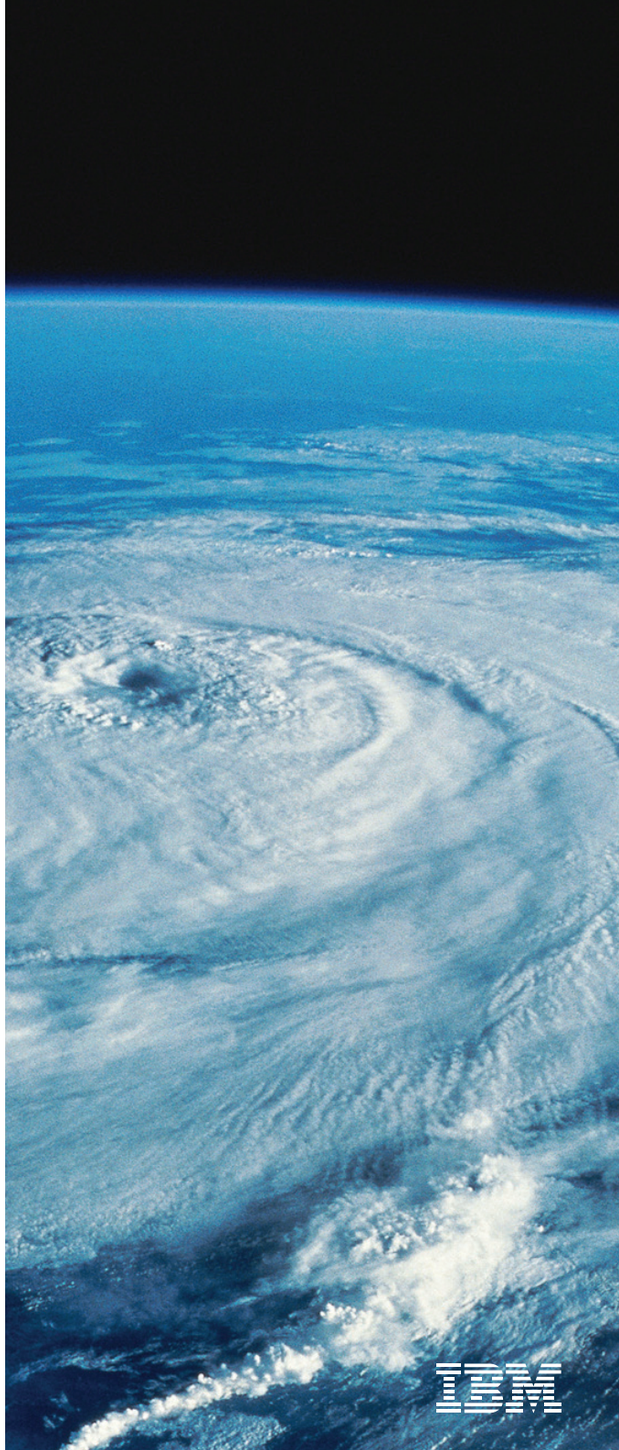
Two names will undoubtedly dominate memories of the summer of 2017: Harvey and Irma. On August 26, Hurricane Harvey inched its way through the Gulf of Mexico over Texas, unleashing winds of up to 130 mph and dumping 52 inches of rain in so me places.

Even before relief efforts to contend with the catastrophic flooding and property loss in cities like Houston had fully ramped up, Hurricane Irma was gaining strength in the Caribbean. As the most powerful storm to reach the U.S. mainland since Hurricane Katrina in 2005, Irma hit Florida on September 10, generated 185 mph winds, and caused flooding in cities from Miami to Charleston, S.C.

The first half of 2017 had already seen a moderate amount of storm activity, with five weather events causing an estimated $1 billion in economic losses. But the preliminary estimates of damage due to Harvey and Irma make that six-month stretch seem like a welcome streak of halcyon weather. Losses from Harvey have been pegged at $190 billion – making it the costliest disaster in U.S. history – while damages from Irma are expected to be between $50 billion and $100 billion.

Though this quick succession of powerful storms was an anomaly – it was the first time in history two category 4 and above hurricanes hit the U.S. mainland in the same year – it may be a harbinger of things to come. Warmer oceans and higher sea levels are expected to make storms more intense and damaging. These two impacts of climate change are transforming seasonal Nor'easters and rainstorms into something far more dangerous.

Events that were routine are being made more severe by other factors, and the sheer magnitude of storm events is becoming more intense



The need for speed

While storm impacts are important to everyone in their path, they are a major concern to the utility companies whose responsibility it is to restore power as quickly as possible. This is especially true in the aftermath of large storms like Hurricane Irma, which knocked out power to more than seven million homes and businesses in the Southeast. Whether power has been out for an hour or a week, utilities understand that customers and regulators expect them to work quickly to get the lights back on. But they also know that a quick response is just good business. Power outages mean lost revenue because homeowners and businesses can't purchase kilowatt-hours – and fast and effective storm response can dramatically trim expenses.

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An inadequate and expensive quo

None of this is news. Indeed, utilities are keenly aware that responding quickly to storm-related outages is key to keeping customers happy and pleasing both policymakers and regulators. According to a recent survey from The Weather Company, an IBM Business, nearly 90% of utilities say that the potential impacts of adverse weather shape their operational decisions, with 59% saying that weather had either a “strong” or “very strong” influence on their operational decisions.

Leaders of utilities aren’t under any illusions that storms will abate in their intensity or their capacity to inflict damage any time soon. According to The Weather Company survey, 94% expect that the impacts severe weather will have on their operational decisions will stay the same or grow in importance over the next three to five years.

While storm response is clearly on the minds and priority lists of many utility executives, the tools with which they respond to damaging weather events are often inadequate. Many depend on local weather forecasts to plan their storm response while others simply react as best as they can to unfolding weather events. This reactive approach to making decisions about where to stage crews and deploy resources often leads to delayed and overly expensive responses.

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Too much preparation can be as bad as too little

It's logical to assume that not doing enough to prepare for outages can have bad consequences, but mobilizing for storms that don't materialize or cause outages is also problematic. This has been the experience of Oncor, a transmission and distribution utility that serves nearly 3.5 million customers in the northern part of Texas. According to Hagen Haentsch, Oncor's director of Distribution Operations Center, the utility has to contend mostly with ice storms, high winds, and thunderstorms.

Haentsch says that, when large storms are imminent, Oncor takes an all-hands-on-deck approach to mobilizing the necessary personnel and resources. Though Haentsch believes that level of response is appropriate for big storms, he sees the potential for improvements in handling smaller events. "The opportunity is in the smaller and medium [storms], where you are holding shifts over during a local weather event," he said. "That is when we burn resources because we thought we needed them, and then [the storm] kind of fell apart five miles outside of town. Those are the kinds of inefficiencies we see throughout the year."

These over-mobilizations can add up, even if they involve relatively modest individual price tags. Mary Glackin, head of government affairs and weather forecasting for The Weather Company, gives the example of a large investor-owned utility that mobilizes 50 times each year for weather-related outages at an average cost of $150,000 per event. "Twenty of those were unnecessary or could have been optimized," said Glackin. The annual tab for not responding in a more efficient manner: $3 million.

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Better response through data

The Weather Company survey found that 77% of utilities that mobilize in advance of storms regularly overestimate the amount of materials and/or resources they will need. This miscalculation and waste can be exacerbated because regulators won't consider reimbursing money spent prepping for storms that never materialized.

According to The Weather Company, a clear majority of utilities understand the need to do a better job predicting the potential localized impact of approaching storms. In the aftermath of Hurricane Sandy in 2012, utilities put a lot of emphasis on upgrading physical hardware and infrastructure, like power lines and smart meters. What has often been missing, however, is a big upgrade to the IT and computing systems utilities use to make decisions based on the data generated by the newly installed infrastructure.

This may well be changing. For example, The Weather Company survey not only found that a clear majority of utilities know they need to do a better job predicting the localized impact of approaching storms, an even larger percent saw data and technology as vital to achieving that goal. In fact, 70% of utilities surveyed believe that data-driven prediction tools will help reduce outage durations.

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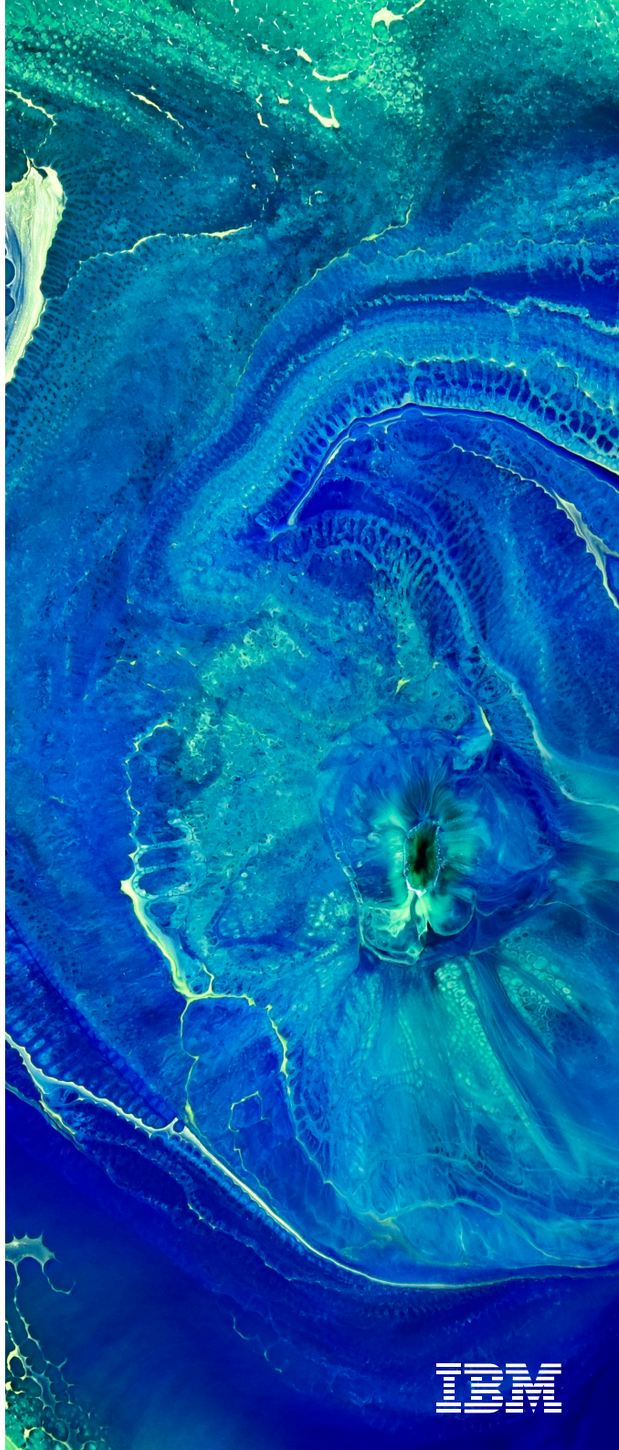
How an outage model works

The types of data-driven prediction tools that can help improve storm response are already emerging. But because these sophisticated tools combine machine learning, the Internet of Things, and a wealth of weather and outage data, it's no surprise utilities aren't building them alone. Utility staffs are stretched thin as it is, which is why the quickest way to take advantage of these rapid advances is to partner with the world's leading data science experts.

For example, The Weather Company recently introduced its Outage Prediction Model, which provides utilities with an easy-to-use tool to help guide storm-response decisions on a hyperlocal level. The model helps utilities make concrete decisions about the right resources and personnel to mobilize as many as 72 hours before a storm arrives.

In part, the model is so powerful and localized because it incorporates outage data that utilities routinely gather, collecting at least three years (though more is better) of outage tickets, which are basically reports of when and why customers have lost power. That information is then paired with at least three years of a utility's weather forecast history on the neighborhood level.

Combining these two data sets is an important step to properly train the model to predict how different storms may impact specific locations in a utility's service territory. As every utility service territory has different weather and different sensitivities to its infrastructure you should consider integrating data about 30 different storms over several years and the outage tickets to train the model and see what kind of damage and outages occur as a result of different weather conditions.



While important, the customized and local data on storms and outages is only part of what makes the model effective. Instead of relying on a single local weather forecast, the model utilizes The Weather Company's Forecast On Demand (FOD) system to track storms. The FOD system draws on 162 global weather models (a number that will soon increase to over 200) and data from over 250,000 weather stations around the globe.

> ***When you use multiple models, you minimize the risk of missing a storm, and it makes your model more valuable.***

Machine-learning helps the model avoid any of the inevitable and natural biases humans apply to weather scenarios. For instance, if a hurricane is heading towards an area, a person may have expectations on the amount of rain and wind. A machine-learning model doesn't. It's agnostic to the type of weather. When it builds the weather to outage connection, it looks at winds of 70 mph and determines the number of outages. AI helps build those relationships based on conditions, not preconceptions.

What does this all look like in the real world? Imagine that a utility equipped with the model gets a forecast that its service territory is about to be hit by a storm carrying 50 mph winds and three inches of heavy, wet snow. The outage prediction model can identify the past three storms with similar characteristics, and analyze the data about how 50 mph winds and three inches of wet snow may impact your infrastructure. As a result, utilities would be able to identify how many outages they are more likely to see and where in the utility's service territory they will likely be.

This type of accurate and local information, particularly delivered well in advance of a storm, can be used to guide better decisions. For instance, utilities can use it to make necessary requests for mutual assistance, schedule their storm response staff to work overtime, and ensure they have the right tools and materials needed to respond. If you know what kind of damage is likely to happen, you'll know whether you should have poles or transformers ready to go and the appropriate crew(s) to do the work.

Proactive storm response not only means getting power back on and meters running again quickly, it delivers substantial savings. According to an IBM Business Impact Assessment for a large US-based investor-owned utility, it can mean savings of between $3 million and $6 million per year. It also represents a much needed paradigm change. Ultimately, it is about getting better information earlier to make the best choices about responding to storms.

The Weather Company
An IBM Business

The Weather Company, an IBM Business, is the world's largest private weather enterprise, delivering up to 26 billion forecasts daily and the most accurate, personalized, and actionable weather data and insights. It helps millions of consumers and businesses make better decisions via its enterprise and consumer products from The Weather Channel and Weather Underground.

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