



# Weather Intelligence for Telecoms

[www.dtn.com](http://www.dtn.com) • 877.845.6598

© 2020 DTN, LLC, all rights reserved. "DTN" and the degree symbol logo are trademarks of DTN, LLC.



## Building and maintaining telecom towers effectively and safely with weather data

With nearly 400 million cell phones in use in the United States, there's no question that wireless service is an essential part of modern life. In fact, there are more than 300,000 telecom towers at the core of the wireless infrastructure. Building, maintaining, and upgrading these towers is crucial work that keeps the wireless industry working seamlessly. Understanding the implications of the weather is a key factor in managing the structural and performance integrity of towers, keeping workers safe, and providing a constant, available signal.

Tower operators face many weather-related challenges, including safely conducting repairs and maintenance, ensuring reliable wireless service — particularly for emergency services — and handling incident management. Read on for insights into how U.S. weather trends impact telecom infrastructure and how accurate weather data can support more efficient operations and maintenance work. It can even contribute to better decisions around protecting people and assets from high-impact weather events, as well as help minimize and prevent outages.

There are more than 300,000 telecom towers at the core of the wireless infrastructure

Over the last decade, extreme weather losses have totaled \$476 billion

Lightning is the number one natural cause of system failures

## Convenience and critical services

Beyond the convenience, we've all come to rely on cell phone technology. Reliable cell phone access for critical services offered by government agencies and first responders is necessary for immediate emergency responses — especially when lives are on the line.

- 80% of all 911 calls are made by cell phones
- During emergencies, companies can't send alerts or update their websites, making it impossible to reach people

## Importance of a consistent power source

Studies show that weather disrupts up to 70% of companies' operating and financial performance, globally. For U.S. businesses alone, it costs nearly \$630 billion a year.

With hundreds of thousands of telecom towers in the United States, they are critical to the infrastructure. Whether it is the lattice towers, monopole towers, or guyed masts rising more than 200 feet into the air, they must be well maintained to ensure consistent service to the millions of U.S. cell phone users.

As careful and thoughtful as telecom tower operators are in trying to ensure peak tower performance, they are reliant on power companies to provide consistent power without interruptions. Coupled with the fact that telecom tower operators are not required to have back up power, outages affecting wireless service are a genuine concern. For those who use cell on wheels (COWs), there are challenges as well. Generators and batteries both have limited duration — hours or days — and when they run out, crews must refuel or install new generators, which can be difficult without cell phone access. Considering all factors, access to reliable power sources is vital.

Many power outages are attributed to increasingly volatile weather, which not only impacts tower performance but the safety of maintenance workers. Due to the number of superstorms in recent years, there have been thousands of outages, and utilities have spent significant unplanned dollars on recovery and restoration efforts. These outages have a significant impact on a tower's service. Here are some key figures:

- Outages due to the weather: 44%
- Major grid disruptions related to the weather: 78%
- The frequency of major outages has increased six-fold in the past 20 years
- Over the last decade, extreme weather losses have totaled \$476 billion

If you look at other recent trends, such as extreme rainfall, it also indicates that this volatility will continue.

## Weather-related impacts on U.S. telecom towers

A network's resilience is increasingly important as the frequency and intensity of severe weather continues to rise. There are several weather events behind outages, including extreme hot and cold temperatures, severe thunderstorms, ice and snow, and fires. Each can cause tower damage and power outages, compromising service.

Working to understand weather patterns and having access to accurate, targeted forecasts can help operators proactively plan for severe weather impacts. This can help reduce vulnerability, save money, and even determine potential options for rerouting cell traffic to manage load — without disrupting service.

### Extreme temperatures

According to the American Meteorological Society, the global climate has seen a 1.4-degree Fahrenheit warming since 1901, which has ultimately impacted the weather every year. To put it into perspective, nine out of the 10 warmest years on record have occurred since 2005.

These extreme temperatures can create service reliability issues. Temperature increases and higher frequency, duration, and intensity of heatwaves can create additional burdens on cooling systems in exchanges and base stations that can result in increased failures. It can stress telecom towers and the related equipment, ultimately reducing lifespan. Extreme temperatures also spike energy demands that can result in the need for incident management, affecting the delivery of telecommunications services. All of these issues can ultimately increase tower operation costs.

Outside of the infrastructure impact, extreme heat may lead to an increase in heat-related health and safety risks for tower workers.

### Precipitation

Interestingly, both increased and decreased precipitation, in varying forms, can impact tower integrity and performance. Icing during rain or snow typically comes to mind when thinking about precipitation damage. But, it's not just ice that causes problems. Increased rain or snow also create issues. Flooding and erosion can cause damage around structures, potentially exposing cables and creating transportation and accessibility issues for maintenance crews. Conversely, decreased precipitation or drought-like conditions can lead to tower instability, requiring added maintenance. A lack of rain, especially when combined with increased temperatures, also raises fire risks, which poses a threat to infrastructure and the potential for long-term outages.

### Fires

The number of large fires in the United States has steadily increased over the last 35 years, especially in the West. This is likely due to warmer temperatures, decreased soil moisture, and vegetation, as well as years of forest management and fire suppression practices.

As wildfires become more common — and more destructive — they create a challenge for telecom tower operators as wireless providers struggle to deliver reliable service during these events. A recent report from the California Public Utilities Commission found that nearly 100,000 wireless customers lost service during the 2017 North Bay fires. And, more recently, the Federal Communications Commission said that up to 27% of Sonoma County's

wireless cell sites were offline during the Kincadee fire in October 2019. This spurred regulators to push for backup power at cell towers after residents lost wireless access to critical emergency services.

### Lightning

One of the most visible weather hazards, particularly with increased storm frequency, are lightning strikes. They can damage transmitters and other tower components, causing power outages. Cloud-to-ground lightning occurs 20 to 25 million times every year in the United States, and the height of telecom towers makes them vulnerable targets. Taking all possible precautions using lightning rods and other methods for physical asset protection is key. However, most important is creating a disaster recovery plan that includes critical first steps after a strike occurs, all the way through electronic replacements and physical tower repairs.

## Leveraging weather data for more efficient operation and maintenance work

Employing accurate weather data is a great way to gain control and drive informed maintenance and safety decisions. It can also help improve the bottom line.

### The importance of a skilled weather partner

It's important to understand all of the work that goes into producing quality forecasts — including the costs, computing power, and human effort. Given that, it's easy to see why so few companies bring weather guidance in-house and why an outside partner is necessary. It takes a significant investment, massive infrastructure, and experienced expertise to provide real value. Beyond the financial costs of gathering the "back end" data required for a forecast, a private weather company must have the capability to house large amounts of data. Companies that choose to contract with a private forecasting company buy access to meteorologists, who are available around the clock, as well as features like portals and apps that provide access to customized solutions — for a fraction of the cost if they had to do it themselves.

"It's really a package deal when contracting with a private weather company. They offer the science of meteorology while performing as a big data company."

Mike Eilts, senior vice president, DTN

### Working with weather data

Most weather data is natively digital: surface observations, radar data, and weather satellites are a few examples. This creates enormous amounts of information about the existing state of the atmosphere. Much of the data preprocessing is for quality control and to combine it all into a comprehensive picture of the atmosphere. This is the starting point for creating a forecast using sophisticated, numerical weather prediction models run on high-performance computing clusters or supercomputers. Using an ensemble of individual models results in better forecasts and empowers advanced users to model potential risks in a probabilistic manner. Even though the techniques applied to produce forecasts continue to evolve, the starting point is a quality set of observations that accurately describe the state of the atmosphere.

Using weather data for planning  
As tower operators increase their understanding of digital information, they can quantify the effects of weather on their business much more quickly and accurately than before. Sophisticated businesses are incorporating weather data into their decision support systems and operational intelligence. As organizations engage in digital transformation, they evolve from using weather information to react to emerging or past weather events to incorporating it with other business data to drive long-term strategic decisions.

Once a company unites weather data and other operational data, it can combine it with artificial intelligence for recommended actions that drive business outcomes — before a severe weather event even happens.

Taking things a step further, it can be used in predictive analytics to improve operational efficiencies, as well as save time, costs, and lives. It removes the guesswork for decision-makers when weather threatens their operations, such as major winter storms, landfall hurricanes, or prolonged heatwaves. Predictive analytics are also just as useful in marginal weather conditions like thunderstorms.

### How weather data contributes to the bottom line

The utility industry has effectively been using weather data to help drive more efficient business practices. The majority of U.S. utilities are working with private weather companies and have already demonstrated how to effectively use weather data and predictive analytics to increase efficiencies and reduce outage times. In particular, major utilities in the Northeast rely on outage prediction solutions to make complex decisions in the days leading up to a forecasted storm that may produce power outages in their service territory. Partnering with weather intelligence companies helps them plan and prepare for outages, often deploying crews in advance so they can restore power faster.

Telecom tower operators can use the same approach, using predictive analytics for more efficient and effective weather incident preparation.

## Protecting people and assets from volatile weather

Whether a carrier upgrades existing or places new equipment, it often involves someone climbing a tower. For maintenance purposes, the crew may look at the structural configuration of the tower or an equipment mount, or perform an inventory of current equipment and its placement — all to determine the modifications needed to reduce the risk of failure. Whatever its age or purpose, it's important to make sure that the equipment offers continual, reliable service.

### Protecting assets

In terms of weather implications, lightning is a real threat to the reliable operation of a telecom tower. A single direct strike can result in physical tower damage and cause electronic components to fail. Lightning is the number one natural cause of system failures, and as a result, can lead to a tower being out of service and, ultimately, lost revenue.

Direct lightning strikes — and their related electrical surges — are virtually unavoidable for telecom towers due to their height and electrical components. When lightning strikes a tower, the current flows through it to the ground, potentially damaging electronic equipment, like radios, antennas, dishes, etc., mounted on it. However, with proper planning and preparation, operators can minimize damage and outages, along with any lasting effects.

Typically, the relationship between carriers and tower employees is complicated, and there are often many contractors and subcontractors involved in construction and maintenance. This can result in confusion as there aren't always clear responsibility guidelines about who is performing what work and when. The responsibility for employee safety follows suit, and often there is no single company in charge of managing it.

### Crew safety in inclement weather

Tower work should be avoided when weather conditions pose safety risks, and lightning is a constant risk to tower climbers. Between 2006-2015, lightning accounted for 11% of work fatalities. Tower height puts maintenance crews at significant risk if they aren't given enough time to seek shelter.

Just watching for lightning and listening thunder isn't an option. By the time maintenance crews hear thunder, it is already too late. Their job is to safely and skillfully complete their tasks, which is much easier without the added distraction of trying to keep an eye on developing weather conditions. Crews need timely, actionable alerts to ensure their safety and maintain their focus.

Supervisors and workers must stay aware of lightning risks through weather reports and forecasts. Many companies provide customizable applications and programs that provide up-to-the-minute information on weather hazards, including lightning. This allows supervisors to make critical safety decisions. It is important to note that lightning can be unpredictable, and can strike as far as 10 miles away from precipitation, which is why workers must remain in a shelter or vehicle for 30 minutes after the last clap of thunder.

Telecom tower operators have the duty to protect their employees from danger. Available commercial weather intelligence is easy to implement and cost-effective. It also provides additional benefits beyond safety, including technology that can identify towers needing inspection, which may have been affected by lightning or severe weather.

“When weather forecasts are used in conjunction with other data, it can create quantitative predictions, including an estimate of the outage incidents in a utility’s service territory, prior to a storm’s arrival.”

Mike Zappone, utility industry consultant

### Preventing and minimizing the duration of outages

In addition to supporting decisions around telecom tower building and maintenance, weather data and technology play a critical role in helping utilities ensure consistent power and shorter outage times.

A promising new approach for managing outages is machine learning. Whether it’s called machine learning, predictive analytics, artificial intelligence, or neural network algorithms, this emerging technology offers a more sophisticated approach to predicting damage and outages.

With the growing application of machine learning in business — from streaming content services recommending products and services based on one’s browsing habits to manufacturers estimating equipment time-to-failure — it can be used by tower operators as well.

Utilities, in particular, are realizing that using weather forecasts in conjunction with other data creates quantitative predictions, such as outage estimates before a storm’s arrival.

Machine learning technology can determine where outages will be throughout a utility’s entire network, identifying areas that will be most affected, allowing operations teams to better plan staging, pre-positioning, or simply alerting local crews. It can also provide useful resiliency insights, highlighting areas of weakness, as illustrated by outage incident history and the damage forecasts themselves.

Machine learning can provide an effective prediction of a storm’s impact and the projected damage to cell towers. The use of this information will continue to grow as a major driver in weather preparation and restoration response decisions. Machine learning also supports the right levels of preparation — before the storm — reducing the frequency of being under or over-prepared.

### How we can help

With weather’s major role in telecom tower performance and integrity, it’s important to have accurate, timely weather data to support confident, targeted decisions. It can help you better assess your assets and plan repairs and maintenance before disaster strikes.

For more information on how our WeatherSentry® solution can help you do this and more, please visit [www.DTN.com](http://www.DTN.com).

## Sources

<https://www.celltowerleaseexperts.com/cell-tower-lease-news/cell-tower-industry-facts-figures-2016/>

["Facing Down Extreme Weather," IDC Energy Insights, July 2013](#)

<https://www.gov1.com/emergency-management/articles/behind-the-badge-metro-net-dispatchers-adjust-to-new-tech-V12OoNnOTEJFbqIN/>

<https://science2017.globalchange.gov/chapter/8/>

California PG&E Blackout during wildfires

<https://huffman.house.gov/media-center/in-the-news/why-cell-phones-failed-in-pgande-outages-and-how-to-prevent-a-repeat>

<https://www.latimes.com/california/story/2020-01-08/california-to-examine-effect-of-blackouts-on-communication>

[Climate Risks Study for Telecommunications and Data Center Services](#)

<http://engineering.electrical-equipment.org/electrical-distribution/top-10-causes-for-power-system-failures-part1.html>

[https://www.weather.gov/media/owlie/OSHA\\_FS-3863\\_Lightning\\_Safety\\_05-2016.pdf](https://www.weather.gov/media/owlie/OSHA_FS-3863_Lightning_Safety_05-2016.pdf)