Winter Storm Stories

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Introduction:

Over the past 10 years, major freeze events and winter storms have caused more than 30 billion-dollar disasters totaling more than **$140 billion** dollars. These extreme cold events, often referred to as cold snaps, have been influenced by both natural climate variability and human-induced climate changes.

While it might seem counterintuitive to global warming trends, swings in extreme temperature shifts can result in more precipitation available for major winter weather events and can result in 'heavier hitting' events.

Areas which have historically seen few freeze events could experience more damaging winter storm events as the jet stream becomes unstable earlier in the year from widespread abnormal temperature variations. This instability causes deeper, slow-moving low-pressure systems that cause larger associated winter storms and deeper intrusions of cold, arctic air.

Let's explore some notable winter weather events and their impacts with DTN experts.

What defines extreme cold?

Extreme cold is temperatures that are lower than historical averages persisting for at least two consecutive days and create a dangerous environment for people, animals, and critical infrastructure. What constitutes as 'extreme cold' can vary across different areas of the country. For instance, what constitutes an extremely cold event in Texas is markedly different from one in Minnesota.

The April nor'easter serves as a reminder of the Northeast's vulnerability to late-season winter storms, with climate variability contributing to unpredictable weather patterns.

Spring nor'easter: snow buries spring blooms

While spring was technically underway, a fierce **nor'easter** swept across New England on April 4, 2024. It in its wake was a trail of heavy, wet snow and high winds, marking one of the most significant late-season storms.

Meteorologist Brad Nelson, a risk communicator at DTN, explained how a classic nor'easter turned into spring blizzard.

"It is not unusual for the Northeast to experience a nor'easter, which are storms formed when cold, arctic air over land collides with warm, moist air being drawn in from the ocean," Nelson noted. "And it is not unusual for the area to see snow in April. But this storm dumped double digit amounts of wet snow in a short amount of time, which is certainly abnormal for the time of year."

Parts of Maine and New Hampshire reported accumulations of over a foot in just a few hours.

Nelson said strong winds with gusts reaching up to 60 mph, combined with the heavy, wet snow, exacerbated already hazardous conditions.

The powerful winds and wet snow weighed down trees and power lines, leading to widespread power outages. At the height of the storm, more than **700,000** homes and businesses were without electricity, with Maine and New Hampshire bearing the brunt of the impact.

The timing and severity of the storm complicated recovery efforts, as crews struggled to restore power amidst icy roads, fallen branches, and frigid conditions. In some of the hardest-hit areas, power outages persisted for several days, sparking community response efforts and emergency assistance for those affected by the cold.

Transportation in the region also came to a near halt, with major highways blocked by snowdrifts and dangerous road conditions further impacting restoration efforts.

The April nor'easter serves as a reminder of the Northeast's vulnerability to late-season winter storms, with climate variability contributing to unpredictable weather patterns. The extensive outages and prolonged restoration efforts underscored the importance of infrastructure resilience in the face of increasingly unpredictable weather patterns.

A Complex Storm: North American Winter Storm 2024

Most winter storms are identified by the dates of impact and type of weather, but when a winter storm like the one in early January 2024, impacts most of the country, it earns the moniker "North American Winter Storm."

The massive storm demonstrated an unusual level of complexity, combining multiple severe weather phenomena that impacted Florida to Maine.

DTN Risk Communicator and Certified Consulting Meteorologist Kevin Mahoney explained that the storm tracked from coast to coast, bringing heavy snows to the Rockies, blizzard conditions to the plains, culminating to a Nor'easter up the Eastern Seaboard.

The storm brought heavy snowfall to the Northeast, with areas of Pennsylvania and New York receiving up to two feet of snow, leading to widespread power outages and dangerous road conditions. This large-scale weather system left nearly 900,000 homes and businesses without power, impacting communities already facing the challenges of cold winter weather.

Snow and heavy precipitation cause widespread outages, flooding, and business and school closings.

![DTN logo]

Thirty-eight confirmed tornadoes occurred from Louisiana to North Carolina over three days, causing structural damage and power outages.

"In addition to snowfall, the storm created coastal flooding impacts, particularly along the New Jersey and New York coasts, as a combination of heavy rainfall, high tides, and onshore flow essentially caused a storm surge like a tropical system would," Mahoney explained.

The flooding complicated recovery efforts and increased damage, especially in low-lying areas. Emergency crews had to respond to both snow removal and flood-related rescue operations, underscoring the storm's multifaceted impact.

Across the Southeast U.S., this storm also brought severe thunderstorms and tornadoes, which are relatively rare but can still occur during winter months. The Gulf Coast and Southeast U.S. were particularly affected.

"This large winter system fed off the abnormally warm conditions across the Gulf while drawing in cold air from Canada. This provided prime conditions for development of a strong low-pressure system to produce heavy snow, high winds, and severe thunderstorms simultaneously," Mahoney explained.

The storm's multifaceted weather impacts highlighted the challenges of forecasting and managing such an expansive weather event. Its complexity underscores the evolving nature of extreme weather, with winter storms now more frequently exhibiting characteristics traditionally seen across multiple seasons. It also emphasizes the importance of emergency preparedness and infrastructure resilience for all types of weather conditions, no matter the season.

A bomb cyclone for the holidays: winter storm December 2022

In late December 2022, a winter storm unleashed its fury across a vast swath of North America.

"The storm's genesis was rooted in an intense arctic cold front sweeping southward from Canada," explained DTN meteorologist and risk communicator Jordan Van Auken. "Driven by a rapidly deepening low-pressure system, the storm evolved into a formidable bomb cyclone."

She noted the meteorological phenomenon, characterized by a swift drop in atmospheric pressure, resulting in hurricane-force winds in some regions, amplifying the storm's destructive potential."

As the fast-moving system collided with warm, moisture-laden air from the Gulf, it triggered heavy snowfall, blizzards, and dangerously cold temperatures across most of the United States and parts of Canada. Michigan, New York, Ohio, Pennsylvania, Wisconsin, and Illinois were among the hardest-hit states. However, the storm's reach extended far beyond, plunging areas as far south as Texas, Georgia, and Florida into a deep freeze, with wind chills dropping to unprecedented lows in regions unaccustomed to such extreme cold.

Snowfall Analysis:
December 20 - December 24
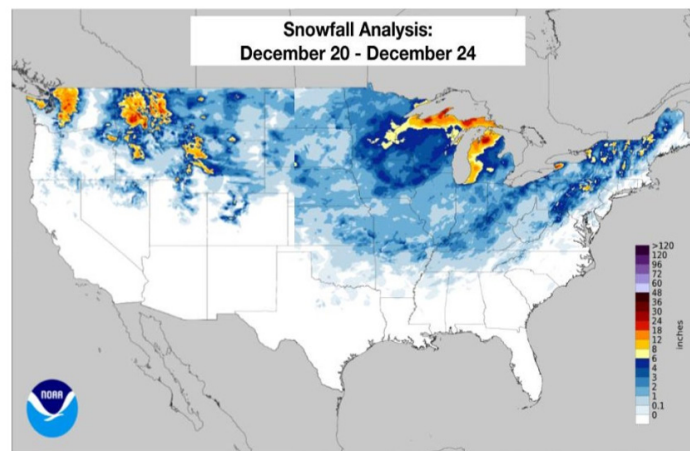
Approximately 72% of the country were under winter weather warnings and advisories.

At the storm's peak, over 1.7 million customers found themselves without power as high winds and ice accumulation wreaked havoc on power lines. The event almost caused the collapse of power and natural gas systems in parts of the eastern half of the country.

Some areas endured blackouts lasting several days due to the challenges of repairing infrastructure under such harsh conditions and overwhelming energy demands.

With roughly 72% of the country under some form of winter weather warning and advisories and utilities across the states working relentlessly to keep the power on, this bomb cyclone will long be remembered as a weather event of historic proportions.

How can utilities prepare for extreme winter weather?

As if ensuring power is always delivered efficiently to customers isn't challenging enough, extreme winter weather events can cause issues that extend far beyond the initial impact.

Weather data and insights are a great starting point – but there is more data intelligence available to help utilities be more weather resilient.

The first step is a post storm analysis to examine what happened before the storm, the challenges during the event, what variables created extreme impacts and how the information can be used to better plan and prepare for the next big winter storm before the temperatures drop.

Before the storm

Nobody knows the weather challenges faced in a region better than the utilities that operate in them. Different regions have their own characteristics – for example, southern regions may have a lower resilience threshold for snow, ice, and wind compared with northern regions.

Use this knowledge to assess the specific weather threats in the region, existing and potential, to create a weather threshold matrix.

For example, at what cold temperature does it affect grid resiliency? At what point does wind speed and frigid temperatures impact transmission lines? At what temperature point and time does demand in the area traditionally spike?

Create action items based on risk analysis. If the roads to a key substation are likely to be snow or ice covered, at what point is preventive action necessary to keep the road clear? When temperatures dip to a certain degree and precipitation reaches a certain threshold, what preventative actions are necessary?

Build a matrix with the identified thresholds and what actions are triggered when the weather risk is evident.

During the storm

Weather data alone is not enough when predicting outages. Smart tools and modelling technology give a deeper level of data to base decisions on. Utilize outage prediction tools and AI models to understand the potential magnitude of outages. Knowledge is power – establishing the worst-case scenario can save you stress later on.

Use this intelligence to mobilize staff and equipment ahead of time. Think strategically and keep a close eye on weather events that could indirectly impact your operations. Don't stop at your local area – look at areas where mutual assistance may be required in all areas of impact.

Leverage global weather intelligence platforms to understand the potential impact of storms. Use the most detailed weather sources available to drill down to street-level granularity accurately to assess the specific risks throughout different regions.

Deploying your resources early in strategic locations can help facilitate quicker restoration of outages.

Invest in advanced analytics for utilities

Preparing for the future means analyzing the impact of previous storms in the region. In addition to a post-storm analysis, an investment in advanced analytics can help to predict what may happen in the next storm. A system that uses machine learning can use this information to inform and predict the magnitude and severity of future outages when a storm is on the horizon.

A comprehensive forecast can help confidently right-size resources, restoration efforts, and requests for mutual assistance with minimal guesswork.

Utilities can make better-informed decisions with new, right-time, utility industry-interpreted weather intelligence through weather application programming interfaces (APIs). Weather APIs enable utilities to access and integrate raw, comprehensive weather information into various applications and legacy systems. With real-time, integrated insights, utilities can confidently anticipate, prepare, and respond, restoring service with timely data modeled specifically for critical utility industry planning.

DTN also offers expert, industry-specific meteorologists that can consult with customers in real-time, around the clock, to help them make decisions when the weather is either impacting them or is forecast to reach risk thresholds. In addition to providing weather forecasts, technology can also help utility companies improve their infrastructure and response plans.

Get the right intelligence for the right response

Utility companies will always find it challenging to keep power on during winter storms, especially when nature throws a weather anomaly. But by understanding the unique challenges different types of winter weather present and mitigating these threats, outages and challenges can be minimized. Data and intelligence are critical for agile, confident decisions.

Weather APIs deliver constantly updated weather information that can be easily integrated into existing systems. Combined with a utility's own data streams and unique datapoints, they have better scope of potential weather impacts and disruption to their service areas.These valuable insights can be the difference between a short outage and a full-scale crisis.

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Learn more

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