



Risk Mitigation Consulting Inc.

Intelligence and Analysis Division

WHITE PAPER SERIES

Case Study: February 2021 Winter Storms

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INTENT

This white paper is designed to provide analysis of relevant, publicly available information on threat and hazard events/trends and their potential impacts to the interests of the United States, both at home and abroad. This product is not intended to be an all-encompassing assessment of the subject.



Case Study: February 2021 Winter Storms

Introduction

February 2021 brought a number of winter storms across the United States. These storms had significant impacts, to include death and injury, impacts to infrastructure, transportation, and the supply chain, as well as impacts to the COVID-19 pandemic. This paper is not intended to serve as an all-encompassing recap of the storms, rather, it seeks to highlight some of these impacts and interdependencies that can be stressed by extreme weather conditions. Additionally, this paper will briefly examine the role varying regional vulnerability plays in the severity of the aforementioned impacts.

Overview/Timeline of Storms

In February 2021, a series of winter storms hit the United States, breaking temperature records across the country. A total of nine winter storms occurred from 24 January to 19 February 2021. Four winter storms hit within days of each other, from Feb. 11-19, affecting almost the entirety of the continental United States as multiple rounds of snow, freezing rain, and ice hit the West, South, Midwest, and Northeast. Furthermore, these winter storms caused multiple tornadoes. On February 15th alone, five tornadoes were reported: one in North Carolina, one in Georgia and three in Florida.¹ These storms resulted in the most widespread snow cover in the Lower 48 states in at least 17 years, with 73% coverage reported.² Additionally, NOAA found 30% of all U.S. reporting stations set record daily cold highs and 20% set record daily cold lows from Feb. 14-16. From Feb. 7-20, there were 9,027 daily cold records tied or set according to preliminary data from NOAA. By contrast, during that same 14-day period only 320 warm records were tied or set, only 1 warm record for every 28 cold records. Further record for snowfall and ice accumulation were set at multiple cities across the country.^{3,4}

Storm Formation/Intensification

Broadly speaking, storm systems intensify with temperature contrasts. The greater the difference in temperatures, the more energy is present for the storm. February is considered the peak of winter storm season as it usually sees the largest contrast in temperatures, and a favorable storm track forms that often brings more snow. From 1956 to 2020, almost three-quarters of all Northeast snowstorms attaining a Category 3 or higher rating on the Northeast Snowfall Impact Scale (NESIS) have occurred in late January or February. In Eastern Canada and the Northeastern parts of the United States, the lowest temperatures of the year occur at the end of January and beginning of February. The cold air builds in the area, then is often pushed southward by domes of high pressure over Ontario and pulled by passing low-pressure systems. During this same time, moisture from the Gulf of Mexico moves northward along with warmer air. Though generally found in the South, this moisture can make its way further north as it is pulled by storms moving across the Southeast. When the moisture reaches the cold air of the Northeast, it can turn to snow. The warm



air interacting with the cold air also serves as a source of energy for winter storms. Additional energy is brought by warm air from the Gulf Stream ocean current that moves northeastward from the North Carolina coast. The contrasts of the cold air from Canada and the warm Gulf Stream air can trigger a rapid intensification of winter storms, resulting in heavy snow along the coast to the north and west of the storm's center.⁵

Storm-Related Impacts

The February storms had wide-ranging impacts in a variety of states. However, this paper will examine four primary focus areas: impacts to utilities/infrastructure; impacts to transportation; impacts to the supply chain; and impacts related to the COVID-19 pandemic.

Impacts to Utilities/Infrastructure

Power failures affected states from coast to coast, from Oregon and Washington to the Southeastern United States. About 300,000 customers in Oregon and 150,000 in Virginia were without electricity in late February. However, the state of Texas received national attention for the catastrophic power failure many of its citizens experienced as a result of the winter storms.⁶

In the winter weather that occurred from mid-to-late February, wind turbines in the northern Texas Panhandle locked up, while pipes and components froze at natural gas plants. A South Texas nuclear reactor also shut down when a small section of uninsulated pipe froze. Power outages statewide affected 4.5 million ERCOT customers. More than 14.5 million Texans experienced serious water supply issues. At least two dozen of the reported 111 storm-related deaths were reportedly caused by the power outages.⁷

The Texas power grid is independent of others in the United States. Most states are on either the Eastern or Western Interconnection. The grid in Texas is simply called the Texas Interconnection. It is run by the Electric Reliability Council of Texas (ERCOT). It does not cover all of Texas. El Paso is on another grid, as is the upper Panhandle and part of East Texas.⁸ Having its own grid(s) helps the state avoid federal regulation, but it limits its ability to draw emergency power from other grids. ERCOT does not have a capacity market, whereby operators are paid to stand by with power that can be used during weather events.⁷ With the other grids, capacity market auctions determine the price that power generators receive in exchange for being on standby. The auctions occur three (3) years in advance. ERCOT relies on a wholesale electricity market. Free market pricing incentivizes generators to provide daily power and to make investments to ensure reliability during peak periods. As the storms continued and customers relied on their home heating systems, ERCOT was unable to meet demand. This forced the utility to cut customers' power to prevent a grid meltdown, leaving many to seek shelter elsewhere.

By the end of the storm in late February, at least 111 Texans had died due to hypothermia, traffic accidents on icy roads, medical equipment failures, chronic illnesses that worsened, a lack of home oxygen, falls, and fire, including from carbon monoxide poisoning when some residents tried to heat their homes.⁹ Those who did not lose power were left with significantly higher electricity bills, as prices skyrocketed. By mid-March, state authorities announced that over \$29 million in



unpaid electric bills would be forgiven as part of a bankruptcy plan by a Texas electricity provider accused of overcharging customers during the storms.¹⁰

Impacts to Transportation

While the impact of the storms reached as far north at Illinois and Indiana and as far west as Washington and Oregon, states in the Southeast and Southwest less accustomed to extreme winters bore the brunt of the storm. New Mexico experienced road closures and slowdowns in mid-February.¹¹ Texas experienced both, along with a series of accidents that resulted in fatalities. On 11 February 2021, early in the storm's timeline, icy roads caused a massive crash involving more than 130 vehicles on I-35 in Fort Worth Texas. Six (6) people were killed and at least 65 were hospitalized. In Austin, there was a 26-vehicle pileup on North State Highway 45 that resulted in five (5) people hospitalized.¹²

In neighboring Louisiana, icy roads caused several multiple-car accidents along the Whiskey Bay span of I-10 during the same period. State Troopers responded to several accidents in a single day, including a 14-vehicle crash on the westbound I-10 and a five-car accident on the eastbound span. Three (3) 18-wheelers also jackknifed along the span that borders Iberville and St. Martin parishes. As with Texas, the infrequency of extreme winter weather left many drivers unprepared for the condition.¹³

Major airlines nationwide canceled flights and issued vouchers to frustrated travelers. American, Delta, United, Southwest, Frontier and JetBlue were all affected. Airports in eastern Texas, including Dallas/Fort Worth International (DFW) and Houston's George Bush Intercontinental (IAH), were affected, with hundreds of flights canceled due to the inclement weather conditions. IAH was even forced to close its airfield.¹⁴

Impacts to the Supply Chain

The storms affected the economic supply chain, in some cases halting freight activity with national implications. It stranded or delayed shipments and shut down shipping operations, disrupting logistics, production, and sales. The effects were worse for the storm's geographic reach, duration, and multimodal impact, including maritime, rail, over-the-road trucking, and mail delivery. As before, the worst occurred in Texas, where the disruptions to the supply chain affected customers nationwide. The Port of Houston saw container terminals closed and truck traffic at the US-Mexico border brought to a standstill. Containers piled up at other ports, including Los Angeles and Long Beach, adding to congestion and preventing the movement of containers from warehouses near ports to inland distribution centers.¹⁵

Even as the storms subsided, roads were still covered in snow and ice in parts of the Southern states. There were also cascading issues in the Union Pacific Railroad's main line and terminal operations. These affected the supply chain of water, food, fuel, and medical supplies.¹⁶ Hospitals experienced a shortage of sharps containers used to hold needles, exacerbated by the increased demand due to COVID-19 vaccinations. Raw material costs rose significantly after plant and factory shutdowns caused price increases.¹⁷



Stocks were depleted at grocery stores not only in Texas, but in neighboring states that affected cross-border shipments at Laredo from Mexico and across state lines. Although multiple industries were affected, perishable items suffered more. Empty grocery store shelves were common in Texas and in neighboring states. Grocers already maintain lean inventories and just-in-time supply chains, with weekly deliveries. This affected store stock drastically when customers attempted to buy food and supplies in bulk.¹⁸

Impacts Related to the COVID-19 Pandemic

As the storms approached Texas and the Southeast, COVID-19-related concerns were raised regarding groups of individuals from different households sheltering together, particularly after power outages struck the region and individuals were forced to rely on family, friends, or community gathering sites for shelter and warmth. Conversely, the storms served as a form of “lockdown,” disrupting normal economic and social activities, which could have removed other opportunities for the spread of COVID-19. Moreover, COVID-19 testing capabilities were diminished in the wake of the storms, and the true impact of the storms on case counts in Texas were unclear. Additional factors such as spring break, the emergence of variants, and the removal of Texas’ state mask mandate were cited by local experts as factors that could also contribute to a rise in the state’s COVID-19 cases. Contact tracing was also cited as a valuable tool that would allow public health officials to determine how many cases were truly storm-related.¹⁹

Additionally, the winter storms had a noted impact on COVID-19 vaccine distribution. A White House official stated that 6 million doses of COVID-19 vaccines were delayed, representing approximately 3 days’ worth of delayed doses. The winter storm conditions affected the transportation and delivery of vaccine shipments, and rendered certain vaccination sites inoperable due to power outages and unsafe road conditions. Plans to clear the backlog of delayed vaccines included tapping into existing vaccine stockpiles, resuming shipment of doses in transit, and extending vaccination site hours in the days following the storms.²⁰

Varying Regional Vulnerability

Varying regional vulnerability also played a role in the severity of impacts in certain regions (such as Texas and the Southeast). The serious impacts felt in Texas and the Southeast were likely strongly connected to the fact that these regions do not generally experience severe winter weather, and are therefore less prepared to deal with such occurrences. For example, much of Texas’ electrical and water distribution infrastructure was not winterized, leading to power and water outages. However, given Texas’ relatively warm climate, such winterization efforts are not cost-effective to implement on a wide scale. Similarly, governmental organizations in these regions may not invest tax dollars in maintaining fleets of snow plows, salt spreaders, or other vehicles to improve road safety, for similar reasons of cost-effectiveness.

Additionally, regional vulnerability may materialize at an individual level, such as drivers in the Southern U.S. being less accustomed to driving in snow, resulting in increased traffic accidents such as those seen in Texas and Louisiana during the February storms (though the aforementioned



governmental capabilities to enhance road safety could also play a role). Individuals may also be less prepared for cold weather in terms of owning appropriate clothing, heating devices, or other items that allow individuals in colder climates to mitigate the effects of such weather events.

Conversely, a region such as the Northeastern U.S. that generally experiences winter storms on a routine basis will be more likely to have advantages such as winterized infrastructure and fleets of vehicles to enhance road safety. Individuals will also likely be more prepared for winter storm events, to include experience driving on snowy/icy roads and owning items such as warm clothing and portable heaters. This observation is not intended to suggest that one region is inherently more capable of preparing for winter storm events than another, rather, it highlights the role of local considerations, many of which are a matter of experience and cost-benefit analyses. Governments and individuals are simply generally more prepared for (and therefore less vulnerable to) hazards that they face on a routine basis, and are generally less prepared (and therefore more vulnerable to) for those hazards that they face less frequently.

Conclusion

The February 2021 winter storms were uniquely severe, occurred in rapid succession, and had far-reaching impacts on vast swaths of the U.S. The storms' impacts directly and indirectly affected infrastructure, transportation, supply chains, and the COVID-19 pandemic, in addition to the deaths and injuries that occurred as a result of the storms. However, it should also be noted that similar impacts can be expected from other forms of extreme weather occurring on a wide scale. This paper sought to evaluate the direct and indirect impacts of the February 2021 storms as a case study, in order to highlight the potential impacts that can occur on a national scale when such weather events occur. Additionally, the varying regional vulnerability should be considered when planning for extreme weather events in the future.

¹ 2021 Winter Storms. (2021, February 13). Center for Disaster Philanthropy. <https://disasterphilanthropy.org/disaster/2021-winter-storms/>.

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³ Our Recap of a Frenetic Stretch of Record-Breaking Winter Weather. (2021, February 19). The Weather Channel. <https://weather.com/storms/winter/news/2021-02-19-record-cold-snow-winter-storms-stretch-recap>.

⁴ Winter Storm Viola Smashed Records in the South and Brought Snow, Ice Into Northeast. (2021, February 14). The Weather Channel. <https://weather.com/safety/winter/news/2021-02-14-cross-country-winter-storm-northwest-south-midwest-east>.

⁵ Why February Has Some of the Biggest Northeast Winter Storms. (2021, January 29). The Weather Channel. <https://weather.com/storms/winter/news/2021-01-29-february-biggest-winter-storms>.



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