



August 2010

## Effects of the February 2010 Snowstorms on Airline Performance

by Jenny Guarino and Theresa Firestine

Several snowstorms in the Northeast, Midwest, and Southeast during February 2010 disrupted air travel not only at airports blanketed with snow but at airports across the United States and its territories. Altogether, more than 20,000 flights, or 4.2 percent of all flights scheduled during the month, were canceled due to weather. This was the highest weather cancellation rate for any month since the Bureau of Transportation Statistics (BTS) began collecting data on the extent and causes of cancellations in June 2003.<sup>1</sup>

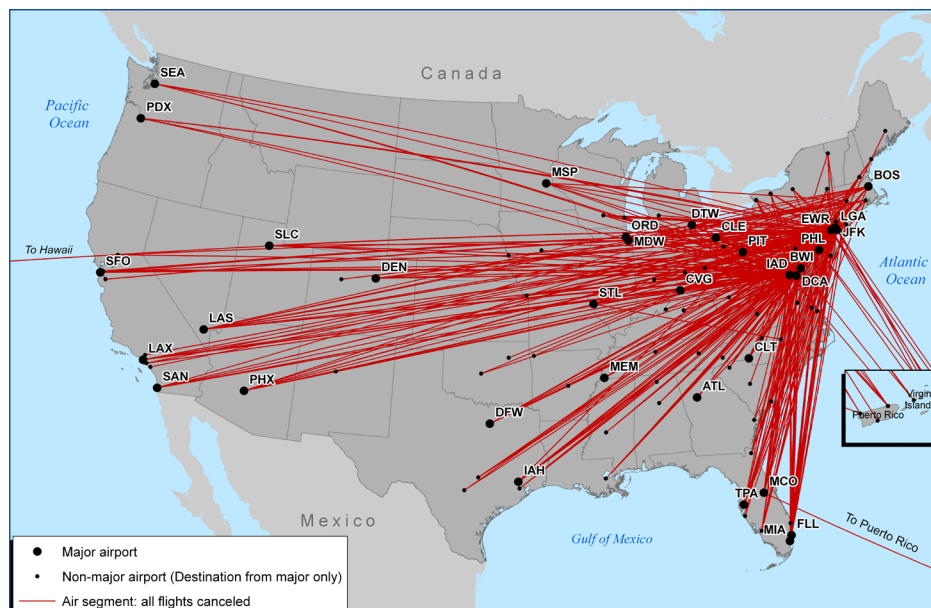
<sup>1</sup> Since June 2003, carriers that account for at least 1 percent of domestic scheduled passenger revenues have reported the cause for both flight cancellations and/or delays in the categories of weather, carrier, national airspace system (NAS), and security. In addition, delays are also reported due to late arriving aircraft that cause a subsequent flight using the same plane to depart late.

The national ramifications can be seen in figure 1, which shows the origin and destination for air travel segments<sup>2</sup> (originating from a major airport) canceled because of weather on Feb. 10, 2010 – the day with the most scheduled flight disruptions in February. From the 35 major airports<sup>3</sup>, all flights were canceled on 510 segments, accounting for 20 percent of all scheduled departures (2,350 flights) from the 35 airports. All flight segments departing

<sup>2</sup> Segment is defined as a nonstop flight from an origin to a destination airport. Segments on the same air route are considered separately. For example, the air route from Newark Liberty (EWR) to Los Angeles International (LAX) and from LAX to EWR is treated as two separate segments.

<sup>3</sup> Based on 35 high-volume airports identified by the FAA in the Operational Evolution Partnership (OEP).

**Figure 1: Air Segments on Which all Flights Departing From a Major Airport Were Canceled: Feb, 10, 2010**



**NOTE:** Segments on the same air route are considered separately. For example, the air route from EWR to LAX and from LAX to EWR is treated as two separate segments.

**SOURCE:** U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, Airline On-Time Performance Database, February 2010

from two major airports – Baltimore Washington (BWI) and Washington Reagan (DCA), and two small airports – Long Island-Islip (ISP) and Atlantic City (ACY) were canceled due to weather.

In looking at the impacts of weather on on-time airline performance in February 2010, this report uses BTS Airline On-Time Performance data<sup>4</sup>. Analysis shows:

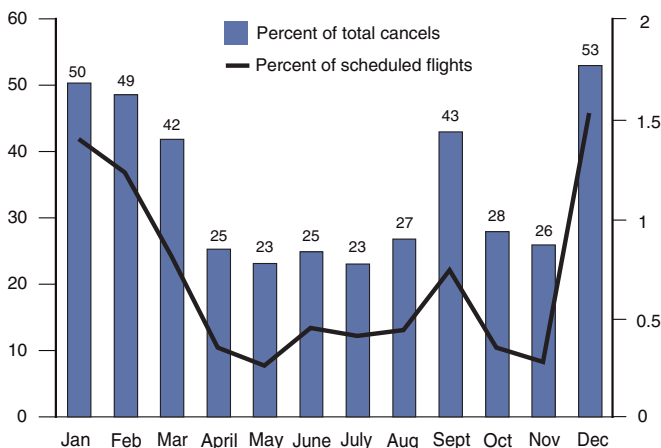
- February 2010 had the greatest proportion of weather-related cancellations on record, with 4.2 percent of flights canceled (20,206 flights). The previous record was 2.8 percent (15,872 flights) in February 2007.
- On the peak day, February 10, 23 percent of all scheduled flights (3,932 flights) were canceled nationwide due mainly to the near or complete closure of several large Northeastern hub airports.
- Cancellations from storms over the entire month are estimated to have cost \$80–100 million.

## A Historical Look at Weather Impacts

On average, the greatest proportion of weather cancellations occur during winter months (December–February), when snowfall or ice storms reduce the ability of an airport to function properly. March and September, months characterized by seasonal changes in weather patterns, follow with high proportions of weather cancellations.

In months with extreme weather, weather-related cancellations account for a large proportion of total cancellations. Weather-related cancellations account for approximately

**Figure 2: Monthly Trend in Weather-Related Cancellations: January 2004 – December 2009**



**SOURCE:** U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, Airline On-Time Performance Database, February 2010

<sup>4</sup> Refer to On-Time Performance Data located in the TranStats section of the BTS website at: [http://www.transtats.bts.gov/Tables.asp?DB\\_ID=120&DB\\_Name=Airline%20On-Time%20Performance%20Data&DB\\_Short\\_Name=On-Time](http://www.transtats.bts.gov/Tables.asp?DB_ID=120&DB_Name=Airline%20On-Time%20Performance%20Data&DB_Short_Name=On-Time)  
Cancellations and delays in this report refer to those reported in the category of weather.

half of all cancellations from December through January and around 43 percent of all cancellations in March and September. The above patterns can be seen in figure 2, which shows the trend in these weather-related cancellations as a percent of scheduled flights and total cancellations.

The five worst months for weather-related cancellations all occurred during winter (see table 1). During three of the five worst months, at least one high-impact storm struck the Northeast Corridor region (NEC) where high-volume hub airports are concentrated. Unusually high snowstorm activity at hub airports in the NEC during February 2010 contributed significantly to the high cancellation rate.

**Table 1: Five Worst Months for Weather-Related Cancellations**

Rank	Month	Scheduled flights	Weather cancellations	
			Total canceled	Percent canceled
1	February 2010	481,988	20,206 (6,824)	4.2 (1.4)
2	February 2007	565,604	15,872 (13,554)	2.8 (2.4)
3	January 2006	594,924	15,748 (13,782)	2.6 (2.3)
4	December 2009	529,269	9,791 (10,887)	1.8 (2.1)
5	December 2008	544,956	10,038 (16,683)	1.8 (3.1)

**NOTE:** Numbers in parentheses represent weather-related delays.

**SOURCE:** U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, Airline On-Time Performance Database, February 2010.

**Table 2: High-Impact Snowstorms That Affected the NE Urban Corridor: January 2004–February 2010**

Rank	Year	Date	NESIS Score	Category
7	2005	Jan. 21-24	6.80	Crippling
14	2007	Feb. 12-15	5.63	Major
17	2010	Feb. 23-28	5.11*	Major
21	2010	Feb. 4-7	4.30*	Major
23	2006	Feb. 12-13	4.10*	Major
25	2009	Dec. 18-21	4.03*	Major
26	2010	Feb. 9-11	3.93*	Significant
32	2007	Mar. 15-18	2.55*	Significant
37	2009	Mar. 1-3	1.65*	Notable

\* Preliminary

**NOTE:** The number 1 ranked storm occurred on Mar. 12–14, 1993. This storm has an NESIS score of 13.20 and is one of only two storms considered extreme in terms of its societal impact.

**SOURCE:** <http://wfn.ncdc.noaa.gov/snow-and-ice/nesis.php> as of February 2010

The severity of NEC weather events can be seen through the Northeast Snowfall Impact Scale (NESIS) (see box A), which measures the societal impact of storms. The impact scores for storms occurring since January 2004 are listed in table 2.

As seen in table 2, two major and one significant storm most recently struck the NEC during February 2010. These storms combined with storms outside of the NEC to cause the weather-related cancellation rate to surpass all previously recorded rates by nearly twofold.

## Box A: The Northeastern Snowfall Impact Scale

The Northeastern Snowfall Impact Scale (NESIS), developed by Paul Kocin and Louis Uccellini of the National Weather Service, ranks storms in the Northeast Corridor by societal impact. The NESIS scores used in ranking account for the physical size of the area impacted, the amount of snow, and the number of people living in the path of the storm.

Storm scores are categorized as:

- extreme (10+)
- crippling (6.0–9.99)
- major (4.0–5.99)
- significant (2.5–3.99)
- notable (1.0–2.499)

For more information, see: <http://lwf.ncdc.noaa.gov/snow-and-ice/nesis.php>, February 2010

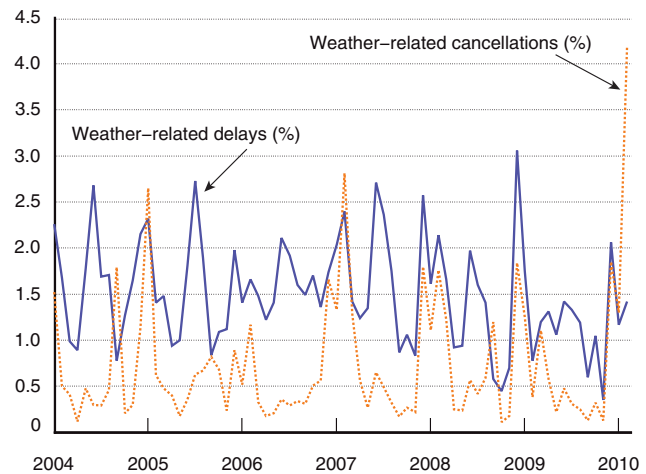
The lower weather-related cancellation rate seen in table 1 for February 2007 reflects the combined effect of the number and magnitude of storm events in 2007 versus 2010. In the NEC alone (see table 2), the storm categorized as "major" in 2007 outranks both of the major storms in 2010. Yet, despite greater potency, the 2007 NEC storm along with all other storms nationwide caused proportionally more weather-related delays in February 2007 than in February 2010. This differential impact demonstrates how more, albeit less intense, storms can halt proportionally more scheduled flights. Each storm, as in February 2010, adds additional stress to an already stressed system, thus causing weather-related cancellations to become more frequent than weather-related delays.

The weather-related cancellation rate exceeds the weather-related delay rate in months with the most numerous or severe storms or both. This can be seen in figure 3, which displays the proportion of scheduled flights experiencing a weather cancellation or delay. As shown, weather-related cancellations exceed weather-related delays in September 2004, January 2005, February 2007, September 2008, and January and February 2010. With the exception of the two Septembers (when several hurricanes disrupted flight operations<sup>5</sup>), these months correspond to the months with

<sup>5</sup> Notably, Hurricanes *Frances*, *Ivan*, and *Jeanne* in September 2004 and Hurricane *Ike* in September 2008. For more information on these hurricanes, see the 2004 and 2008 State of the Climate Hurricane & Tropical Storms reports published by the National Oceanic and Atmospheric Administration National Climate Data Center: <http://www.ncdc.noaa.gov/sotc>

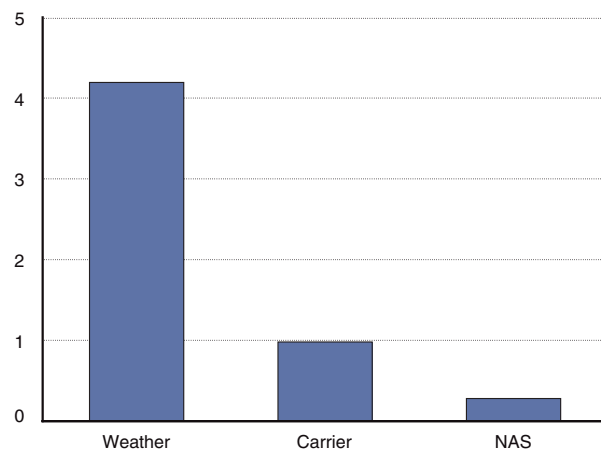
numerous and severe winter storms in the NEC (refer to table 2).

**Figure 3: Percent of Weather-Related Delays and Cancellations: January 2004–February 2010**  
(as a percent of scheduled flights)



**SOURCE:** U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, Airline On-Time Performance Database, February 2010

**Figure 4: Percent Canceled Flights Nationally: February 2010**  
(as a percent of scheduled flights)



**SOURCE:** U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, Airline On-Time Performance Database, February 2010

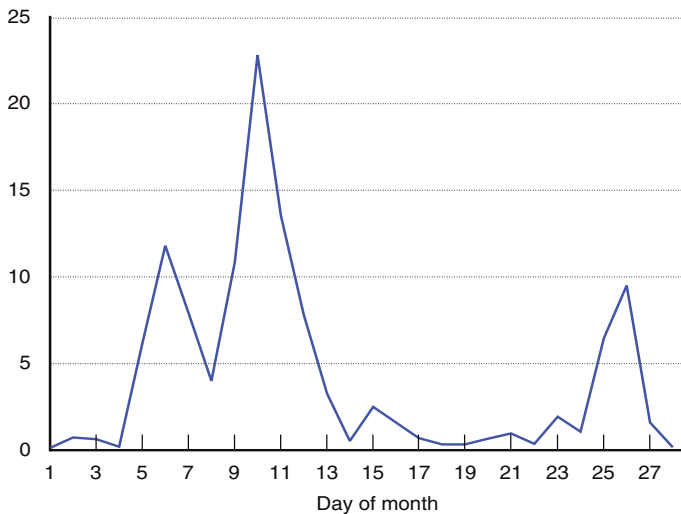
## February 2010 Weather-Related Cancellations

Examining the trend of cancellations during February 2010, figure 4 displays the percent of flights canceled by type. As shown, weather-related cancellations were more prominent than any other cancellation type.

Weather-related cancellations in February 2010 were predominant due to the severe snowstorms in the NEC, see table 2, as well as in the Midwest and across Southern states. The impact of these storms on scheduled flights

can be seen in figure 5, which shows the rate of weather-related cancellations on a daily basis.

**Figure 5: Percent of Weather-Related Cancellations Nationally, by Date: February 2010**  
(as a percent of scheduled flights)



**SOURCE:** U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, Airline On-Time Performance Database, February 2010

Weather accounted for three-fourths of total cancellations in February. While 4.2 percent of flights were canceled due to weather, the percent of scheduled flights canceled varied with each NEC storm. Table 3 compares the distribution of weather-related cancellations across the three major storms, the nonstorm periods, and nonweather cancellations to total flight cancellations and scheduled flights in February.

**Table 3: Nationwide Cancellations: February 2010**

Cancellations	Count	Percent of all cancellations	Percent of all flights
Weather cancels	20,206	76.88	4.19
Storm 1 (Feb 4-7)	4,053	15.42	0.84
Storm 2 (Feb 9-11)	8,208	31.23	1.70
Storm 3 (Feb 23-28)	3,693	14.05	0.77
All other days	4,252	16.18	0.88
Nonweather cancels	6,075	23.12	1.26

**NOTE:** There were 26,281 cancellations and 481,988 scheduled flights in February 2010. Storms correspond to those listed on NESIS (table 2).

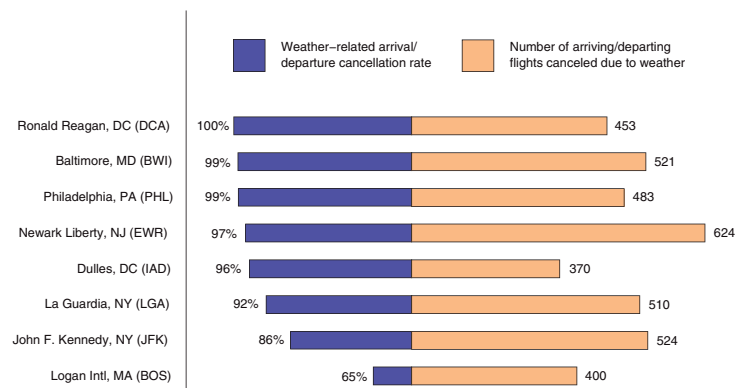
**SOURCE:** U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, Airline On-Time Performance Database, February 2010

As shown in table 3, the February 9–11 storm accounts for the greatest percent of cancellations in February 2010, even though it ranks only as “significant” and the least severe of the three storms on the NESIS. This can be explained by two severe snowstorms that hit the Midwest and Southern states during the February 9-11 NEC event. The first of these severe storms dumped 12.6 inches of

snow on the Chicago O’Hare (ORD) airport on February 9. This storm caused 17 percent of scheduled departures and 18 percent of arrivals to be canceled due to weather. These cancellations account for 4 percent of all weather cancels during February 9–11.

The second storm outside the NEC struck Southern states February 11–12. During this storm, the most significant cancellations occurred at Dallas Fort Worth (DFW) on February 11 due to record breaking snowfall (11.2 inches)<sup>6</sup>. As a result of this snowfall, 55 percent of departing and 60 percent of arriving flights at DFW were canceled due to weather. These cancellations comprise 11 percent of all weather-related cancellations during the February 9–11 period. A greater share of cancellations occurred on February 11 at DFW even though a nearly equal amount of snow fell at ORD due to DFW receiving nine times<sup>7</sup> its February snowfall average.

**Figure 6: Major Airports Where the Percent of Arriving and Departing Flights Canceled Due to Weather Exceeded 50 Percent: Feb. 10, 2010**



**SOURCE:** U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, Airline On-Time Performance Database, February 2010

## February 10, 2010

The peak day for weather-related cancellations across all airports was February 10 when 23 percent of all scheduled flights (3,932 flights) were canceled. All flights departing from and arriving at Washington Reagan (DCA) were canceled and 85 percent or more were canceled due to weather at John F. Kennedy (JFK), La Guardia (LGA), Dulles (IAD), Newark Liberty (EWR), Philadelphia (PHL), and Baltimore Washington (BWI) (see figure 6). The weather-related cancellations at these airports accounted for 87 percent of all weather-related cancellations on February 10—1,750 scheduled departures and 1,735 scheduled arrivals.

<sup>6</sup> For snowfall records, see: <http://www.ncdc.noaa.gov/extremes/records.php>. For more information on daily snowfall amounts, see: <http://www7.ncdc.noaa.gov/CDO/georegion>

<sup>7</sup> The mean February snowfall from 1971 to 2000 at DFW is 1.2 inches (<http://cdo.ncdc.noaa.gov> National Weather Service Climate Normals 1971-2000 CLIM20-02)


For more information regarding airport variation in weather-related cancellations and delays throughout February, refer to the supplementary materials on the BTS website<sup>8</sup>.

## Cost of the February 2010 Storms

The February storms did not strike carriers without a cost. In particular, the severe weather events resulted in revenue lost not only from cancellations but also from delays. The total cost of cancellations is not known, as the potential lost revenue varies across carriers due to the severity of local weather events and carriers' ability to rebook. Across all carriers, analyst Helane Becker, from Jesup & Lamont, estimates a total of \$80 – 100 million in revenue lost to the February 2010 storms<sup>9</sup>.

<sup>8</sup> For supplementary materials, see: [http://www.bts.gov/publications/special\\_reports\\_and\\_issue\\_briefs/special\\_report/2010\\_07/pdf/supplemental.pdf](http://www.bts.gov/publications/special_reports_and_issue_briefs/special_report/2010_07/pdf/supplemental.pdf)

<sup>9</sup> Mary Jane Credeur and Mary Schlangenstein. "US Airways, Delta Lead Traffic Decline on Storm Cancellations," *BusinessWeek*, 9 March 2010:

The total cost of February 2010 storms in terms of delays can be estimated based on the direct aircraft operating cost per block minute, which according to the most recent (calendar year 2008) estimate from the Air Transport Association is \$60.99<sup>10</sup>. Applying this cost to total weather delay minutes in February 2010 (307,997 minutes) leads to an estimated cost of \$18.8 million. This cost underestimates the true cost as it does not include the cost of weather delays on airline customers, e.g., from lost productivity, wages, etc. 

<sup>10</sup> Air Transport Association, costs of delays: <http://www.airlines.org/pages/home.aspx>

### About This Report

This article was prepared by Jenny Guarino, a Mathematical Statistician in the Bureau of Transportation Statistics (BTS), and Theresa Firestine, an Economist in BTS. BTS is a component of the U.S. Department of Transportation's Research and Innovative Technology Administration (RITA). Both authors contributed equally.

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### Data-

This special report is based on data from monthly Airline On-Time Performance data reported to the Bureau of Transportation Statistics (BTS):

- <http://www.transtats.bts.gov/>