



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

June 23, 2021

Specialist's Factual Report

METEOROLOGY

HWY21FH005

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A. ACCIDENT

Location: Fort Worth, Texas
Date: February 11, 2021
Time: approximately 0600 central standard time
1200 Coordinated Universal Time (UTC)
Vehicles: 133 vehicle collision on southbound Interstate Highway 35

B. METEOROLOGIST

Don Eick
Senior Meteorologist
Operational Factors Division (AS-30)
National Transportation Safety Board

C. SUMMARY

About 0600 central standard time on Thursday, February 11, 2021, a multi-vehicle crash occurred in the southbound toll lanes of Interstate 35 West (I-35W), in Fort Worth, Tarrant County, Texas. The crash occurred in the vicinity of the exit to Northside Drive and involved approximately 133 vehicles. At this location, I-35W included an elevated portion of roadway and the traffic lanes were comprised of both toll operated lanes and general use lanes. There were two southbound toll lanes and three general use lanes, with the toll lanes having a posted speed limit of 75 mph, while the speed limit for the general use lanes was posted at 65 mph. Additionally, the toll lanes were separated from the general use lanes by a concrete barrier. In the days leading up to the crash, the area had been experiencing freezing temperatures and roadway authorities had been engaged in pretreatment strategies for the anticipated snow and ice conditions that had been forecast. The area was also experiencing periods of freezing precipitation hours before the crash. The crash involved a mixture of commercial and passenger vehicles and resulted in six vehicle occupants being fatally injured. Preliminary reports from local authorities estimated that 36 other vehicle occupants were transported to area hospitals for treatment of their injuries and 65 others self-transported for treatment following the crash.

D. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's (NTSB) Senior Meteorologist was not on scene for this investigation and conducted the meteorology phase of the investigation from the Washington D.C. office, collecting data from official National Weather Service (NWS) sources including the Weather Prediction Center (WPC) and the National Center for Environmental Information (NCEI). All times are central standard time (CST) based upon the 24-hour clock, local time is +6 hours to UTC, and UTC=Z. Directions are referenced to true north and distances in nautical miles. Heights are in feet (ft) above mean sea level (msl) unless otherwise noted. Visibility is in statute miles and fractions of statute miles.

This report provides a meteorological review on the weather conditions and NWS weather products applicable to the local Fort Worth area around the time of the accident and for the days preceding the accident. The accident site was based on the coordinates of latitude 32.785157° N and longitude 97.320917° W.

E. WEATHER INFORMATION

1.0 Synoptic Conditions

The synoptic or large-scale migratory weather systems influencing the area were documented using standard NWS charts issued by the National Center for Environmental Prediction (NCEP) located in College Park, Maryland. These are the base products used in describing weather features and in the creation of forecasts and warnings. Reference to these charts and other weather products documented in this report can be found in the joint NWS and Federal Aviation Administration (FAA) Advisory Circular “Aviation Weather Services”, AC 00-45H change 2.

1.1 Surface Analysis Chart

The southcentral section of the NWS Surface Analysis Chart for 0600 CST is included as figure 1 with the approximate location of the accident site marked by the red star. The chart depicted a low-pressure system over northern Georgia with a central pressure of 1015-hectopascals (hPa)¹ with a cold front extending southwestward into Alabama, Mississippi, Louisiana, and into the Gulf of Mexico off the Texas coast. A high-pressure ridge extended from Kansas southward into western Texas. The accident site was located on the cold air side of the front and immediately east of the ridge where the coldest temperatures were noted. Winds were from the north at 10 to 15 knots. The station models depicted temperatures in the 20’s degrees Fahrenheit (F) with temperature dew point spreads of 4° F or less in the vicinity, with overcast clouds along and north of the front, and many surrounding stations reporting visibility restrictions in mist with one immediately northeast reporting unknown freezing precipitation.

¹ Hectopascals (hPa) is the standard term for reporting sea-level pressure and is interchangeable with the former term millibar (mb) with the same units. Standard sea-level pressure is 1013.25-hPa at 59° Fahrenheit (F) or 15° Celsius (C).

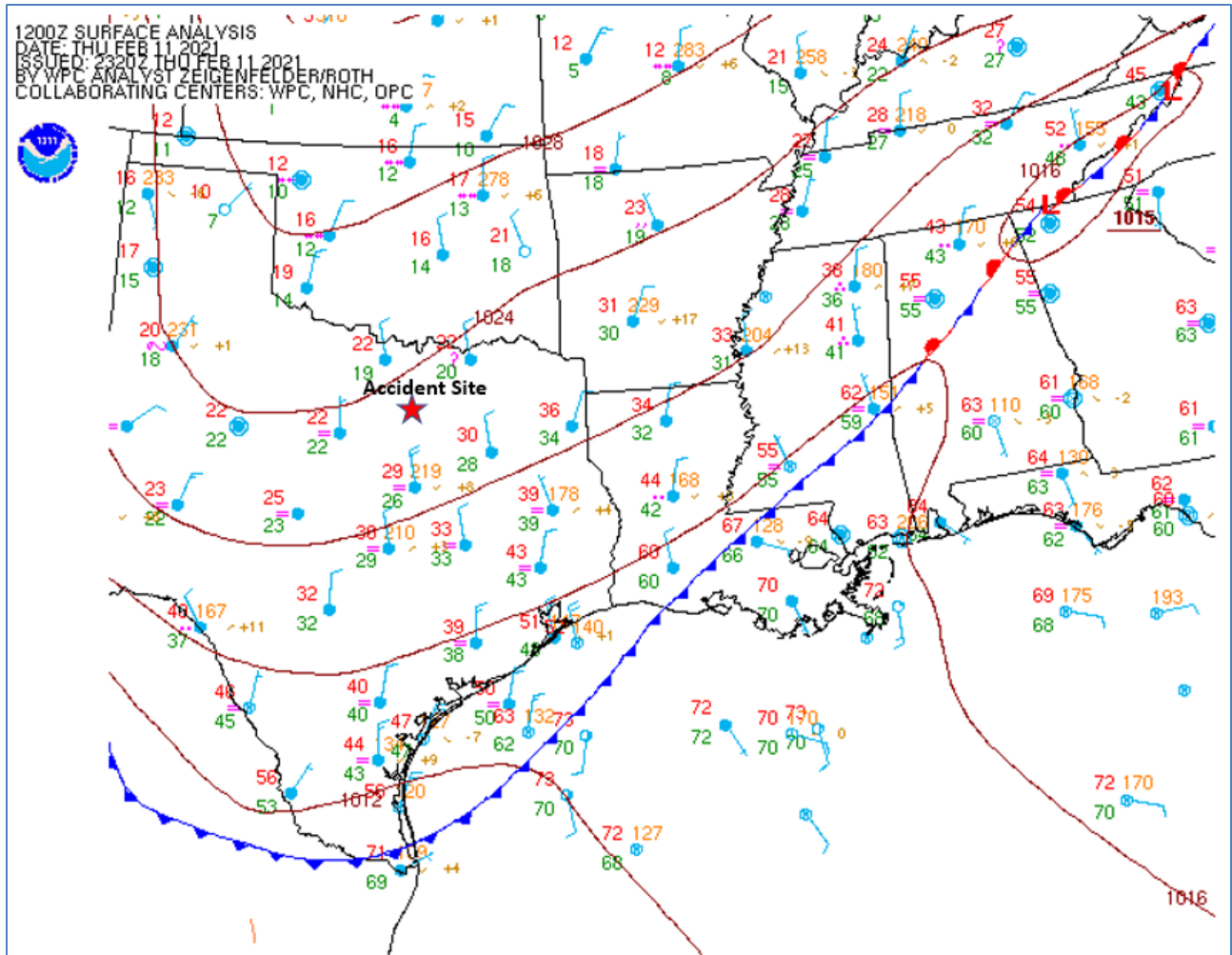


Figure 1 - NWS Surface Analysis Chart for 0600 CST with the accident site marked by the red star

2.0 Surface Observations

The closest observations surrounding the area were documented. The magnetic variation was estimated at 3.5° east. Wind speed has been converted from knots to mph, and temperatures reported in degrees Fahrenheit, and cloud heights are provided in height above ground level (agl) in the following section. A map of the Fort Worth, Texas area with the accident site and the closest weather reporting locations is included as figure 2.

The NTSB investigator was unable to identify if there were any Road Weather Information Systems (RWIS)² pavement sensors in the area during the period and did not have access to any other highway weather systems.

² Road Weather Information Systems (RWIS) are in-pavement sensors that help to identify the pavement temperature, water thickness, freezing temperature, and pavement conditions that can be monitored remotely for winter service operations.

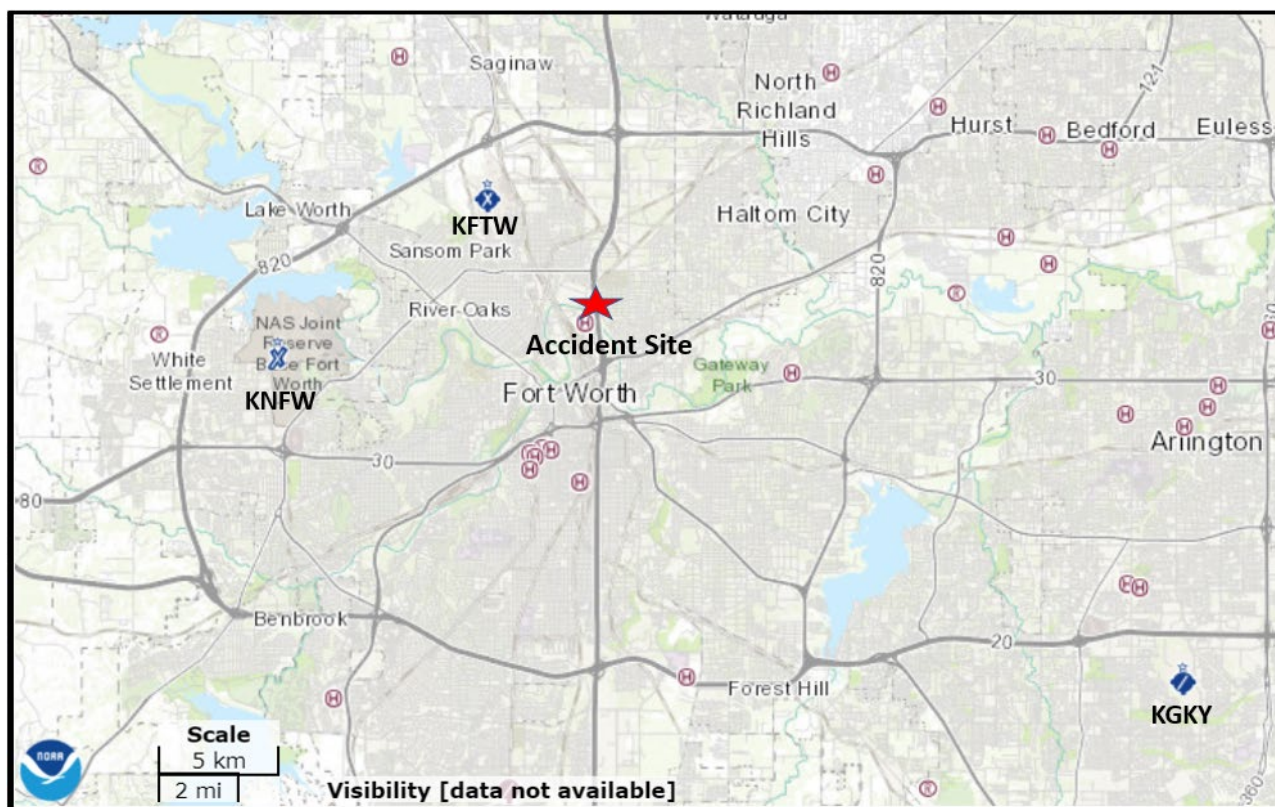


Figure 2 - Fort Worth, Texas area and closest weather reporting locations

2.1 Fort Worth Meacham International Airport, Fort Worth, Texas

The closest weather reporting location to the accident site was from Fort Worth Meacham International Airport (KFTW), Fort Worth, Texas, located approximately 3 miles northwest of the accident location at an elevation of 710 ft. The airport had a federally installed and maintained Automated Surface Observation System (ASOS) and was augmented by air traffic control personnel during normal operating hours. The following conditions were reported at KFTW prior to and at the approximate time of the accident, the wind has been converted from knots to miles per hour (mph), and temperatures in degrees Fahrenheit from Celsius ($^{\circ}\text{C}$), cloud heights are reported above ground level (agl).

Fort Worth special weather observation at 0103 CST, wind from 340° at 14 mph, visibility 7 statute miles, overcast clouds at 800 ft agl, temperature 25°F , dew point temperature 23°F , altimeter 30.19 inches of mercury (inHg). Remarks: automated observation system with a precipitation discriminator (A02), ceiling³ 700 ft variable 1,200 ft agl, temperature -3.9°C , dew point temperature -5.0°C .

Fort Worth special weather observation at 0140 CST, wind from 340° at 14 mph gusting to 23 mph, visibility 6 miles in light freezing rain and mist, overcast clouds at 900 ft agl, temperature 26°F , dew point temperature 23°F , altimeter 30.19 inHg. Remarks: A02,

³ A ceiling is defined as the lowest layer of clouds reported as broken or overcast, or the vertical visibility into a surface-based obscuration.

freezing rain began 0134 CST, ceiling 800 ft variable 1,200 ft agl, hourly precipitation less than 0.01 inches, 1-hour ice accretion rate 0.01 inches, temperature -3.3° C, dew point temperature -5.0° C.

Fort Worth weather observation at 0153 CST, wind from 330° at 12 mph, visibility 6 miles in light freezing rain and mist, overcast clouds at 900 ft agl, temperature 25° F, dew point temperature 23° F, altimeter 30.19 inHg. Remarks: A02, freezing rain began 0134 CST, ceiling 800 ft variable 1,200 ft agl, sea-level pressure 1022.9-hPa, hourly precipitation since 0053 CST less than 0.01 inches, 1-hour ice accretion rate 0.02 inches, temperature -3.9° C, dew point temperature -5.0° C.

Fort Worth special weather observation at 0216 CST, wind from 340° at 14 mph, visibility 8 miles, overcast clouds at 900 ft agl, temperature 25° F, dew point temperature 23° F, altimeter 30.19 inHg. Remarks: A02, freezing rain ended at 0210 CST, hourly precipitation since 0153 CST less than 0.01 inches, 1-hour ice accretion rate less than 0.00 inches, temperature -3.9° C, dew point temperature -5.0° C.

Fort Worth weather observation at 0253 CST, automated, wind from 330° at 13 mph, visibility 6 miles in mist, overcast clouds at 700 ft agl, temperature 25° F, dew point temperature 23° F, altimeter 30.19 inHg. Remarks: A02, freezing rain ended at 0210 CST, sea-level pressure 1022.8-hPa, hourly precipitation since 0153 CST less than 0.01 inches, 6-hour precipitation less than 0.01 inches, 1-hour ice accretion rate less than 0.00 inches, 3-hour ice accretion rate 0.02 inches, temperature -3.9° C, dew point temperature -5.0° C, 3-hour pressure tendency fallen 0.01-hPa.

Accident at Western Center Boulevard⁴ at 0308 CST

Fort Worth weather observation at 0353 CST, automated, wind from 350° at 14 mph gusting to 23 mph, visibility 5 miles in mist, overcast clouds at 800 ft agl, temperature 25° F, dew point temperature 23° F, altimeter 30.19 inHg. Remarks: A02, ceiling 700 ft variable 1,200 ft, sea-level pressure 1022.9-hPa, temperature -4.4° C, dew point temperature -5.6° C.

Fort Worth weather observation at 0453 CST, automated, wind from 340° at 15 mph gusting to 23 mph, visibility 4 miles in mist, overcast clouds at 700 ft agl, temperature 25° F, dew point temperature 23° F, altimeter 30.20 inHg. Remarks: A02, ceiling 500 ft variable 1,000 ft, sea-level pressure 1023.4-hPa, 1-hour ice accretion rate less than 0.00 inches, temperature -4.4° C, dew point temperature -5.0° C.

Fort Worth weather observation at 0553 CST, wind from 350° at 18 mph gusting to 25 mph, visibility 9 statute miles, low overcast clouds at 700 ft agl, temperature 23° F, dew point temperature 21° F, altimeter 30.21 inHg. Remarks; A02, sea-level pressure 1023.7-hPa, 6-hour precipitation total less than 0.01 inches, 6-hour ice accretion rate 0.02 inches,

⁴ A previous crash occurred on February 11, 2021 at 0308 CST approximately 400 feet north of I-35W at Western Center Boulevard, where two cars northbound began to spin, with one hitting the concrete barrier. Both drivers reported icy road conditions as the cause of their loss of control.

temperature -5.0° C, dew point temperature -6.1° C, 6-hour maximum temperature 26° F, 6-hour minimum temperature 23° F, 3-hour pressure tendency risen 0.8-hPa.

Accident near Northside Drive at 0600 CST

Fort Worth weather observation at 0653 CST, wind from 340° at 15 mph gusting to 23 mph, visibility 9 statute miles, low overcast clouds at 1,000 ft agl, temperature 23° F, dew point temperature 21° F, altimeter 30.21 inHg. Remarks: A02, unknown precipitation began at 0651 and ended at 0653 CST, sea-level pressure 1023.9-hPa, hour precipitation less than 0.01 inches, temperature -5.0° C, dew point temperature -6.1° C.

A review of the KFTW observations prior to the accident indicated between 0134 and 0210 CST light freezing rain and mist were reported. It was the first measurable precipitation reported in February, with less than 0.01 inches reported during that period. The accident also occurred after approximately 36 hours of consecutive below freezing temperatures reported at KFTW. The relative humidity at the time of the accident was 92%, with the minimum temperature of 23° F. The 6-hour ice accretion reported at the time of the accident was 0.02 inches. The ASOS icing sensor⁵ is known to detect ice accretion from freezing drizzle, wind driven mist that freezes on elevated objects, freezing fog, hoarfrost⁶, all of which can result in the formation of “black ice”⁷. The occurrence of freezing drizzle prior to the accident could not be ruled during the period of mist, low cloud cover, and periods of high relative humidity due to limitations in the ASOS sensors⁸.

A table listing of the KFTW observations with time referenced to UTC and wind speeds in knots is included below for the period from February 7 through the 11th is included below. The column for “Weather” uses the standard abbreviations such as “FG” for fog, “-FZRA” for light freezing rain.

STN	TIME	PMSL	ALTM	TMP	DEW	RH	DIR	SPD	GUS	VIS	CLOUDS	Weather	MIN	MAX	P01	PCP
	DD/HHMM	hPa	inHg	F	F	%	deg	kt	kt	mile			F	F	in	in
FTW	11/1353	1024.4	30.23	23	21	92	350	14	27	7.0	OVC010					0.00
FTW	11/1253	1023.9	30.21	23	21	92	340	13	20	9.0	OVC010					0.00
FTW	11/1153	1023.7	30.21	23	21	92	350	16	22	9.0	OVC007		23	26		0.00
FTW	11/1053	1023.4	30.20	24	23	96	340	13	20	4.0	OVC007	FG				
FTW	11/0953	1022.9	30.19	24	22	91	350	12	20	5.0	OVC008	FG				
FTW	11/0853	1022.8	30.19	25	23	92	330	11		6.0	OVC007	FG				0.00 0.00
FTW	11/0753	1022.9	30.19	25	23	92	330	10		6.0	OVC009	-FZRA	FG			0.00
FTW	11/0653	1023.1	30.20	25	23	92	330	12		7.0	OVC010					
FTW	11/0553	1022.8	30.19	26	23	88	350	13		8.0	OVC011		26	29		
FTW	11/0453	1023.0	30.19	27	23	85	340	11	18	8.0	OVC010					

⁵ Goodrich Sensor 872C3 icing sensor uses a magnetostrictive oscillator that responds to changes in mass on a small sensing element.

⁶ Hoarfrost is a grayish-white crystalline deposit of frozen water vapor in clear still weather on vegetation, and other objects. It is formed by direct condensation of water vapor to ice at temperatures below freezing and occurs when air is brought to its frost point by cooling.

⁷ The NWS defines "black ice" as patchy ice on roadways or other transportation surfaces that cannot easily be seen. It is often clear (not white) with the black road surface visible underneath. It is most prevalent during the early morning hours, especially after snow melt on the roadways has a chance to refreeze overnight when the temperature drops below freezing. Black ice can also form when roadways are slick from rain and temperatures drop below freezing overnight. Common locations for black ice formation include bridges, elevated overpasses, and spots on the road shaded by trees or other object.

⁸ The standard ASOS Precipitation Indicator (PI) better known as a Light Emitting Diode Weather Identification (LEDWI) is presently unable to determine freezing drizzle due to its small particle size (smaller than 0.5 mm in diameter) and precipitation detection thresholds (less than 0.0098 in/h), thus requiring human augmentation.

FTW	11/0353	1022.9	30.19	27	24	89	360	12	19	8.0	OVC009			
FTW	11/0253	1022.5	30.18	27	26	96	360	15	23	5.0	OVC006	FG		
FTW	11/0153	1022.6	30.18	28	26	92	340	11		4.0	OVC006	FG		
FTW	11/0053	1021.5	30.15	29	26	89	340	14		10.0	OVC008			
FTW	10/2353	1020.8	30.13	29	27	92	350	14		9.0	OVC007		29	31
FTW	10/2253	1020.4	30.12	30	28	92	350	14		10.0	OVC007			
FTW	10/2153	1020.1	30.11	31	28	89	350	13	17	10.0	OVC006			
FTW	10/2053	1020.6	30.13	31	28	89	350	13		10.0	OVC006			
FTW	10/1953	1021.4	30.14	30	29	96	330	11	17	5.0	OVC005	FG		
FTW	10/1853	1022.1	30.17	29	28	96	330	12		4.0	OVC005	FG		
FTW	10/1753	1022.7	30.18	29	28	96	330	10		7.0	OVC005		26	29
FTW	10/1653	1022.8	30.19	29	27	92	350	11		6.0	OVC005	FG		
FTW	10/1553	1022.7	30.18	28	26	92	340	9		8.0	OVC006			
FTW	10/1453	1022.7	30.18	27	26	96	330	10		6.0	OVC004	FG		
FTW	10/1353	1021.8	30.16	27	26	96	360	7		4.0	OVC004	FG		
FTW	10/1253	1022.1	30.17	27	26	96	330	10		4.0	OVC004	FG		
FTW	10/1153	1021.0	30.14	27	26	96	350	8		4.0	OVC004	FG	27	29
FTW	10/1053	1020.8	30.13	27	27	100	360	8		7.0	OVC005			
FTW	10/0953	1021.1	30.14	28	27	96	360	10		4.0	OVC004	FG		
FTW	10/0853	1021.5	30.15	28	28	100	330	9		3.0	OVC005	FG		
FTW	10/0753	1021.8	30.16	28	27	96	330	8		4.0	OVC005	FG		
FTW	10/0653	1021.7	30.16	28	27	96	350	10		2.5	OVC005	FG		
FTW	10/0553	1021.8	30.16	29	26	89	340	9		5.0	OVC011	FG	29	31
FTW	10/0453	1021.8	30.16	30	26	85	360	7		10.0	OVC011			
FTW	10/0353	1021.6	30.15	30	26	85	350	9		10.0	BKN011 OVC019			
FTW	10/0253	1021.9	30.16	30	26	85	350	6		10.0	BKN011 OVC023			
FTW	10/0153	1021.9	30.16	31	26	82	360	8		10.0	BKN011 OVC025			
FTW	10/0053	1021.5	30.15	31	26	82	360	8		10.0	BKN010 OVC023			
FTW	09/2353	1021.2	30.14	31	27	85	360	9		10.0	OVC012		31	34
FTW	09/2253	1021.3	30.15	32	27	81	360	10		10.0	OVC011			
FTW	09/2153	1021.2	30.14	33	28	82	360	10		10.0	OVC011			
FTW	09/2053	1021.5	30.15	33	28	82	350	9		10.0	OVC011			
FTW	09/1953	1021.7	30.16	34	29	82	350	10		10.0	OVC010			
FTW	09/1853	1022.6	30.19	32	29	88	330	10		10.0	OVC008			
FTW	09/1753	1023.5	30.21	31	29	92	320	8		7.0	OVC005		28	31
FTW	09/1653	1023.9	30.23	30	29	96	310	8		4.0	OVC005	FG		
FTW	09/1553	1023.6	30.22	29	28	96	310	9		2.5	OVC004	FG		
FTW	09/1453	1023.0	30.20	29	27	92	320	9		4.0	OVC005	FG		
FTW	09/1353	1022.1	30.17	28	27	96	330	9		2.5	OVC005	FG		
FTW	09/1253	1021.3	30.15	29	28	96	320	9		4.0	OVC005	FG		
FTW	09/1153	1020.5	30.13	29	28	96	320	11		4.0	OVC007	FG	29	35
FTW	09/1053	1019.8	30.12	31	29	92	320	9		5.0	OVC007	FG		
FTW	09/0953	1019.3	30.10	33	31	92	320	10		6.0	OVC008	FG		
FTW	09/0853	1019.0	30.09	34	32	92	330	8		10.0	OVC006			
FTW	09/0753	1018.7	30.08	34	33	96	330	10		9.0	OVC006			
FTW	09/0653	1018.5	30.08	35	33	92	320	8		10.0	OVC007			
FTW	09/0553	1018.2	30.07	35	33	92	330	8		10.0	OVC007		35	52
FTW	09/0453	1017.9	30.06	36	33	89	330	11		10.0	BKN011			
FTW	09/0353	1017.3	30.04	36	33	89	330	8		10.0	FEW011			
FTW	09/0253	1016.7	30.02	38	34	85	330	10		10.0	FEW031			
FTW	09/0153	1016.1	30.00	39	34	82	320	12	20	10.0	CLR			
FTW	09/0053	1015.1	29.98	44	35	70	320	12		10.0	CLR			
FTW	08/2353	1013.4	29.93	52	39	61	320	16	24	10.0	BKN030 BKN036		52	66
FTW	08/2253	1011.7	29.88	62	49	62	320	13	16	10.0	BKN026			
FTW	08/2153	1011.1	29.87	66	55	68	180	9		10.0	BKN030 BKN043			
FTW	08/2053	1011.2	29.87	64	54	70	180	10		10.0	BKN030 BKN043			
FTW	08/1953	1011.6	29.88	59	53	81	160	10		10.0	OVC015			
FTW	08/1853	1012.4	29.91	57	53	87	170	14	20	10.0	OVC011			
FTW	08/1753	1013.2	29.92	56	52	87	160	10		10.0	OVC010		48	56
FTW	08/1653	1013.7	29.94	53	51	93	140	8		7.0	OVC005			
FTW	08/1553	1013.6	29.94	52	51	97	140	11		6.0	OVC006	FG		
FTW	08/1453	1013.5	29.94	51	51	100	140	9		4.0	OVC006	FG		
FTW	08/1353	1012.7	29.91	50	50	100	150	12	21	3.0	OVC006	FG		
FTW	08/1253	1012.0	29.89	50	48	93	150	13	23	8.0	OVC006			
FTW	08/1153	1012.0	29.89	48	46	93	140	11		9.0	OVC006		46	50
FTW	08/1053	1011.8	29.89	48	45	89	140	12		10.0	OVC010			
FTW	08/0953	1011.9	29.89	49	44	83	140	14	20	10.0	OVC012			
FTW	08/0853	1012.2	29.89	48	42	80	140	13		10.0	CLR			
FTW	08/0753	1012.7	29.91	49	39	69	120	11		10.0	CLR			
FTW	08/0653	1012.3	29.90	50	39	66	130	13		10.0	CLR			
FTW	08/0553	1012.8	29.91	46	37	71	100	7		10.0	CLR		46	56

FTW	08/0453	1012.8	29.91	47	37	68	100	7	10.0	CLR		
FTW	08/0353	1013.0	29.91	49	37	63	100	9	10.0	CLR		
FTW	08/0253	1012.9	29.91	52	36	54	100	10	10.0	CLR		
FTW	08/0153	1012.4	29.90	52	36	54	100	8	10.0	CLR		
FTW	08/0053	1012.0	29.88	54	36	50	110	9	10.0	CLR		
FTW	07/2353	1011.6	29.88	56	36	47	130	12	10.0	CLR	43	59
FTW	07/2253	1011.6	29.88	58	36	44	140	11	10.0	CLR		
FTW	07/2153	1011.9	29.88	58	37	46	150	13	10.0	CLR		
FTW	07/2053	1012.8	29.91	55	36	48	130	15	10.0	CLR		
FTW	07/1953	1014.0	29.94	52	36	54	140	11	18	10.0	CLR	
FTW	07/1853	1015.3	29.98	49	36	61	130	8	18	10.0	CLR	
FTW	07/1753	1016.8	30.03	44	36	73	130	11	17	10.0	OVC013	35 44
FTW	07/1653	1018.3	30.07	39	35	86	160	10	10.0	OVC008		
FTW	07/1553	1018.4	30.07	37	34	89	140	10	10.0	OVC007		
FTW	07/1453	1018.1	30.06	37	35	92	130	8	10.0	OVC007		
FTW	07/1353	1017.4	30.04	36	35	96	130	6	10.0	OVC006		
FTW	07/1253	1017.0	30.03	36	35	96	150	7	10.0	OVC006		

The NWS Local Climatological Data (LCD) obtained from NCEI for KFTW for February 1-11, 2021 is included as figure 3 showing the temperature data from the maximum, minimum, and the departure from normal, the weather, precipitation, pressure, and maximum wind reported on the previous days leading to the accident. The data indicated the cold Arctic airmass impacting the area resulted in the mean temperature deviations ranged from -16.2° to -22° F from normal on February 9-11th.

U.S. Department of Commerce National Oceanic & Atmospheric Administration National Environmental Satellite, Data, and Information Service Current Location: Elev: 687 ft. Lat: 32.8192° N Lon: -97.3614° W Station: FORT WORTH MEACHAM FIELD, TX US WBAN: 74739013961 (KFTW)													Local Climatological Data Daily Summary February 2021 Generated on 03/08/2021				National Centers for Environmental Information 151 Patton Avenue Asheville, North Carolina 28801							
Date	Temperature (F)								Degree Days (base 65F)		Sun (LST)		Weather			Precipitation (in)			Pressure (inHg)		Wind	Maximum Wind Speed = MPH		
	Max	Min	Avg	Dep	ARH	ADP	AWB	Heat	Cool	Rise	Set	Weather Type	TLC	Snow Fall	Snow Depth	Avg Stn	Avg SL	Avg Speed	Peak Speed	Peak Dir	Sust. Speed	Sust. Dir		
	1	2	3	4	5	6	7	8	9	10	11	12	14	15	16	17	18	19	20	21	22	23		
01	58	31	45	-2.1				20	0	0725	1802					29.61		5.8	19s	330s	14	360		
02	65	38	52	4.8				13	0	0724	1803					29.39		7.6	22	170	16	130		
03	71	42	57	9.6				8	0	0723	1804					29.12		15.0	34	160	25	170		
04	63	41	52	4.5				13	0	0722	1805					29.10		14.5	37	300	26	310		
05	59	36	48	0.4				17	0	0722	1806					29.16		6.0	20	160	15	150		
06	60	41	51	3.2				14	0	0721	1807					29.16		11.7	31	300	24	300		
07	59	35	47	-0.9				18	0	0720	1808					29.20		9.8	25	120	18	130		
08	66	35	51	2.9				14	0	0719	1809	BR				29.19		12.9	29	320	21	320		
09	35	28	32	-16.2				33	0	0718	1809	BR				29.39		10.2	20	330	15	320		
10	31	26	29	-19.4				36	0	0718	1810	BR				29.39		12.6	26	010	20	360		
11	28	23	26	-22.6				39	0	0717	1811	FZRA BR UP	T	0.0	0	29.46		14.3	31	350	21	350		

Figure 3 - Local Climatological Data for Fort Worth for February 1-11, 2021

The local summaries for FTW for February 8-11, 2021 with time referenced to local time and winds in mph are included as figures 4 through 7. The official NWS logs use the weather type “BR” for mist⁹ or light fog, and “UP” for unknown freezing precipitation¹⁰. Fog¹¹ with the abbreviation “FG” implies surface visibility restrictions of 3/4 statute mile or less.

⁹ Mist – as defined by the American Meteorological Society (AMS) is a suspension in the air consisting of microscopic water droplets or wet hygroscopic particles, reducing the visibility at Earth's surface to not less than 1 km or 5/8 statute mile. The term mist is used in weather reports when there is such obscurity, and the corresponding relative humidity is 95% or more, but is generally lower than 100%.

¹⁰ Unknown freezing precipitation is often freezing drizzle which the ASOS/AWOS systems have a difficult time detecting due to the small droplet size and fall rates.

¹¹ Fog – as defined by the AMS occurs when Water droplets suspended in the atmosphere in the vicinity the earth's surface that affect visibility. According to international definition, fog reduces visibility below 1 km (0.62 miles). Fog differs from cloud only in that the base of fog is at the earth's surface while clouds are above the surface. When composed of ice crystals, it is termed ice fog. Visibility reduction in fog depends on concentration of cloud condensation nuclei and the resulting distribution of droplet sizes. Mist may be considered an intermediate between fog and haze; its particles are smaller (a few µm maximum) in size, it has lower relative humidity than fog, and does not obstruct visibility to the same

Station: FORT WORTH MEACHAM FIELD, TX US WBAN: 74739013961 (KFTW)

Date	Time (LST)	Station Type	Sky Conditions	Visi- bility	Weather Type (see documentation)	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Hum %	Wind Speed (MPH)	Wind Dir (Deg)	Wind Gusts (MPH)	Station Press (inHg)	Press. Tend	Net 3-Hr Change (inHg)	Sea Level Press. (inHg)	Report Type	Precip Total (in)	Alti- meter Setting (inHg)
						(F)	(C)	(F)	(C)	(F)	(C)											
					AU AW MW	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
08	0053	7	CLR.00	10.00		50	10.0	45	7.2	39	3.9	66	15	130		29.15		29.89	FM-15	0.00	29.90	
08	0153	7	CLR.00	10.00		49	9.4	44	6.7	39	3.9	69	13	120		29.15		29.91	FM-15	0.00	29.91	
08	0253	7	CLR.00	10.00		48	8.9	45	7.2	42	5.6	80	15	140		29.13	8	+0.01	29.89	FM-15	0.00	29.89
08	0328	7	BKN.07 13	10.00		48	8.9	46	7.8	43	6.1	83	17	140	26	29.13			FM-16		29.89	
08	0353	7	OVC.08 12	10.00		49	9.4	47	8.3	44	6.7	83	16	140	23	29.13			29.88	FM-15	0.00	29.89
08	0453	7	OVC.08 10	10.00		48	8.9	47	8.3	45	7.2	89	14	140		29.13			29.88	FM-15	0.00	29.89
08	0507	7	OVC.08 9	10.00		48	8.9	47	8.3	45	7.2	89	13	140		29.13			29.88	FM-15	0.00	29.89
08	0553	7	OVC.08 6	9.00		48	8.9	47	8.3	46	7.8	93	13	140		29.13	5	+0.01	29.88	FM-15	0.00	29.89
08	0653	7	OVC.08 6	8.00		50	10.0	49	9.4	48	8.9	93	15	150	26	29.13			29.88	FM-15	0.00	29.89
08	0753	7	OVC.08 6	3.00	BR-1	50	10.0	50	10.0	50	10.0	100	14	150	24	29.15			29.91	FM-15	0.00	29.91
08	0853	7	OVC.08 6	4.00	BR-1	51	10.6	51	10.6	51	10.6	100	10	140		29.18	3	-0.04	29.93	FM-15	0.00	29.94
08	0953	7	OVC.08 6	6.00	BR-1	52	11.1	51	10.6	51	10.6	97	13	140		29.18			29.93	FM-15	0.00	29.94
08	1053	7	OVC.08 5	7.00		53	11.7	52	11.1	51	10.6	93	9	140		29.18			29.93	FM-15	0.00	29.94
08	1151	6	OVC.08 10	10.00		55	12.8	53	11.7	52	11.1	88	14	160		29.18			FM-16		29.93	
08	1153	7	OVC.08 10	10.00		56	13.3	54	12.2	52	11.1	87	11	160		29.16	8	+0.01	29.92	FM-15	0.00	29.92
08	1216	7	OVC.08 9	10.00		56	13.3	54	12.2	52	11.1	87	10	180		29.16			29.90	FM-16		29.92
08	1253	7	OVC.08 11	10.00		57	13.9	55	12.8	53	11.7	87	16	170	23	29.15			29.90	FM-15	0.00	29.91
08	1300	7	OVC.08 11	10.00		57	13.9	55	12.8	53	11.7	87	16	160		29.15			29.90	FM-16		29.90
08	1351	6	OVC.08 15	10.00		59	15.0	56	13.3	54	12.2	82	14	160		29.13			29.87	FM-16		29.88
08	1353	7	OVC.08 15	10.00		59	15.0	56	13.3	53	11.7	81	11	160		29.13			29.87	FM-15	0.00	29.88
08	1453	7	BKN.07 30 BKN.07 43	10.00		64	17.8	58	14.4	54	12.2	70	11	180		29.12	6	+0.05	29.86	FM-15	0.00	29.87
08	1500	7	BKN.07 30 BKN.07 43	10.00		63	17.2	58	14.4	54	12.2	73	10	180		29.12			29.86	FM-16		29.87
08	1553	7	BKN.07 30 BKN.07 43	10.00		66	18.9	60	15.6	55	12.8	68	10	180		29.12			29.86	FM-15	0.00	29.87
08	1600	7	BKN.07 26	10.00		65	18.3	59	15.0	54	12.2	68	9	180		29.12			29.86	FM-16		29.87
08	1653	7	BKN.07 26	10.00		62	16.7	55	12.8	49	9.4	62	15	320	18	29.13			29.88	FM-15	0.00	29.88
08	1710	7	BKN.07 26 OVC.08 36	10.00		59	15.0	51	10.6	43	6.1	56	15	330		29.15			29.88	FM-16		29.90
08	1737	7	BKN.07 30 BKN.07 34	10.00		55	12.8	48	8.9	41	5.0	59	18	320	25	29.16			29.88	FM-16		29.92
08	1753	7	BKN.07 30 BKN.07 36	10.00		52	11.1	46	7.8	39	3.9	61	18	320	28	29.18	3	-0.06	29.93	FM-15	0.00	29.93
08	1853	7	CLR.00	10.00		44	6.7	40	4.4	35	1.7	71	14	320		29.22			29.98	FM-15	0.00	29.98
08	1953	7	CLR.00	10.00		39	3.9	37	2.8	34	1.1	82	14	320	23	29.24			30.01	FM-15	0.00	30.00
08	2053	7	FEW.02 31	10.00		38	3.3	36	2.2	34	1.1	86	11	330		29.26	1	-0.09	30.02	FM-15	0.00	30.02
08	2117	7	BKN.07 11	10.00		37	2.8	35	1.7	33	0.6	86	10	330		29.27			30.01	FM-16		30.03
08	2142	7	SCT.04 11	10.00		36	2.2	35	1.7	33	0.6	89	10	330	18	29.28			30.01	FM-16		30.04
08	2153	7	FEW.02 11	10.00		36	2.2	35	1.7	33	0.6	89	9	330		29.28			30.04	FM-15	0.00	30.04
08	2203	7	BKN.07 11	10.00		36	2.2	35	1.7	33	0.6	89	11	340		29.28			30.04	FM-16		30.04
08	2253	7	BKN.07 11	10.00		36	2.2	35	1.7	33	0.6	89	13	330		29.30			30.06	FM-15	0.00	30.06
08	2300	7	OVC.08 8	10.00		36	2.2	35	1.7	33	0.6	89	11	330		29.30			30.06	FM-16		30.06
08	2353	7	OVC.08 7	10.00		35	1.7	34	1.1	33	0.6	93	9	330		29.31	1	-0.05	30.07	FM-15	0.00	30.07

Figure 4 - Local Climatological Data for Fort Worth on February 8, 2021

Station: FORT WORTH MEACHAM FIELD, TX US WBAN: 74739013961 (KFTW)

Date	Time (LST)	Station Type	Sky Conditions	Visi- bility	Weather Type (see documentation)	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Hum %	Wind Speed (MPH)	Wind Dir (Deg)	Wind Gusts (MPH)	Station Press (inHg)	Press. Tend	Net 3-Hr Change (inHg)	Sea Level Press. (inHg)	Report Type	Precip Total (in)	Alti- meter Setting (inHg)
						(F)	(C)	(F)	(C)	(F)	(C)											
					AU AW MW	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
09	0053	7	OVC.08 7	10.00		35	1.7	34	1.1	33	0.6	93	9	320		29.32			30.08	FM-15	0.00	30.08
09	0153	7	OVC.08 6	9.00		34	1.1	34	1.1	33	0.6	97	11	330		29.32			30.08	FM-15	0.00	30.08
09	0253	6	OVC.08 6	10.00		34	1.1	33	0.6	32	0.0	92	9	330		29.33	2	-0.02	30.09	FM-15	0.00	30.09
09	0353	7	OVC.08 8	6.00	BR-1	33	0.6	32	0.0	31	-0.6	92	11	320		29.34			30.10	FM-15	0.00	30.10
09	0453	6	OVC.08 7	5.00	BR-1	31	-0.6	30	-1.1	29	-1.7	92	10	320		29.36			30.11	FM-15	0.00	30.12
09	0553	7	OVC.08 7	4.00	BR-1	29	-1.7	29	-1.7	28	-2.2	96	13	320		29.37	3	-0.04	30.14	FM-15	0.00	30.13
09	0653	7	OVC.08 5	4.00	BR-1	29	-1.7	29	-1.7	28	-2.2	96	10	320		29.39			30.16	FM-15	0.00	30.15
09	0753	7	OVC.08 5	2.50	BR-1	28	-2.2	28	-2.2	27	-2.8	96	10	330		29.41			30.18	FM-15	0.00	30.17
09	0832	7	OVC.08 5	3.00	BR-1	29	-1.7	29	-1.7	28	-2.2	96	10	330		29.43			30.18	FM-16		30.19
09	0853	7	OVC.08 5	4.00	BR-1	29	-1.7	28	-2.2	27	-2.8	92	10	320		29.44	3	-0.06	30.21	FM-15	0.00	30.20
09	0904	7	OVC.08 5	2.00	BR-1	28	-2.2	28	-2.2	27	-2.8	96	10	310		29.44			30.18	FM-16		30.20
09	0912	7	OVC.08 5	1.50	BR-1	28	-2.2	28	-2.2	28	-2.2	100	11	310		29.45			30.18	FM-16		30.21
09	0919	7	OVC.08 4	1.50	BR-1	28	-2.2	28	-2.2	28	-2.2	100	11	320		29.45			30.18	FM-16		30.21
09	0941	7	OVC.08 4	2.50	BR-1	29	-1.7	29	-1.7	28	-2.2	96	11	320		29.45			30.18	FM-16		30.21
09	0953	7	OVC.08 4	2.50	BR-1	29	-1.7	29	-1.7	28	-2.2	96	10	310		29.46			30.23	FM-15	0.00	30.22
09	1016	7	OVC.08 4	4.00	BR-1	29	-1.7	29	-1.7	28	-2											

Station: FORT WORTH MEACHAM FIELD, TX US WBAN: 74739013961 (KFTW)

GENERATED BY: METEOROLOGIST

Date	Time (LST)	Station Type	Sky Conditions	Visibility	Weather Type (see documentation) AU AW MW	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Hum %	Wind Speed (MPH)	Wind Dir (Deg)	Wind Gusts (MPH)	Station Press (inHg)	Press. Tend.	Net 3-Hr Change (inHg)	Sea Level Press. (inHg)	Report Type	Precip Total (in)	Alti-meter Setting (inHg)
						(F)	(C)	(F)	(C)	(F)	(C)											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
10	0008	7	OVC:08 9	4.00	BR:1	28	-2.2	27	-2.8	26	-3.3	92	11	340		29.40				FM-16		30.16
10	0038	7	OVC:08 5	2.50	BR:1	28	-2.2	28	-2.2	27	-2.8	96	9	340		29.40				FM-16		30.16
10	0053	7	OVC:08 5	2.50	BR:1	28	-2.2	28	-2.2	27	-2.8	96	11	350		29.40		30.17	FM-15	0.00		30.16
10	0104	7	OVC:08 5	3.00	BR:1	28	-2.2	28	-2.2	27	-2.8	96	9	350		29.40				FM-16		30.16
10	0153	7	OVC:08 5	4.00	BR:1	28	-2.2	28	-2.2	27	-2.8	96	9	330		29.40		30.17	FM-15	0.00		30.16
10	0206	7	OVC:08 4	4.00	BR:1	28	-2.2	28	-2.2	27	-2.8	96	10	360		29.40				FM-16		30.16
10	0229	7	OVC:08 5	5.00	BR:1	28	-2.2	28	-2.2	27	-2.8	96	8	340		29.40				FM-16		30.16
10	0253	7	OVC:08 5	3.00	BR:1	28	-2.2	28	-2.2	28	-2.2	100	10	330		29.39	8	+0.01	30.16	FM-15	0.00	30.15
10	0304	7	OVC:08 4	5.00	BR:1	28	-2.2	28	-2.2	27	-2.8	96	9	340		29.39				FM-16		30.15
10	0326	7	OVC:08 5	4.00	BR:1	28	-2.2	28	-2.2	27	-2.8	96	9	350		29.39				FM-16		30.15
10	0344	7	OVC:08 4	4.00	BR:1	28	-2.2	28	-2.2	27	-2.8	96	10	360		29.38				FM-16		30.14
10	0353	7	OVC:08 4	4.00	BR:1	28	-2.2	28	-2.2	27	-2.8	96	11	360		29.38		30.15	FM-15	0.00		30.14
10	0436	7	OVC:08 5	6.00	BR:1	28	-2.2	28	-2.2	27	-2.8	96	8	350		29.38				FM-16		30.14
10	0453	7	OVC:08 5	7.00		27	-2.8	27	-2.8	27	-2.8	100	9	360		29.37		30.14	FM-15	0.00		30.13
10	0551	6	OVC:08 4	4.00	BR:1	27	-2.8	27	-2.8	27	-2.8	100	11	350		29.38				FM-16		30.14
10	0553	6	OVC:08 4	4.00	BR:1	27	-2.8	27	-2.8	26	-3.3	96	9	350		29.38	5	+0.02	30.15	FM-15	0.00	30.14
10	0653	6	OVC:08 4	4.00	BR:1	27	-2.8	27	-2.8	26	-3.3	96	11	330		29.41				FM-15	0.00	30.17
10	0753	6	OVC:08 4	4.00	BR:1	27	-2.8	27	-2.8	26	-3.3	96	8	360		29.40				FM-15	0.00	30.16
10	0853	6	OVC:08 4	6.00	BR:1	27	-2.8	27	-2.8	26	-3.3	96	11	330		29.42	1	-0.05	30.17	FM-15	0.00	30.18
10	0914	6	OVC:08 5	8.00		28	-2.2	27	-2.8	26	-3.3	92	11	330		29.42				FM-16		30.18
10	0953	6	OVC:08 6	8.00		28	-2.2	27	-2.8	26	-3.3	92	10	340		29.42			30.20	FM-15	0.00	30.18
10	1053	6	OVC:08 5	6.00	BR:1	29	-1.7	28	-2.2	27	-2.8	92	13	350		29.43			30.20	FM-15	0.00	30.19
10	1153	6	OVC:08 5	7.00		29	-1.7	29	-1.7	28	-2.2	96	11	330		29.42	8	0.00	30.20	FM-15	0.00	30.18
10	1253	6	OVC:08 5	4.00	BR:1	29	-1.7	29	-1.7	28	-2.2	96	14	330		29.41				FM-15	0.00	30.17
10	1353	6	OVC:08 5	5.00	BR:1	30	-1.1	30	-1.1	29	-1.7	96	13	330	20	29.38			30.18	FM-15	0.00	30.14
10	1453	6	OVC:08 6	10.00		31	-0.6	30	-1.1	28	-2.2	89	15	350		29.37	8	+0.06	30.14	FM-15	0.00	30.13
10	1553	6	OVC:08 6	10.00		31	-0.6	30	-1.1	28	-2.2	89	15	350	20	29.35			30.12	FM-15	0.00	30.11
10	1653	7	OVC:08 7	10.00		30	-1.1	29	-1.7	28	-2.2	92	16	350		29.36			30.13	FM-15	0.00	30.12
10	1753	7	OVC:08 7	9.00		29	-1.7	28	-2.2	27	-2.8	92	16	350		29.37	3	0.00	30.14	FM-15	0.00	30.13
10	1853	7	OVC:08 8	10.00		29	-1.7	28	-2.2	26	-3.3	89	16	340		29.39			30.15	FM-15	0.00	30.15
10	1953	6	OVC:08 6	4.00	BR:1	28	-2.2	27	-2.8	26	-3.3	92	13	340		29.42			30.20	FM-15	0.00	30.18
10	2053	6	OVC:08 6	5.00	BR:1	27	-2.8	27	-2.8	26	-3.3	96	17	360	26	29.42	0	-0.05	30.19	FM-15	0.00	30.18
10	2153	6	OVC:08 9	8.00		27	-2.8	26	-3.3	24	-4.4	89	14	360	22	29.43			30.21	FM-15	0.00	30.19
10	2209	6	OVC:08 10	8.00		27	-2.8	26	-3.3	24	-4.4	89	16	350		29.44				FM-16		30.20
10	2253	6	OVC:08 10	8.00		27	-2.8	26	-3.3	23	-5.0	85	13	340	21	29.43			30.21	FM-15	0.00	30.19
10	2353	6	OVC:08 11	8.00		26	-3.3	25	-3.9	23	-5.0	88	15	350		29.43	0	-0.01	30.20	FM-15	0.00	30.19

Figure 6 - Local Climatological Data for Fort Worth on February 10, 2021

Station: FORT WORTH MEACHAM FIELD, TX US WBAN: 74739013961 (KFTW)

GENERATED BY: METEOROLOGIST

Date	Time (LST)	Station Type	Sky Conditions	Visibility	Weather Type (see documentation) AU AW MW	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Hum %	Wind Speed (MPH)	Wind Dir (Deg)	Wind Gusts (MPH)	Station Press (inHg)	Press. Tend.	Net 3-Hr Change (inHg)	Sea Level Press. (inHg)	Report Type	Precip Total (in)	Alti-meter Setting (inHg)
						(F)	(C)	(F)	(C)	(F)	(C)											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
11	0053	6	OVC:08 10	7.00		25	-3.9	24	-4.4	23	-5.0	92	14	330		29.44			30.21	FM-15	0.00	30.20
11	0103	6	OVC:08 8	7.00		25	-3.9	24	-4.4	23	-5.0	92	14	340		29.43				FM-16		30.19
11	0140	6	OVC:08 9	6.00	-FZ-8 RA:02 BR:1 [FZRA]	26	-3.3	25	-3.9	23	-5.0	88	14	340	23	29.43				FM-16		30.19
11	0151	6	OVC:08 9	7.00		25	-3.9	24	-4.4	23	-5.0	93	14	340		29.43				FM-16		30.19
11	0153	6	OVC:08 9	6.00	-FZ-8 RA:02 BR:1 [FZRA]	25	-3.9	24	-4.4	23	-5.0	92	11	330		29.43		30.21	FM-15	T		30.19
11	0216	6	OVC:08 9	8.00		25	-3.9	24	-4.4	23	-5.0	92	14	340		29.43				FM-16		30.19
11	0253	6	OVC:08 7	6.00	BR:1	25	-3.9	24	-4.4	23	-5.0	92	13	330		29.43	8	0.00	30.20	FM-15	T	30.19
11	0353	6	OVC:08 8	5.00	BR:1	24	-4.4	23	-5.0	22	-5.6	91	14	350	23	29.43			30.21	FM-15	0.00	30.19
11	0453	6	OVC:08 7	4.00	BR:1	24	-4.4	24	-4.4	23	-5.0	96	15	340	23	29.44			30.22	FM-15	0.00	30.20
11	0553	6	OVC:08 7	9.00		23	-5.0	22	-5.6	21	-6.1	92	18	350	25	29.45	3	-0.02	30.23	FM-15	0.00	30.21
11	0651	6	OVC:08 10	9.00	UP:09	25	-3.9	24	-4.4	21	-6.1	86	16	340	23	29.45				FM-16		30.21
11	0653	6	OVC:08 10	9.00		23	-5.0	22	-5.6	21	-6.1	92	15	340	23	29.45			30.24	FM-15	T	30.21
11	0753	6	OVC:08 10	7.00		23	-5.0	22	-5.6	21	-6.1	92	16	350		29.47			30.25	FM-15	T	30.23
11	0812	6	OVC:08 9	7.00		23	-5.0	22	-5.6	21	-6.1	92	16	350	24	29.47				FM-16		30.23
11	0830	6	OVC:08 11	8.00		23	-5.0	22	-5.6	20	-6.7	88	17	350	23	29.48				FM-16		30.24
11	0838	6	OVC:08 8	8.00		23	-5.0	22	-5.6	20	-6.7	88	17	340		29.48				FM-16		30.24
11	0853	6	OVC:08 8	9.00		23	-5.0	22	-5.6	20	-6.7	88	17	350	24	29.48	3	-0.03	30.26	FM-15	0.00	30.24
11	0900	6	OVC:08 12	10.00		23	-5.0	22	-5.6	20	-6.7	88	17	350		29.48				FM-16		30.24
11	0953	6	OVC:08 14	10.00		24	-4.4	23	-5.0	20	-6.7	84	17	360		29.48			30.26	FM-15	0.00	30.24
11	1053	6	OVC:08 14	10.00		26	-3.3	24	-4.4	20	-6.7	78	16	350	24	29.47			30.24	FM-15	0.00	30.23
11	1153	6	OVC:08 14	10.00		25	-3.9	23	-5.0	20	-6.7	81	14	340		29.48	3	0.00	30.26	FM-15	0.00	30.24
11	1200	6	OVC:08 16	10.00		25	-3.9	23	-5.0	20	-6.7	81	11	330		29.48				FM-16		30.24
11	1253	6	OVC:08 16	10.00		26	-3.3	24	-4.4	20	-6.7	78	10	330		29.46			30.24	FM-15	0.00	30.22
11	1353	6	BKN:07 18 OVC:08 30	10.00		27	-2.8	25	-3.9	20	-6.7	75	14	350		29.44			30.22	FM-15	0.00	30.20
11	1453	6	OVC:08 17	10.00		27	-2.8	25	-3.9	20	-6.7	75	14	340		29.43	6	+0.05	30.21	FM-15	0.00	30.19
11	1553	6	BKN:07 18 OVC:08 26	10.00		27	-2.8	25	-3.9	20	-6.7											

2.2 Fort Worth Naval Air Station/Carswell Field, Fort Worth, Texas

The next closest weather reporting site was from Fort Worth Naval Air Station/Carswell Field (KNFW), Fort Worth, Texas, located approximately 6 miles west of the accident site at an elevation of 650 ft. At the approximate time of the accident the following conditions were reported.

Fort Worth Naval Air Station weather observation at 0552 CST, automated, wind from 010° at 13 mph, visibility 10 statute miles or more, low overcast clouds at 1,100 ft agl, temperature 27° F, dew point temperature 22° F, altimeter 30.23 inHg. Remarks: A02, unknown precipitation began at 0537 and ended at 0547 CST, sea-level pressure 1021.7-hPa, hourly precipitation less than 0.01 inches, 6-hour precipitation total less than 0.01 inches, temperature -2.8° C, dew point temperature -5.6° C, 6-hour maximum temperature 29° F, 6-hour minimum temperature 27° F, 3-hour pressure tendency risen 0.7-hPa, thunderstorm sensor inoperative, visibility sensor south inoperative, maintenance indicator on.

Fort Worth Naval Air Station weather observation at 0652 CST, wind from 350° at 17 mph, visibility 10 statute miles or more in light freezing drizzle, low overcast clouds at 1,200 ft agl, temperature 27° F, dew point temperature 21° F, altimeter 30.23 inHg. Remarks: A02, sea-level pressure 1021.9-hPa, hourly precipitation less than 0.01 inches, temperature -2.8° C, dew point temperature -5.6° C, visibility sensor south inoperative, maintenance indicator on.

A review of the observation indicated that unknown freezing precipitation was first reported between 0123 and 0201 CST and again between 0537 and 0547 CST with less than 0.01 inches of precipitation reported. Light freezing drizzle was also reported after the accident between 0652 and 0712 CST. The station did not report the ice accretion rate during the period and reported less than 0.01 inches of precipitation on February 11, 2021.

A table of the reported conditions from KNFW from 1752 CST on February 10, 2021 through 0752 CST on February 11, 2021 were as follows, with time referenced to UTC, wind speed in knots. Weather codes under “WX” are “HZ” for haze, “UP” for unknown precipitation, and “-FZDL” for light freezing drizzle.

ID	TIME	T	TD	RH	DIR	SPD	GST	ALT	SLP	VIS	CIL	COV	WX	MAX	MIN	PR6	PR24	SC
KNFW	10/2352	0	-3	82	360	11		30.14	1018.9	10	9	OVC		1	0			
KNFW	11/0052	0	-3	79	350	14		30.16	1019.6	10	9	OVC						
KNFW	11/0152	-1	-3	82	360	13		30.19	1020.6	5	8	OVC	HZ					
KNFW	11/0252	-1	-3	85	360	13		30.19	1020.7	8	9	OVC						
KNFW	11/0352	-1	-4	78	360	10		30.20	1021.0	9	9	OVC						
KNFW	11/0452	-1	-5	75	360	13		30.21	1021.3	10	10	OVC						
KNFW	11/0552	-2	-4	82	350	11		30.20	1020.8	8	11	OVC		1	-3			
KNFW	11/0652	-2	-5	78	360	11		30.21	1021.3	10	12	OVC						
KNFW	11/0752	-2	-4	82	350	14		30.20	1021.0	7	12	OVC	UP					
KNFW	11/0852	-2	-5	81	360	16	22	30.20	1021.0	9	12	OVC						
KNFW	11/0952	-3	-6	81	360	13		30.21	1021.1	7	12	OVC						
KNFW	11/1052	-3	-5	85	350	14		30.22	1021.5	9	10	OVC						
KNFW	11/1152	-3	-6	81	10	11		30.23	1021.7	6	11	OVC	-FZDZ	-2	-3	0		
KNFW	11/1252	-3	-6	81	350	15		30.23	1021.9	10	12	OVC	-FZDZ					
KNFW	11/1352	-3	-6	81	360	16		30.25	1022.4	9	10	OVC						

2.3 Arlington Municipal Airport, Arlington, Texas

The next closest weather reporting facility was from Arlington Municipal Airport (KGKY), Arlington, Texas, located approximately 14 miles southeast of the accident site. The airport listed an elevation of 628 ft and had an ASOS installed for automated weather reporting. At the approximate time of the accident the following conditions were reported.

Arlington special weather observation at 0542 CST, automated, wind from 330° at 15 mph, visibility 4 miles in light freezing rain and mist, overcast clouds at 700 ft agl, temperature 27° F, dew point temperature 24° F, altimeter 30.21 inches of Hg. Remarks: automated station with a precipitation discriminator, freezing rain began at 0536 CST, hourly precipitation less than 0.01 inches, 1-hour icing accretion rate 0.01 inch, temperature 27° F (-2.8° C), dew point temperature 23° F (-5.0° C), maintenance indicator on.

Arlington weather observation at 0553 CST, automated, wind from 330° at 15 mph, visibility 4 miles in mist, overcast clouds at 700 ft agl, temperature 27° F, dew point temperature 24° F, altimeter 30.20 inches of Hg. Remarks: automated station with a precipitation discriminator, freezing rain began at 0536 and ended at 0549 CST, sea-level pressure 1023.1-hPa, hourly precipitation less than 0.01 inch or a trace, 6-hour precipitation total less than 0.01 inch, 1-hour icing accretion rate 0.02 inch, 6-hour icing accretion 0.06 inch, temperature 27° F (-2.8° C), dew point temperature 24° F (-4.4° C), 6-hour maximum temperature 31° F, 6-hour minimum temperature 27°F, 3-hour pressure tendency fallen 0.7-hPa, maintenance indicator on.

A review of the observations indicated precipitation was first reported beginning at 0326 and ended at 0336 CST in the form of light freezing rain with a trace of precipitation reported or less than 0.01 inches. Freezing rain was again reported between 0405 and ended at 0425 CST, and between 0536 and ending at 0549 CST with less than 0.01 inches reported. The total ice accretion reported at the time of the accident was 0.02 inches for the hour, with the 6-hour total as being 0.06 inches of ice.

A table of the reporting conditions for KGKY on February 11, 2021 were as follows, with time reference to UTC, and wind speeds in knots. Weather code “BR” is for mist or light fog.

ID	TIME	T	TD	RH	DIR	SPD	GST	ALT	SLP	VIS	CIL	CLD	WX	MAX	MIN	PR6	PR24	SC
KGKY	10/2353	1	-2	81	330	12		30.13	1020.7	10	8	OVC		1	0			
KGKY	11/0053	1	-2	81	340	15		30.14	1020.9	10	8	OVC						
KGKY	11/0153	1	-2	81	350	15		30.16	1021.6	4	7	OVC	HZ					
KGKY	11/0253	0	-2	85	340	14		30.17	1021.9	2.5	6	OVC	-FZRA					
KGKY	11/0353	0	-2	85	360	11	19	30.19	1022.5	4	6	OVC	BR					
KGKY	11/0453	0	-2	85	350	11		30.19	1022.6	3	5	OVC	BR					
KGKY	11/0553	-1	-3	85	330	10		30.18	1022.3	5	7	OVC	BR	2	-1	0		
KGKY	11/0653	-1	-3	85	310	13		30.18	1022.3	6	8	OVC	BR					
KGKY	11/0753	-2	-4	85	320	13		30.19	1022.6	8	9	OVC						
KGKY	11/0853	-2	-4	82	320	14		30.18	1022.4	5	8	OVC	HZ					
KGKY	11/0953	-2	-4	85	320	14		30.19	1022.6	4	7	OVC	BR					
KGKY	11/1053	-2	-4	85	330	15	22	30.20	1022.9	4	7	OVC	BR					
KGKY	11/1153	-3	-4	89	330	13		30.20	1023.1	4	7	OVC	BR	-1	-3	0		
KGKY	11/1253	-3	-5	85	330	15		30.21	1023.4	5	8	OVC	BR					
KGKY	11/1353	-3	-5	85	340	11		30.22	1023.8	6	9	OVC	BR					

3.0 Upper Air Sounding

The NWS Dallas/Fort Worth (KFWD) Weather Forecast Office (WFO) sounding for 0600 CST depicting the vertical structure of temperature, moisture, and winds over the area was also documented. The sounding was plotted on a standard Skew T log P diagram¹² using the Universal Rawinsonde Observation (RAOB) program¹³ software. Figure 8 is the sounding for 0600 CST plotted from the surface to 400-hPa or approximately 24,000 ft over the Fort Worth area.

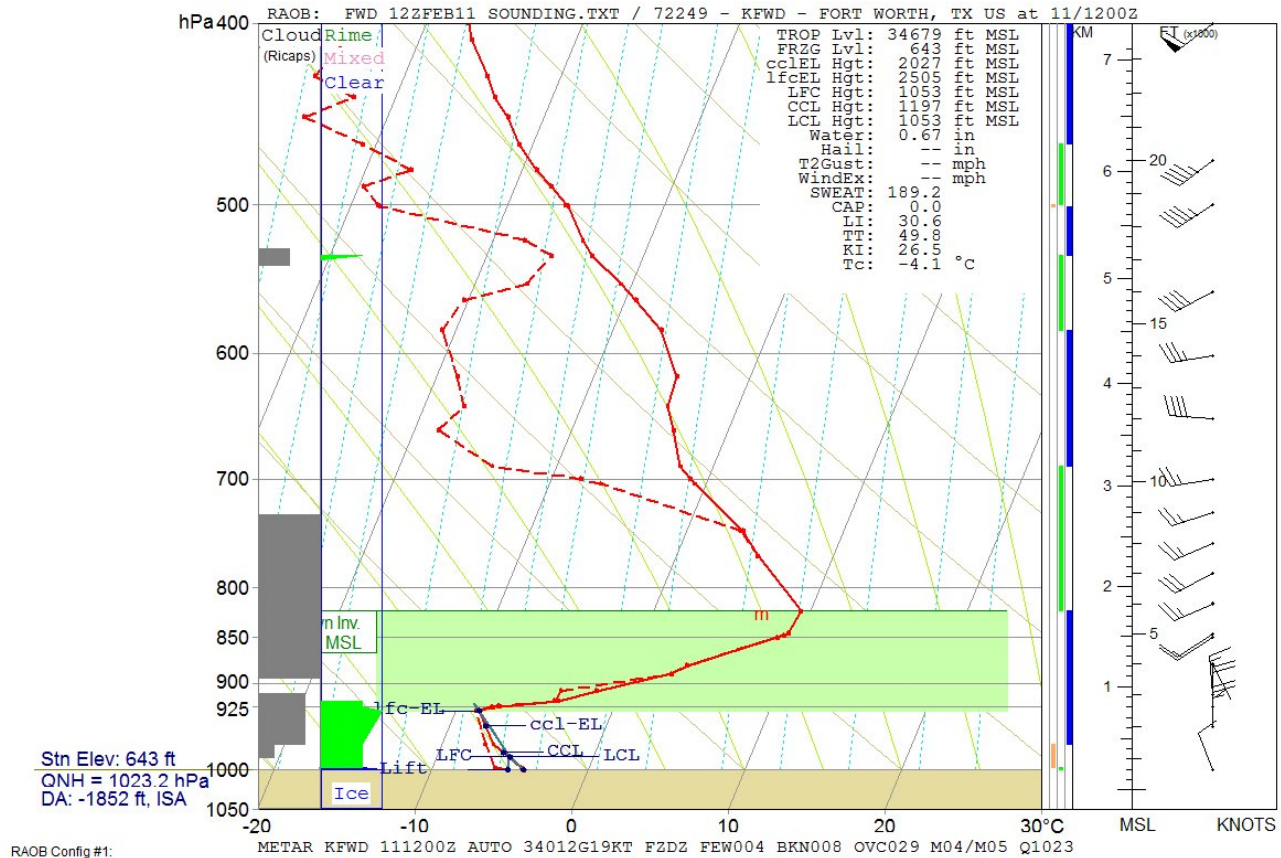


Figure 8 - NWS Fort Worth sounding for 0600 CST

The 0600 CST KFWD sounding depicted an elevation of 643 ft, with a near surface temperature 25° F (-4° C), and a dew point temperature of 23° F (-5° C), with a relative humidity of 92%. The sounding depicted a lifted condensation level (LCL)¹⁴ and level of free convection (LFC)¹⁵ at 410 ft agl (1,053 ft msl) and represented the cloud base as depicted by RAOB. The sounding was saturated from the LCL through approximately 8,500 ft, and supported clouds producing light precipitation in

¹² Skew T log P diagram – is a standard meteorological plot or thermodynamic diagram using temperature and the logarithmic of pressure as coordinates, used to display winds, temperature, dew point, and various indices used to define the vertical structure of the atmosphere.

¹³ RAOB – (The Universal RAwinsonde OBServation program) is an interactive sounding analysis program developed by Eosonde Research Services (ERS) previously known as Environmental Research Services, The Villages, Florida.

¹⁴ Lifted Condensation Level (LCL) - the level at which a lifted parcel becomes saturated. The LCL height corresponds to cloud base height for forced ascent.

¹⁵ Level of Free Convection (LFC) - the last level where a parcel becomes buoyant, or "warmer" than the environmental temperature at the same level. The LFC represents the bottom of the layer containing CAPE.

the form of freezing rain. The precipitable water¹⁶ content was 0.67 inches. A low-level temperature inversion was noted between approximately 2,500 feet through 5,800 ft which capped the cold surface air mass and where temperatures increased above freezing.

The KFWD sounding wind profile indicated surface winds from the northwest or from 340° at 14 mph (12 knots) with potential gust to 22 mph (19 knots). The winds were from the north through 4,000 ft and then abruptly shifted to the west-southwest with increasing wind speeds.

4.0 Weather Surveillance Radar Imagery

The NWS Dallas (KFWS) Weather Surveillance Radar 1988 Doppler (WSR-88D)¹⁷ was located approximately 12 miles south of the accident site. The NWS level II data were obtained from the NCEI archive and displayed using the NWS NEXRAD Interactive Viewer and Data Exporter software. The radar data from 0100 through 0630 CST were downloaded and reviewed using the NWS Weather Tool Kit software to verify the periods of precipitation (echoes greater than 15 dBZ¹⁸) reported at the primary reporting sites surrounding the accident site. A close review of the radar imagery immediately prior to the accident, revealed several small echoes that form over the area and moved over the accident site, and did not directly impact KFFW and KFTW. Figures 9-11 are the KFWS WSR-88D 0.5° base reflectivity or lowest elevation scan imagery surrounding the period of the accident and depicted a small area of light intensity echoes with maximum reflectivity near 30 dBZ develop west-southwest and move over the accident site between the period from 0553 through 0602 CST.

¹⁶ Precipitable Water (PW) - The total amount of (condensed) water available within the lowest 400 mb of the sounding.

¹⁷ The WSR-88D is a S-band 10-centimeter wavelength radar with a power output of 750,000 watts, with a 28-foot parabolic antenna concentrating the energy into a 0.95° beam width. The radar produces three basic types of products reflectivity, radial velocity, and spectral width.

¹⁸

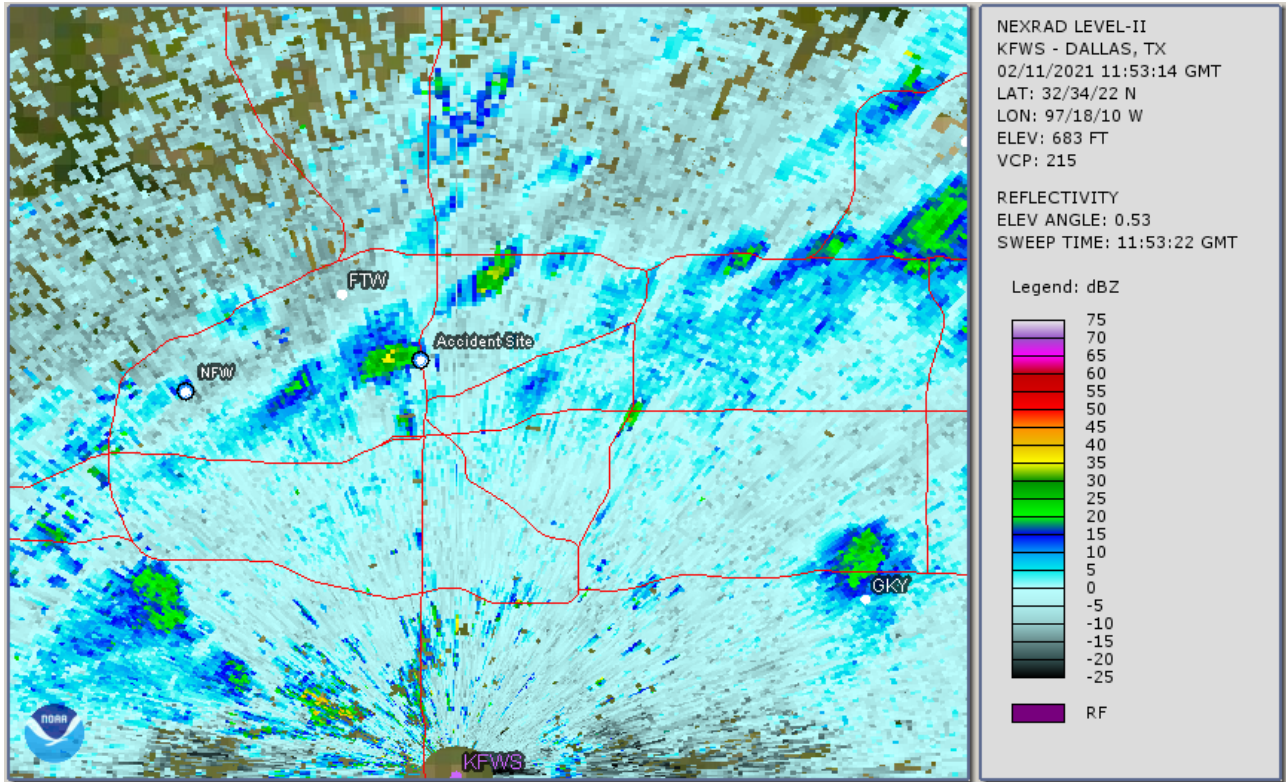


Figure 9 - NWS Dallas WSR-88D 0.5° base reflectivity image at 0553 CST

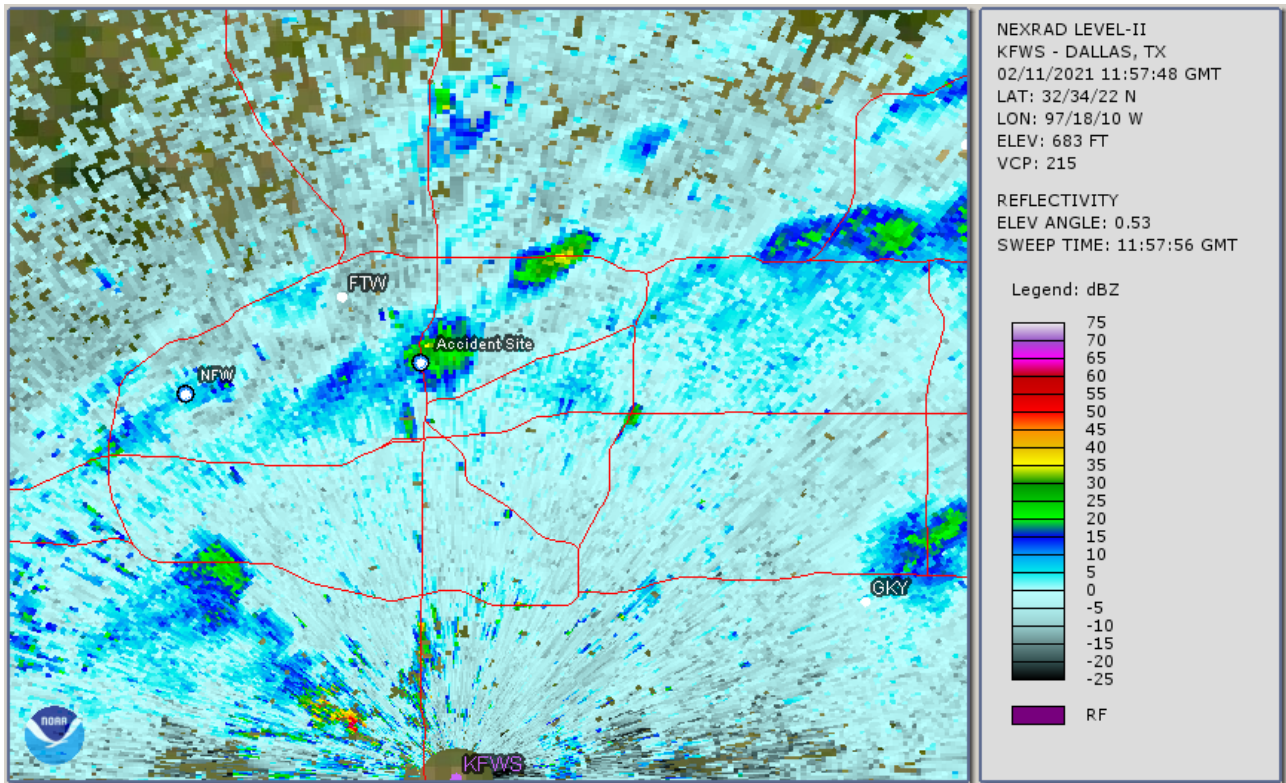


Figure 10 - NWS Dallas WSR-88D 0.5° base reflectivity image at 0557 CST

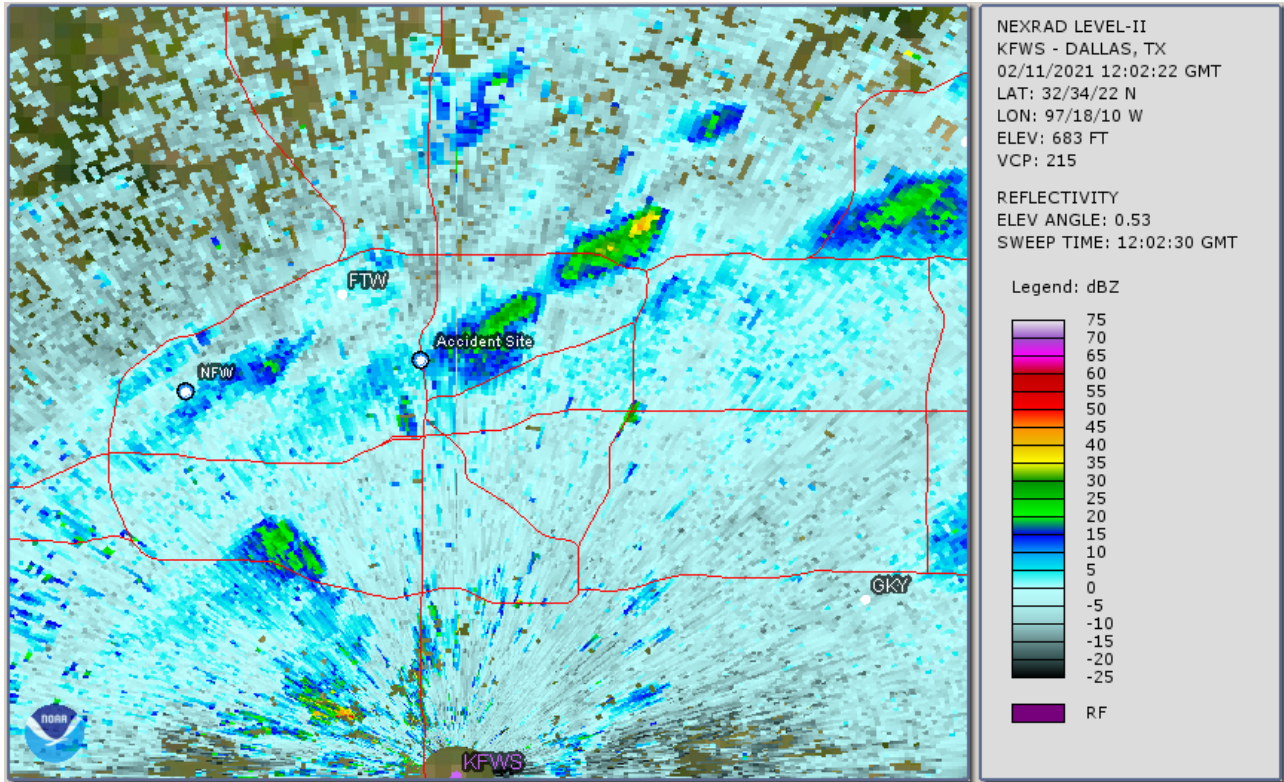


Figure 11 - NWS Dallas WSR-88D 0.5° base reflectivity image at 0602 CST

5.0 NWS Forecasts and Advisories

The NWS Dallas/Fort Worth WFO was responsible for the area where the accident occurred. The following advisories were issued by the KFWD WFO during the period.

5.1 Area Forecast Discussion

The NWS Area Forecast Discussions (AFD) are issued by each WFO to describe the short-term weather conditions within their region with a marine section that includes the general conditions as they relate to the creation of the zone forecast or coastal forecast. The discussion also gives some reasoning behind the forecast. These are generated roughly every 6 hours and corresponds to the release of the latest forecast for that office. The NWS KFWD WFO issued the AFD at 0114 CST for the Fort Worth area and was as follows.

*FXUS64 KFWD 110714
AFDFWD*

*Area Forecast Discussion
National Weather Service Fort Worth TX
114 AM CST Thu Feb 11 2021*

...New Short Term, Aviation...

.SHORT TERM... /NEW/

/Through Tonight/

Forecast changes with this update include a small areal expansion of the Winter Weather Advisory into Falls, Limestone, and Freestone counties, while precip amounts have been lowered some across parts of North Texas.

*Some drier air is beginning to work into North Texas tonight within the deepening frontal inversion layer. **However, isentropic ascent above the frontal zone¹⁹ will continue to increase as a shortwave trough moves overhead. This should result in continued light rain/drizzle roughly from the DFW area northwestward, while more showery convective precipitation occurs to the south.** Any precip that is convective in nature will have the ability to fall as light sleet, perhaps resulting in some minor accumulations. We've already received a few reports of sleet as of midnight. In addition, elevated instability will support a few instances of thunder at times.*

Fortunately, areas that are the coldest across our northwest should experience the lightest of the precipitation, with accumulations of ice and sleet likely remaining on the order of a few hundredths of an inch. Where greater precipitation is expected south of I-20, temperatures are more marginal in the 30-33 degree range which may limit any accumulations on surface roads. Impacts to bridges/overpasses and elevated surfaces continue to be the primary concern across most of the Advisory area through this morning.

The main forecast problem is what to make of precipitation potential through the afternoon and early evening across Central Texas. As the main shortwave energy swings through, a swath of rain/sleet is expected to traverse much of the Hill Country and Central Texas as it moves eastward with time. Most of this precipitation will fall between noon and 8pm or so south of a Lampasas to Athens line. (Areas north of there will likely be dry by this time period.) Temperatures in this area will be quite marginal with readings mostly in the 30-33 degree range, and in order to get significant accumulations of ice, temperatures would really need to be a few degrees colder than this. At this point, it seems the Advisory should suffice for impacts to bridges/overpasses and perhaps a few surface roads if precip can become heavy enough to result in minor surface accumulations of ice/sleet. In a later update, we'll need to reconfigure/repurpose the Winter Weather Advisory to address this area while North Texas remains mostly dry. Most precipitation should exit the forecast area to the east/southeast by mid evening.

At this point, it looks like most of the area will be cold but dry overnight into early Friday. Temperatures will be at or below freezing across the entire area, however.

-Stalley

*.LONG TERM... /Issued 439 PM CST Wed Feb 10 2021/
/Thursday Night through Wednesday/*

Precipitation should be tapering off by early Thursday evening as the strongest forcing for ascent associated with the shortwave departs to the east. High pressure will build back southward into North Texas, but our cold frontal layer will remain nearly saturated. Extensive low cloud cover should continue but temperatures will still drop into the low/mid 20s across most of the region. Weak isentropic ascent should support at least some additional patchy freezing drizzle northwest of the Metroplex late Thursday night into Friday morning. This may warrant yet another extension of the Winter Weather Advisory for light ice accumulations.

We should see a brief lull in the precipitation Friday afternoon as we'll be in between shortwaves within the progressive flow aloft. It'll remain cold nonetheless with extensive cloud cover. Highs are likely to top out only near freezing by afternoon, with mid 30s to the south of I-20. Another fast moving shortwave will approach late Friday night into early Saturday which again will promote ascent within our moist frontal layer. Areas of freezing drizzle are likely to develop across much of the region early Saturday morning as a reinforcing front slides southward. The column could become cold enough for some light snow across our far north and

¹⁹ These conditions are known as overrunning, where warm moist air rides over a frontal system and colder air and results in clouds and precipitation.

northwest counties during this time, but for now we'll keep freezing drizzle as the primary precip type. Highs on Saturday may remain in the mid/upper 20s north of I-20 with low/mid 30s to the south.

The freezer door will then be propped open on Sunday as mid level ridging amplifies over the Northwest U.S. and our polar low over Southern Canada pivots eastward allowing a chunk of arctic air to spread southward through the Plains. A 1050 mb high will surge southward behind a strong cold front but ahead of a compact shortwave ejecting out of the southwest U.S. This will set the stage for some exceptionally cold air to spread into North Texas over the latter half of the weekend into early next week. We're becoming increasingly concerned for a prolonged cold spell with actual air temperatures falling into the single digits to near 0 across parts of the region by Monday. While the GFS is currently the coldest guidance, other global guidance and ensemble members indicate 850 mb temps falling into the -12 to -17 degree range which would be in the coldest 10% of temperatures in our observed sounding data. In addition, a pool of moisture will reside across much of East Texas and should quickly surge northwestward into the region as strong forcing overspreads North Texas late Sunday into Monday. With column temperatures as cold as currently forecast, widespread moderate to heavy snow would be expected to develop as the shortwave spreads across the Southern Plains. The current forecast will reflect these trends with all snow by late Sunday night and continuing into Monday. While it's a little early to pin down exact accumulations, as of now, it appears that widespread snowfall amounts of 2 to 4 inches will be possible over a large area of the region. Column temperatures would be cold enough to support higher snowfall ratios than we typically see which could result in significantly heftier snow totals. North winds 15 to 25 mph could also result in significant reductions to visibility during the snow. This will be a fast moving system, but definitely has the potential for significant impacts to travel and infrastructure across the region. Extremely cold weather will continue into the middle of next week.

It should be stressed that this bout of extreme cold may have significant impact to infrastructure over the latter part of the weekend into early next week. Exposed pipes are likely to burst in the prolonged cold. Preparations should be made now to protect exposed pipes or other infrastructure sensitive to the cold. Plans should be made for pets and people.

While significant snow is forecast for Monday, the extreme cold and wind will make travel dangerous and snow clearing operations much more difficult. The snowpack is likely to linger and become compacted further complicating the clearing efforts.

Dunn

.AVIATION... /NEW/
/06z TAFs/

Modest cig improvement is taking place across the Metroplex with slightly drier air arriving in the low levels within the deepening frontal inversion. However, **light precipitation is still expected tonight into the morning as ascent increases with an approaching trough. Most of this will fall as light freezing rain/drizzle, although brief periods of light sleet are also possible. Accumulations should generally be confined to elevated surfaces. At the Metroplex, am expecting most precipitation to end around 15z or so with the arrival of even drier air. MVFR should then prevail through the rest of today into tonight, and am not expecting additional precipitation through the period at this time.**

At Waco, some heavier bursts of precip could occur overnight with perhaps even an infrequent lightning strike. Current temperatures are right around freezing, so much of this precip will fall as light freezing rain with perhaps some sleet. It's more likely that light precip will continue throughout day at least on an intermittent basis, and possibly all the way into the evening. IFR will likely prevail through most of the period before possibly an improvement to MVFR late this afternoon or evening.

-Stalley

.PRELIMINARY POINT TEMPS/POPS..
Dallas-Ft. Worth 26 34 27 32 27 / 40 10 0 5 10
Waco 30 36 30 36 30 / 50 40 20 10 5

Paris	24 32 30 33 27 / 50 10 0 10 10
Denton	23 33 25 31 22 / 30 10 0 5 10
McKinney	23 33 25 32 25 / 40 10 0 5 10
Dallas	26 34 27 34 28 / 40 10 0 5 5
Terrell	27 33 30 34 28 / 70 20 5 10 5
Corsicana	30 34 31 36 32 / 80 40 20 20 5
Temple	31 35 31 37 30 / 50 50 20 10 5
Mineral Wells	23 34 25 32 22 / 30 10 0 5 10

.FWD WATCHES/WARNINGS/ADVISORIES...

Winter Weather Advisory until 3 PM CST Thursday for TXZ091>095-100>107-115>123-129>135-141>147-156>161.

5.2 Zone Forecast

The NWS KFWD WFO Zone Forecast for the Fort Worth area is included below, which provided a plain language forecast for the week and is typically used by local weather broadcasts to the public. The forecasts issued surrounding the period were as follows.

*FPUS54 KFWD 110939
ZFPFWD*

*Zone Forecast Product for Texas
National Weather Service Fort Worth TX
339 AM CST Thu Feb 11 2021*

*TXZ118-112215-
Tarrant-Including the cities of Fort Worth and Arlington
339 AM CST Thu Feb 11 2021*

...WINTER WEATHER ADVISORY IN EFFECT UNTIL 3 PM CST THIS AFTERNOON...

.TODAY...Cloudy. Areas of freezing drizzle this morning. Cold with highs in the mid 30s. North winds 10 to 15 mph. Wind chill values as low as 10 above.

.TONIGHT...Mostly cloudy. Cold with lows in the mid 20s. North winds 10 to 15 mph. Wind chill values as low as 14.

.FRIDAY...Mostly cloudy. Patchy freezing drizzle in the morning. Cold with highs in the mid 30s. North winds 10 to 15 mph. Wind chill values as low as 13.

.FRIDAY NIGHT...Mostly cloudy. Cold with lows in the mid 20s. North winds 10 to 15 mph. Wind chill values as low as 13.

.SATURDAY...Cloudy. A 20 percent chance of sleet in the morning. Little or no sleet accumulation. Cold with highs in the lower 30s. North winds 10 to 15 mph. Wind chill values as low as 9 above.

.SATURDAY NIGHT...Mostly cloudy. Cold with lows around 20. Wind chill values as low as 10 above.

.SUNDAY...Cloudy. A 20 percent chance of snow in the afternoon. Little or no snow accumulation. Cold with highs in the upper 20s. Wind chill values as low as 5 above.

.SUNDAY NIGHT...Cloudy. A chance of snow in the evening, then snow likely after midnight. Light snow accumulation possible. Cold with lows around 10 above. Chance of snow 70 percent. Wind chill values as low as 5 below.

.WASHINGTONS BIRTHDAY...Cloudy with snow likely in the morning, then partly sunny with a slight chance of snow in the afternoon. Additional light snow accumulation possible. Colder with highs 15 to 20. Chance of snow 70 percent. Wind chill values as low as 10 below.

.MONDAY NIGHT...Partly cloudy. Cold with lows 5 to 10 above. Wind chill values as low as 10 below.

.TUESDAY...Mostly sunny in the morning, then becoming partly sunny. Cold with highs in the mid 20s.

.TUESDAY NIGHT...Mostly cloudy. A 20 percent chance of snow after midnight. Little or no snow accumulation. Not as cold with lows in the lower 20s.

.WEDNESDAY...Mostly cloudy with a 40 percent chance of snow. Little or no snow accumulation. Not as cold with highs in the mid 30s.

5.3 Hazardous Weather Outlook

The NWS FWD WFO issued several Hazardous Weather Outlooks (HWO) during the period, the advisories issued beginning on February 6, 2021 through the time of the accident are documented below.

February 5, 2021 advisories issued.

*FLUS44 KFWD 050859
HWO FWD
Hazardous Weather Outlook
National Weather Service Fort Worth TX
259 AM CST Fri Feb 5 2021*

*TXZ091>095-100>107-115>123-129>135-141>148-156>162-174-175-060900-
Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-
Palo Pinto-Parker-Tarrant-Dallas-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-
Johnson-Ellis-Henderson-Comanche-Mills-Hamilton-Bosque-Hill-Navarro-Freestone-Anderson-Lampasas-
Coryell-Bell-McLennan-Falls-Limestone-Leon-Milam-Robertson-
259 AM CST Fri Feb 5 2021*

This Hazardous Weather Outlook is for North and Central Texas.

*.DAY ONE...Today and Tonight.
No hazardous weather is expected at this time.*

*.DAYS TWO THROUGH SEVEN...Saturday through Thursday.
There is a chance of winter weather late next week. It is still too soon to know how widespread or how significant the impacts would be.*

*.SPOTTER INFORMATION STATEMENT...
Spotter activation is not expected at this time.*

*....
FLUS44 KFWD 051317 AAA*

HWOFWD
Hazardous Weather Outlook...UPDATED
National Weather Service Fort Worth TX
717 AM CST Fri Feb 5 2021

TXZ091>095-100>107-115>123-129>135-141>148-156>162-174-175-061145-
Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-
Palo Pinto-Parker-Tarrant-Dallas-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-
Johnson-Ellis-Henderson-Comanche-Mills-Hamilton-Bosque-Hill-Navarro-Freestone-Anderson-Lampasas-
Coryell-Bell-McLennan-Falls-Limestone-Leon-Milam-Robertson-
717 AM CST Fri Feb 5 2021

This Hazardous Weather Outlook is for North and Central Texas.

*.DAY ONE...Today and Tonight.
An isolated thunderstorm is possible across Central Texas this morning. Lightning will be the primary hazard.*

*.DAYS TWO THROUGH SEVEN...Saturday through Thursday.
There is a chance of winter weather late next week. It is still too soon to know how widespread or how significant the impacts would be.*

...
FLUS44 KFWD 051713
HWOFWD
Hazardous Weather Outlook
National Weather Service Fort Worth TX
1113 AM CST Fri Feb 5 2021

TXZ091>095-100>107-115>123-129>135-141>148-156>162-174-175-061130-
Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-
Palo Pinto-Parker-Tarrant-Dallas-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-
Johnson-Ellis-Henderson-Comanche-Mills-Hamilton-Bosque-Hill-Navarro-Freestone-Anderson-Lampasas-
Coryell-Bell-McLennan-Falls-Limestone-Leon-Milam-Robertson-
1113 AM CST Fri Feb 5 2021

This Hazardous Weather Outlook is for North and Central Texas.

*.DAY ONE...This Afternoon and Tonight.
No hazardous weather is expected at this time.*

*.DAYS TWO THROUGH SEVEN...Saturday through Thursday.
There is a chance of winter weather late next week. It is still too soon to know how widespread or how significant the impacts would be.*

....
FLUS44 KFWD 052130
HWOFWD
Hazardous Weather Outlook
National Weather Service Fort Worth TX
330 PM CST Fri Feb 5 2021

TXZ091>095-100>107-115>123-129>135-141>148-156>162-174-175-061145-
Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-
Palo Pinto-Parker-Tarrant-Dallas-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-
Johnson-Ellis-Henderson-Comanche-Mills-Hamilton-Bosque-Hill-Navarro-Freestone-Anderson-Lampasas-
Coryell-Bell-McLennan-Falls-Limestone-Leon-Milam-Robertson-

330 PM CST Fri Feb 5 2021

This Hazardous Weather Outlook is for North and Central Texas.

.DAY ONE...Tonight.

No hazardous weather is expected at this time.

.DAYS TWO THROUGH SEVEN...Saturday through Thursday.

There is a chance of winter weather late next week. It is still too soon to know how widespread or how significant the impacts would be.

February 6, 2021 advisories issued.

FLUS44 KFWD 060836

HWO FWD

Hazardous Weather Outlook

National Weather Service Fort Worth TX

236 AM CST Sat Feb 6 2021

TXZ091>095-100>107-115>123-129>135-141>148-156>162-174-175-070845-

Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-

Palo Pinto-Parker-Tarrant-Dallas-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-

Johnson-Ellis-Henderson-Comanche-Mills-Hamilton-Bosque-Hill-Navarro-Freestone-Anderson-Lampasas-

Coryell-Bell-McLennan-Falls-Limestone-Leon-Milam-Robertson-

236 AM CST Sat Feb 6 2021

This Hazardous Weather Outlook is for North and Central Texas.

.DAY ONE...Today and Tonight.

No hazardous weather is expected at this time.

.DAYS TWO THROUGH SEVEN...Sunday through Friday.

There is a chance of winter weather late next week. It is still too soon to know how widespread or how significant the impacts would be.

....

FLUS44 KFWD 061734

HWO FWD

Hazardous Weather Outlook

National Weather Service Fort Worth TX

1134 AM CST Sat Feb 6 2021

TXZ091>095-100>107-115>123-129>135-141>148-156>162-174-175-071200-

Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-

Palo Pinto-Parker-Tarrant-Dallas-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-

Johnson-Ellis-Henderson-Comanche-Mills-Hamilton-Bosque-Hill-Navarro-Freestone-Anderson-Lampasas-

Coryell-Bell-McLennan-Falls-Limestone-Leon-Milam-Robertson-

1134 AM CST Sat Feb 6 2021

This Hazardous Weather Outlook is for North and Central Texas.

.DAY ONE...This Afternoon and Tonight.

No hazardous weather is expected at this time.

.DAYS TWO THROUGH SEVEN...Sunday through Friday.

There is a chance of winter weather late next week. It is still too soon to know how widespread or how significant the impacts would be.

....

FLUS44 KFWD 062034

HWOFFWD

Hazardous Weather Outlook

National Weather Service Fort Worth TX

234 PM CST Sat Feb 6 2021

TXZ091>095-100>107-115>123-129>135-141>148-156>162-174-175-071200-

Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-

Palo Pinto-Parker-Tarrant-Dallas-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-

Johnson-Ellis-Henderson-Comanche-Mills-Hamilton-Bosque-Hill-Navarro-Freestone-Anderson-Lampasas-

Coryell-Bell-McLennan-Falls-Limestone-Leon-Milam-Robertson-

234 PM CST Sat Feb 6 2021

This Hazardous Weather Outlook is for North and Central Texas.

.DAY ONE...This Afternoon and Tonight.

No hazardous weather is expected at this time.

.DAYS TWO THROUGH SEVEN...Sunday through Friday.

There is a chance of winter weather late next week. It is still too soon to know how widespread or how significant the impacts would be.

....

FLUS44 KFWD 070510

HWOFFWD

Hazardous Weather Outlook

National Weather Service Fort Worth TX

1110 PM CST Sat Feb 6 2021

TXZ091>095-100>107-115>123-129>135-141>148-156>162-174-175-080515-

Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-

Palo Pinto-Parker-Tarrant-Dallas-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-

Johnson-Ellis-Henderson-Comanche-Mills-Hamilton-Bosque-Hill-Navarro-Freestone-Anderson-Lampasas-

Coryell-Bell-McLennan-Falls-Limestone-Leon-Milam-Robertson-

1110 PM CST Sat Feb 6 2021

This Hazardous Weather Outlook is for North and Central Texas.

.DAY ONE...Tonight.

No hazardous weather is expected at this time.

.DAYS TWO THROUGH SEVEN...Sunday through Friday.

There is a chance of winter weather late next week. It is still too soon to know how widespread or how significant the impacts would be.

February 7, 2021 advisories issued

FLUS44 KFWD 070848

HWOFWD
Hazardous Weather Outlook
National Weather Service Fort Worth TX
248 AM CST Sun Feb 7 2021

TXZ091>095-100>107-115>123-129>135-141>148-156>162-174-175-080900-
Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-
Palo Pinto-Parker-Tarrant-Dallas-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-
Johnson-Ellis-Henderson-Comanche-Mills-Hamilton-Bosque-Hill-Navarro-Freestone-Anderson-Lampasas-
Coryell-Bell-McLennan-Falls-Limestone-Leon-Milam-Robertson-
248 AM CST Sun Feb 7 2021

This Hazardous Weather Outlook is for North and Central Texas.

*.DAY ONE...Today and Tonight.
No hazardous weather is expected at this time.*

*.DAYS TWO THROUGH SEVEN...Monday through Saturday.
There is a chance of sleet, freezing rain, or snow Wednesday night into Thursday. It is still too soon to know how significant or widespread the impacts will be.*

....

FLUS44 KFWD 071103
HWOFWD
Hazardous Weather Outlook
National Weather Service Fort Worth TX
503 AM CST Sun Feb 7 2021

TXZ091>095-100>107-115>123-129>135-141>148-156>162-174-175-081115-
Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-
Palo Pinto-Parker-Tarrant-Dallas-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-
Johnson-Ellis-Henderson-Comanche-Mills-Hamilton-Bosque-Hill-Navarro-Freestone-Anderson-Lampasas-
Coryell-Bell-McLennan-Falls-Limestone-Leon-Milam-Robertson-
503 AM CST Sun Feb 7 2021

This Hazardous Weather Outlook is for North and Central Texas.

*.DAY ONE...Today and Tonight.
Patchy fog may reduce visibility to around a mile or less in parts of North Texas this morning.*

*.DAYS TWO THROUGH SEVEN...Monday through Saturday.
There is a chance of sleet, freezing rain, or snow Wednesday night into Thursday. It is still too soon to know how significant or widespread the impacts will be.*

...

FLUS44 KFWD 071741
HWOFWD
Hazardous Weather Outlook
National Weather Service Fort Worth TX
1141 AM CST Sun Feb 7 2021

TXZ091>095-100>107-115>123-129>135-141>148-156>162-174-175-081200-
Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-
Palo Pinto-Parker-Tarrant-Dallas-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-

Johnson-Ellis-Henderson-Comanche-Mills-Hamilton-Bosque-Hill-Navarro-Freestone-Anderson-Lampasas-Coryell-Bell-McLennan-Falls-Limestone-Leon-Milam-Robertson-1141 AM CST Sun Feb 7 2021

This Hazardous Weather Outlook is for North and Central Texas.

*.DAY ONE...This Afternoon and Tonight.
No hazardous weather is expected at this time.*

*.DAYS TWO THROUGH SEVEN...Monday through Saturday.
There is a chance of sleet, freezing rain, or snow Wednesday night into Thursday. It is still too soon to know how significant or widespread the impacts will be.*

...

*FLUS44 KFWD 072105
HWO FWD
Hazardous Weather Outlook
National Weather Service Fort Worth TX
305 PM CST Sun Feb 7 2021*

*TXZ091>095-100>107-115>123-129>135-141>148-156>162-174-175-081230-
Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-
Palo Pinto-Parker-Tarrant-Dallas-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-
Johnson-Ellis-Henderson-Comanche-Mills-Hamilton-Bosque-Hill-Navarro-Freestone-Anderson-Lampasas-
Coryell-Bell-McLennan-Falls-Limestone-Leon-Milam-Robertson-
305 PM CST Sun Feb 7 2021*

This Hazardous Weather Outlook is for North and Central Texas.

*.DAY ONE...This Afternoon and Tonight.
No hazardous weather is expected at this time.*

*.DAYS TWO THROUGH SEVEN...Monday through Saturday. **There is a low chance of sleet, freezing rain, or snow Wednesday night into Thursday. At this time we don't anticipate significant impacts with this activity.***

Wind chill values in the teens are in the forecast Friday and Saturday morning across most of North and Central TX.

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*FLUS44 KFWD 080525
HWO FWD
Hazardous Weather Outlook
National Weather Service Fort Worth TX
1125 PM CST Sun Feb 7 2021*

*TXZ091>095-100>107-115>123-129>135-141>148-156>162-174-175-090530-
Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-
Palo Pinto-Parker-Tarrant-Dallas-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-
Johnson-Ellis-Henderson-Comanche-Mills-Hamilton-Bosque-Hill-Navarro-Freestone-Anderson-Lampasas-
Coryell-Bell-McLennan-Falls-Limestone-Leon-Milam-Robertson-
1125 PM CST Sun Feb 7 2021*

This Hazardous Weather Outlook is for North and Central Texas.

*.DAY ONE...Tonight.
No hazardous weather is expected at this time.*

*.DAYS TWO THROUGH SEVEN...Monday through Saturday.
There is a low chance of sleet, freezing rain, or snow Wednesday night into Thursday. At this time we don't anticipate significant impacts with this activity.*

Wind chill values in the teens are in the forecast Friday and Saturday morning across most of North and Central TX.

February 8, 2012

*FLUS44 KFWD 080824
HWOFWD
Hazardous Weather Outlook
National Weather Service Fort Worth TX
224 AM CST Mon Feb 8 2021*

*TXZ091>095-100>107-115>123-129>135-141>148-156>162-174-175-090830-
Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-
Palo Pinto-Parker-Tarrant-Dallas-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-
Johnson-Ellis-Henderson-Comanche-Mills-Hamilton-Bosque-Hill-Navarro-Freestone-Anderson-Lampasas-
Coryell-Bell-McLennan-Falls-Limestone-Leon-Milam-Robertson-
224 AM CST Mon Feb 8 2021*

This Hazardous Weather Outlook is for North and Central Texas.

*.DAY ONE...Today and Tonight.
No hazardous weather is expected at this time.*

*.DAYS TWO THROUGH SEVEN...Tuesday through Sunday.
There is a chance of freezing rain and sleet Wednesday night into Thursday across North Texas. No significant impacts are expected at this time.*

Wind chill values in the teens are in the forecast Friday and Saturday morning across most of North and Central TX.

...

*FLUS44 KFWD 081743
HWOFWD
Hazardous Weather Outlook
National Weather Service Fort Worth TX
1143 AM CST Mon Feb 8 2021*

*TXZ091>095-100>107-115>123-129>135-141>148-156>162-174-175-091200-
Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-
Palo Pinto-Parker-Tarrant-Dallas-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-
Johnson-Ellis-Henderson-Comanche-Mills-Hamilton-Bosque-Hill-Navarro-Freestone-Anderson-Lampasas-
Coryell-Bell-McLennan-Falls-Limestone-Leon-Milam-Robertson-
1143 AM CST Mon Feb 8 2021*

This Hazardous Weather Outlook is for North and Central Texas.

*.DAY ONE...This Afternoon and Tonight.
No hazardous weather is expected at this time.*

*.DAYS TWO THROUGH SEVEN...Tuesday through Sunday.
There is a chance of freezing rain and sleet Wednesday night into Thursday across North Texas. No significant impacts are expected at this time.*

Wind chill values in the teens are in the forecast Friday and Saturday morning across most of North and Central TX.

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*FLUS44 KFWD 082018
HWOFWD
Hazardous Weather Outlook
National Weather Service Fort Worth TX
218 PM CST Mon Feb 8 2021*

*TXZ091>095-100>107-115>123-129>135-141>148-156>162-174-175-091200-
Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-
Palo Pinto-Parker-Tarrant-Dallas-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-
Johnson-Ellis-Henderson-Comanche-Mills-Hamilton-Bosque-Hill-Navarro-Freestone-Anderson-Lampasas-
Coryell-Bell-McLennan-Falls-Limestone-Leon-Milam-Robertson-
218 PM CST Mon Feb 8 2021*

This Hazardous Weather Outlook is for North and Central Texas.

*.DAY ONE...Tonight.
No hazardous weather is expected at this time.*

*.DAYS TWO THROUGH SEVEN...Tuesday through Sunday.
There is a chance of freezing rain and sleet Wednesday night into Thursday across North Texas. No significant impacts are expected at this time.*

Exceptionally cold temperatures will be possible by the weekend, with wind chill values potentially falling into the single digits on Saturday and Sunday. Additional frozen precipitation will also be possible on Saturday, though amounts and impacts are highly uncertain at this time.

...

*FLUS44 KFWD 090005
HWOFWD
Hazardous Weather Outlook
National Weather Service Fort Worth TX
605 PM CST Mon Feb 8 2021*

*TXZ091>095-100>107-115>123-129>135-141>148-156>162-174-175-100015-
Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-
Palo Pinto-Parker-Tarrant-Dallas-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-
Johnson-Ellis-Henderson-Comanche-Mills-Hamilton-Bosque-Hill-Navarro-Freestone-Anderson-Lampasas-
Coryell-Bell-McLennan-Falls-Limestone-Leon-Milam-Robertson-
605 PM CST Mon Feb 8 2021*

This Hazardous Weather Outlook is for North and Central Texas.

.DAY ONE...Tonight.

No hazardous weather is expected at this time.

.DAYS TWO THROUGH SEVEN...Tuesday through Sunday.

There is a chance of freezing rain and sleet Wednesday night into Thursday across North Texas. No significant impacts are expected at this time.

Exceptionally cold temperatures will be possible by the weekend, with wind chill values potentially falling into the single digits on Saturday and Sunday. Additional frozen precipitation will also be possible on Saturday, though amounts and impacts are highly uncertain at this time.

February 9, 2021

FLUS44 KFWD 090940

HWO FWD

Hazardous Weather Outlook

National Weather Service Fort Worth TX

340 AM CST Tue Feb 9 2021

TXZ091>095-100>107-115>123-129>135-141>148-156>162-174-175-100945-

Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-

Palo Pinto-Parker-Tarrant-Dallas-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-

Johnson-Ellis-Henderson-Comanche-Mills-Hamilton-Bosque-Hill-Navarro-Freestone-Anderson-Lampasas-

Coryell-Bell-McLennan-Falls-Limestone-Leon-Milam-Robertson-

340 AM CST Tue Feb 9 2021

This Hazardous Weather Outlook is for North and Central Texas.

.DAY ONE...Today and Tonight.

Some freezing drizzle is expected to develop after midnight into early Wednesday morning across parts of North Texas. This could result in light ice accumulations on bridges and overpasses²⁰ for locations near and north of a Cisco to Paris line.

.DAYS TWO THROUGH SEVEN...Wednesday through Monday.

There is a chance of freezing rain and sleet late Wednesday into Thursday across North Texas. Some minor accumulations on area roads, especially bridges and overpasses, may cause a few travel delays.

Exceptionally cold conditions appear likely by the weekend, with wind chill values falling into the single digits (possibly below zero in some locations) on Saturday and Sunday. Additional frozen precipitation will also be possible on Saturday, but accumulations are not likely.

There may be more chances for winter precipitation by Monday, but details are uncertain at this time.

...

FLUS44 KFWD 091344

HWO FWD

Hazardous Weather Outlook

National Weather Service Fort Worth TX

744 AM CST Tue Feb 9 2021

²⁰ Bridges and overpasses are prone for black ice because cold air is able to flow underneath the road surface, since it is elevated, therefore lowering the pavement temperature. Once formed black ice is hard to detect and leads to hazardous driving conditions and an increased risk of car accidents.

TXZ091>095-100>107-115>123-129>135-141>148-156>162-174-175-101200-
Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-
Palo Pinto-Parker-Tarrant-Dallas-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-
Johnson-Ellis-Henderson-Comanche-Mills-Hamilton-Bosque-Hill-Navarro-Freestone-Anderson-Lampasas-
Coryell-Bell-McLennan-Falls-Limestone-Leon-Milam-Robertson-
744 AM CST Tue Feb 9 2021

This Hazardous Weather Outlook is for North and Central Texas.

.DAY ONE...Today and Tonight.

Freezing drizzle is ongoing this morning mainly north of I-20. Some slick spots on bridges and overpasses have been reported. This will continue through around noon. The cold temperatures will persist, but the drizzle will likely stop through the evening.

Some freezing drizzle is expected to develop after midnight into early Wednesday morning across parts of North Texas. This could result in light ice accumulations on bridges and overpasses for locations near and north of a Cisco to Paris line.

.DAYS TWO THROUGH SEVEN...Wednesday through Monday.

There is a chance of freezing rain and sleet late Wednesday into Thursday across North Texas. Some minor accumulations on area roads, especially bridges and overpasses, may cause a few travel delays.

Exceptionally cold conditions appear likely by the weekend, with wind chill values falling into the single digits (possibly below zero in some locations) on Saturday and Sunday. Additional frozen precipitation will also be possible on Saturday, but accumulations are not likely.

There may be more chances for winter precipitation by Monday, but details are uncertain at this time.

.SPOTTER INFORMATION STATEMENT...

Spotter activation is not expected at this time, but any reports of frozen precipitation on roads would be greatly appreciated.

...

FLUS44 KFWD 091813

HWOFWD

Hazardous Weather Outlook

National Weather Service Fort Worth TX

1213 PM CST Tue Feb 9 2021

TXZ091>095-100>107-115>123-129>135-141>148-156>162-174-175-101130-
Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-
Palo Pinto-Parker-Tarrant-Dallas-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-
Johnson-Ellis-Henderson-Comanche-Mills-Hamilton-Bosque-Hill-Navarro-Freestone-Anderson-Lampasas-
Coryell-Bell-McLennan-Falls-Limestone-Leon-Milam-Robertson-
1213 PM CST Tue Feb 9 2021

This Hazardous Weather Outlook is for North and Central Texas.

.DAY ONE...This Afternoon and Tonight.

Some freezing drizzle is expected to develop late this evening, continuing into Wednesday morning across parts of North Texas. This could result in light ice accumulations on bridges and overpasses for locations near and north of a Cisco to Paris line.

.DAYS TWO THROUGH SEVEN...Wednesday through Monday.

There is a chance of freezing rain and sleet late Wednesday into Thursday across North Texas. Some minor accumulations on area roads, especially bridges and overpasses, may cause a few travel delays.

Exceptionally cold conditions appear likely by the weekend, with windchill values falling into the single digits (possibly below zero in some locations) on Saturday and Sunday. Additional frozen precipitation will also be possible on Saturday, but accumulations are not likely.

There may be more chances for winter precipitation by Monday, but details are uncertain at this time.

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FLUS44 KFWD 092139
HWOFWD
Hazardous Weather Outlook
National Weather Service Fort Worth TX
339 PM CST Tue Feb 9 2021

TXZ091>095-100>107-115>123-129>135-141>148-156>162-174-175-101200-
Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-
Palo Pinto-Parker-Tarrant-Dallas-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-
Johnson-Ellis-Henderson-Comanche-Mills-Hamilton-Bosque-Hill-Navarro-Freestone-Anderson-Lampasas-
Coryell-Bell-McLennan-Falls-Limestone-Leon-Milam-Robertson-
339 PM CST Tue Feb 9 2021

This Hazardous Weather Outlook is for North and Central Texas.

.DAY ONE...Tonight.

Areas of freezing drizzle or light freezing rain are expected to develop later tonight and continue into early Wednesday morning mainly north of an Eastland to Fort Worth to Paris line. This could result in light ice accumulations on bridges and overpasses.

.DAYS TWO THROUGH SEVEN...Wednesday through Monday.

Areas of freezing rain are expected to develop again late Wednesday into Thursday across North Texas. Some minor ice accumulations on area roads, especially bridges and overpasses, will likely cause a few travel delays.

Exceptionally cold conditions appear likely by the weekend, with wind chill values falling into the single digits (possibly below zero in some locations) on Saturday through Monday. Additional frozen precipitation will also be possible on Saturday and again Monday.

February 10, 2012 advisories issues.

FLUS44 KFWD 100959
HWOFWD
Hazardous Weather Outlook
National Weather Service Fort Worth TX
359 AM CST Wed Feb 10 2021

TXZ091>095-100>107-115>123-129>135-141>148-156>162-174-175-111000-
Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-
Palo Pinto-Parker-Tarrant-Dallas-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-

Johnson-Ellis-Henderson-Comanche-Mills-Hamilton-Bosque-Hill-Navarro-Freestone-Anderson-Lampasas-Coryell-Bell-McLennan-Falls-Limestone-Leon-Milam-Robertson-359 AM CST Wed Feb 10 2021

This Hazardous Weather Outlook is for North and Central Texas.

.DAY ONE...Today and Tonight.

Areas of freezing drizzle or light freezing rain remain possible through tonight, mainly for areas along and northwest of a line from Sulphur Springs to Goldthwaite. This could result in ice accumulations and travel impacts on area roads, particularly bridges and overpasses.

.DAYS TWO THROUGH SEVEN...Thursday through Tuesday.

Areas of freezing rain may linger through around midday Thursday, with additional minor ice accumulations and travel impacts possible.

Exceptionally cold conditions appear likely by the weekend. Wind chill values will fall into the single digits (possibly below zero in some locations) starting Saturday and continuing through Tuesday.

There is a slight chance of snow on Saturday, with better chances arriving late Sunday through Monday.

*.SPOTTER INFORMATION STATEMENT...
Spotter activation is not expected at this time.
...*

*FLUS44 KFWD 102146
HWOFWD
Hazardous Weather Outlook
National Weather Service Fort Worth TX
346 PM CST Wed Feb 10 2021*

*TXZ091>095-100>107-115>123-129>135-141>148-156>162-174-175-111215-
Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-
Palo Pinto-Parker-Tarrant-Dallas-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-
Johnson-Ellis-Henderson-Comanche-Mills-Hamilton-Bosque-Hill-Navarro-Freestone-Anderson-Lampasas-
Coryell-Bell-McLennan-Falls-Limestone-Leon-Milam-Robertson-
346 PM CST Wed Feb 10 2021*

This Hazardous Weather Outlook is for North and Central Texas.

.DAY ONE...Tonight.

Areas of freezing rain and drizzle will develop tonight and continue into early Thursday. A few bursts of sleet may also occur in thunderstorms overnight. This could result in ice accumulations and travel impacts on area roads, particularly bridges and overpasses.

.DAYS TWO THROUGH SEVEN...Thursday through Tuesday.

Areas of freezing rain may linger through around midday Thursday, with additional minor ice accumulations and travel impacts possible.

Exceptionally cold conditions appear likely by the weekend. Wind chill values will fall into the single digits (possibly below zero in some locations) starting Saturday and continuing through Tuesday.

Snow is expected across most of the region late Sunday through Monday. Some significant accumulations may occur with temperatures falling below 10 degrees and breezy conditions. Significant disruptions to travel may occur.

....
FLUS44 KFWD 110235
HWOFWD
Hazardous Weather Outlook
National Weather Service Fort Worth TX
835 PM CST Wed Feb 10 2021

TXZ091>095-100>107-115>123-129>135-141>148-156>162-174-175-120245-
Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-
Palo Pinto-Parker-Tarrant-Dallas-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-
Johnson-Ellis-Henderson-Comanche-Mills-Hamilton-Bosque-Hill-Navarro-Freestone-Anderson-Lampasas-
Coryell-Bell-McLennan-Falls-Limestone-Leon-Milam-Robertson-
835 PM CST Wed Feb 10 2021

This Hazardous Weather Outlook is for North and Central Texas.

.DAY ONE... Tonight.

Areas of freezing rain and drizzle will develop tonight and continue into early Thursday. A few bursts of sleet may also occur in thunderstorms overnight. This could result in ice accumulations and travel impacts on area roads, particularly bridges and overpasses.

.DAYS TWO THROUGH SEVEN... Thursday through Tuesday.

Areas of freezing rain may linger through around midday Thursday, with additional minor ice accumulations and travel impacts possible. Isolated thunderstorms are possible across Central Texas on Thursday.

Exceptionally cold conditions appear likely by the weekend. Wind chill values will fall into the single digits (possibly below zero in some locations) starting Saturday and continuing through Tuesday.

Snow is expected across most of the region late Sunday through Monday. Some significant accumulations may occur with temperatures falling below 10 degrees and breezy conditions. Significant disruptions to travel may occur.

....
The advisory was updated at 0411 CST and was as follows.

FLUS44 KFWD 111011
HWOFWD
Hazardous Weather Outlook
National Weather Service Fort Worth TX
411 AM CST Thu Feb 11 2021

TXZ091>095-100>107-115>123-129>135-141>148-156>162-174-175-121015-
Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-
Palo Pinto-Parker-**Tarrant-Dallas**-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-
Johnson-Ellis-Henderson-Comanche-Mills-Hamilton-Bosque-Hill-Navarro-Freestone-Anderson-Lampasas-
Coryell-Bell-McLennan-Falls-Limestone-Leon-Milam-Robertson-
411 AM CST Thu Feb 11 2021

This Hazardous Weather Outlook is for North and Central Texas.

.DAY ONE... Today and Tonight.

Areas of freezing rain and drizzle will continue through mid afternoon, with the best chances along and south of I-20. Precipitation will gradually shift south with time and should be confined to the Central Texas counties by afternoon. This could result in ice accumulations and travel impacts on area roads, particularly bridges and overpasses.

.DAYS TWO THROUGH SEVEN...Friday through Wednesday. Exceptionally cold conditions are likely this weekend through the middle of next week. Wind chill values will fall into the single digits (possibly below zero in some locations) starting Saturday and continuing through at least Tuesday.

Snow is expected across most of the region late Sunday through Monday. Some significant accumulations may occur with temperatures falling below 10 degrees and breezy conditions. Significant disruptions to travel will likely result.

*.SPOTTER INFORMATION STATEMENT...
Spotter activation is not expected at this time.*

....

*FLUS44 KFWD 111153
HWOFWD
Hazardous Weather Outlook
National Weather Service Fort Worth TX
553 AM CST Thu Feb 11 2021*

*TXZ091>095-100>107-115>123-129>135-141>148-156>162-174-175-121200-
Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-
Palo Pinto-Parker-Tarrant-Dallas-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-
Johnson-Ellis-Henderson-Comanche-Mills-Hamilton-Bosque-Hill-Navarro-Freestone-Anderson-Lampasas-
Coryell-Bell-McLennan-Falls-Limestone-Leon-Milam-Robertson-
553 AM CST Thu Feb 11 2021*

This Hazardous Weather Outlook is for North and Central Texas.

.DAY ONE... Today and Tonight.

Areas of freezing rain and light sleet will continue across both North and Central Texas this morning, before ending in North Texas by midday. This afternoon, another more widespread area of freezing rain and sleet is expected to move into Central Texas. This could result in ice accumulations and travel impacts on area roads, especially on bridges and overpasses. Occasional lightning strikes are also possible with this activity.

.DAYS TWO THROUGH SEVEN...Friday through Wednesday. Exceptionally cold conditions are likely this weekend through the middle of next week. Wind chill values will fall into the single digits (possibly below zero in some locations) starting Saturday and continuing through at least Tuesday.

Snow is expected across most of the region late Sunday through Monday. Some significant accumulations may occur with temperatures falling below 10 degrees and breezy conditions. Significant disruptions to travel will likely result.

*.SPOTTER INFORMATION STATEMENT...
Spotter activation is not expected at this time.*

5.4 Winter Weather Messages

The NWS issues Winter Weather Messages (WSW) whenever a winter weather event such as snow, sleet, ice, or dangerous wind chills are expected to occur that can impact public safety²¹. The following advisories were issued from the NWS FWD WFO during the period.

*WWUS44 KFWD 110557
WSWFWD*

*URGENT - WINTER WEATHER MESSAGE
National Weather Service Fort Worth TX
1157 PM CST Wed Feb 10 2021*

*TXZ091>095-100>107-115>123-129>135-141>146-156>159-111500-
/O.CON.KFWD.WW.Y.0003.000000T0000Z-210211T2100Z/*

*Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-
Palo Pinto-Parker-Tarrant-Dallas-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-
Johnson-Ellis-Henderson-Comanche-Mills-Hamilton-Bosque-Hill-Navarro-Lampasas-Coryell-Bell-
McLennan-Including the cities of Bowie, Nocona, Gainesville, Sherman, Denison, Bonham, Paris, Graham,
Olney, Jacksboro, Decatur, Bridgeport, Carrollton, Denton, Lewisville, Flower Mound, Plano, McKinney,
Allen, Frisco, Greenville, Commerce, Cooper, Sulphur Springs, Breckenridge, Mineral Wells, Weatherford,
Briar, **Fort Worth, Arlington, Dallas**, Rockwall, Heath, Terrell, Kaufman, Forney, Canton, Grand Saline, Wills
Point, Van, Edgewood, Emory, East Tawakoni, Point, Cisco, Eastland, Ranger, Gorman, Stephenville, Dublin,
Granbury, Oak Trail Shores, Glen Rose, Cleburne, Bursleson, Waxahachie, Ennis, Midlothian, Athens, Gun
Barrel City, Comanche, De Leon, Goldthwaite, Hamilton, Hico, Clifton, Meridian, Valley Mills, Hillsboro,
Corsicana, Lampasas, Copperas Cove, Gatesville, Killeen, Temple, Fort Hood, and Waco
1157 PM CST Wed Feb 10 2021*

...WINTER WEATHER ADVISORY REMAINS IN EFFECT UNTIL 3 PM CST THURSDAY...

** WHAT...Areas of freezing rain and freezing drizzle will continue into early Thursday. Some brief bursts of sleet may also occur at times. Ice accumulations of up to 1/10 of an inch will be possible, mainly on elevated surfaces. Some slick roads, bridges, and overpasses can be expected through Thursday.*

** WHERE...Across most of North and Central Texas.*

** WHEN...Until 3 PM CST Thursday.*

** IMPACTS...Very slippery sidewalks, roads, and bridges are possible. The hazardous conditions could impact Thursday morning's commute, and poor conditions may persist into the afternoon.*

PRECAUTIONARY/PREPAREDNESS ACTIONS...

Slow down and use caution while traveling. Prepare for possible power outages.

The latest road conditions for Texas can be found at drivetexas.org.

The advisory was updated and issued at 0526 CST prior to the accident.

*WWUS44 KFWD 111126
WSWFWD*

²¹ NWS instruction 10-513 Winter Weather Products Specifications

URGENT - WINTER WEATHER MESSAGE
National Weather Service Fort Worth TX
526 AM CST Thu Feb 11 2021

TXZ091>095-100>107-115>123-129>134-141-111800-
/O.EXT.KFWD.WW.Y.0003.000000T0000Z-210211T1800Z/
Montague-Cooke-Grayson-Fannin-Lamar-Young-Jack-Wise-Denton-Collin-Hunt-Delta-Hopkins-Stephens-
Palo Pinto-Parker-Tarrant-Dallas-Rockwall-Kaufman-Van Zandt-Rains-Eastland-Erath-Hood-Somervell-
Johnson-Ellis-Comanche-Including the cities of Bowie, Nocona, Gainesville, Sherman, Denison, Bonham,
Paris, Graham, Olney, Jacksboro, Decatur, Bridgeport, Carrollton, Denton, Lewisville, Flower Mound, Plano,
McKinney, Allen, Frisco, Greenville, Commerce, Cooper, Sulphur Springs, Breckenridge, Mineral Wells,
Weatherford, Briar, **Fort Worth, Arlington, Dallas, Rockwall, Heath, Terrell, Kaufman, Forney, Canton,**
Grand Saline, Wills Point, Van, Edgewood, Emory, East Tawakoni, Point, Cisco, Eastland, Ranger, Gorman,
Stephenville, Dublin, Granbury, Oak Trail Shores, Glen Rose, Cleburne, Burleson, Waxahachie, Ennis,
Midlothian, Comanche, and De Leon
526 AM CST Thu Feb 11 2021

...WINTER WEATHER ADVISORY NOW IN EFFECT UNTIL NOON CST TODAY...

*** WHAT...Areas of light freezing rain and some sleet will continue through the morning hours. This could result in ice accumulations of up to 1/10 of an inch, mainly on elevated surfaces. Some slick roads, bridges, and overpasses can be expected through the morning.**

*** WHERE...Across most of North and Central Texas.**

*** WHEN...Until noon CST today.**

*** IMPACTS...Very slippery sidewalks, roads, and bridges are possible. The hazardous conditions could impact Thursday morning's commute, and poor conditions may persist into the afternoon.**

PRECAUTIONARY/PREPAREDNESS ACTIONS...

Slow down and use caution while traveling. Prepare for possible power outages.

The latest road conditions for Texas can be found at drivetexas.org.

5.5 NWS Preliminary Storm Reports

The NWS preliminary storm reports received at the KFWD WFO were as follows surrounding the period.

<u>Time</u>	<u>Event</u>	<u>City/County /State</u>	<u>Lat.</u>	<u>Long.</u>
0656 AM 02/11/2021	FREEZING RAIN E0.10 INCH	MEXIA, LIMESTONE, TX	31.68N	96.49W

DISPATCH REPORTING MULTIPLE MINOR ACCIDENTS, ICE ON HWY 84 OVERPASS IN MEXIA AND ICE ON BRIDGE AT HWY 164 AND NAVASOTA RIVER. RPTD BY EMERGENCY MNGR

0700 AM 02/11/2021	FREEZING RAIN E0.10 INCH	3 NNE FORT WORTH, TARRANT, TX	32.80N	97.32W
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SOCIAL MEDIA REPORT: ALL LANES AND TOLL LANES OF I-35W ARE SHUT DOWN AT 28 STREET/SH 183 DUE TO A CRASH. RPTD BY PUBLIC

1045 AM FREEZING RAIN BELLMEAD, MCLENNAN, TX 31.60N 97.09W
02/11/2021 M0.13 INCH

*DELAYED REPORT FROM STORM SPOTTER NEAR BELLMEAD, TX. 1/8TH INCH OF ICE
ACUMULATION ON PAVED SURFACES WITH TREE LIMBS HANGING DOWN.*

0250 PM SLEET LAMPASAS, TX 31.07N 98.18W
02/11/2021 E1.0 INCH

LAMPASAS COUNTY EM ESTIMATED 1 INCH OF SLEET. RPTD BY EMERGENCY MNGR

0306 PM FREEZING RAIN GATESVILLE, CORYELL, TX 31.44N 97.73W
02/11/2021 E0.25 INCH

*CORYELL COUNTY EM ESTIMATES AROUND 1/4 INCH OF ICE ACCUMULATION WITH UNKNOWN
SLEET ACCUMULATION. SHERIFFS OFFICE REPORTED OVER 50 ACCIDENTS ACROSS THE
COUNTY TODAY WITH VIRTUALLY ALL BRIDGES AND OVERPASSES IN THE COUNTY BEING ICE
COVERED. RPTD BY EMERGENCY MNGR*

0334 PM SLEET 1 S BEVERLY HILLS, MCLENNAN, TX 31.51N 97.16W
02/11/2021 M0.5 INCH

*BROADCAST MEDIA REPORTED 1/2 INCH OF SLEET ACCUMULATION WITH 0.10 INCH ICE
ACCUMULATION ON TREE BRANCHES. RPTD BY BROADCAST MEDIA*

0600 AM FREEZING RAIN 2 NNE FORT WORTH, TARRANT, TX 32.79N 97.32W
02/11/2021 E0.01 INCH LAW ENFORCEMENT

***** 6 FATAL, 101 INJ *****

**MAJOR CAR PILEUP WITH OVER 100 VEHICLES RESULTING IN 6 FATALITIES AND 101
INJURIES JUST SOUTH OF THE STATE HIGHWAY 183 AND INTERSTATE 35W JUNCTION.
FORT WORTH MEACHAM ASOS REPORTED TOTAL ICE ACCUMULATIONS OF NEAR 0.02 THIS
MORNING.**

6.0 Storm Summary

The NWS KFWD WFO issues a summary of the event on February 11-12, 2021, with a map of the ice accumulations across the region which is included as figure 12.

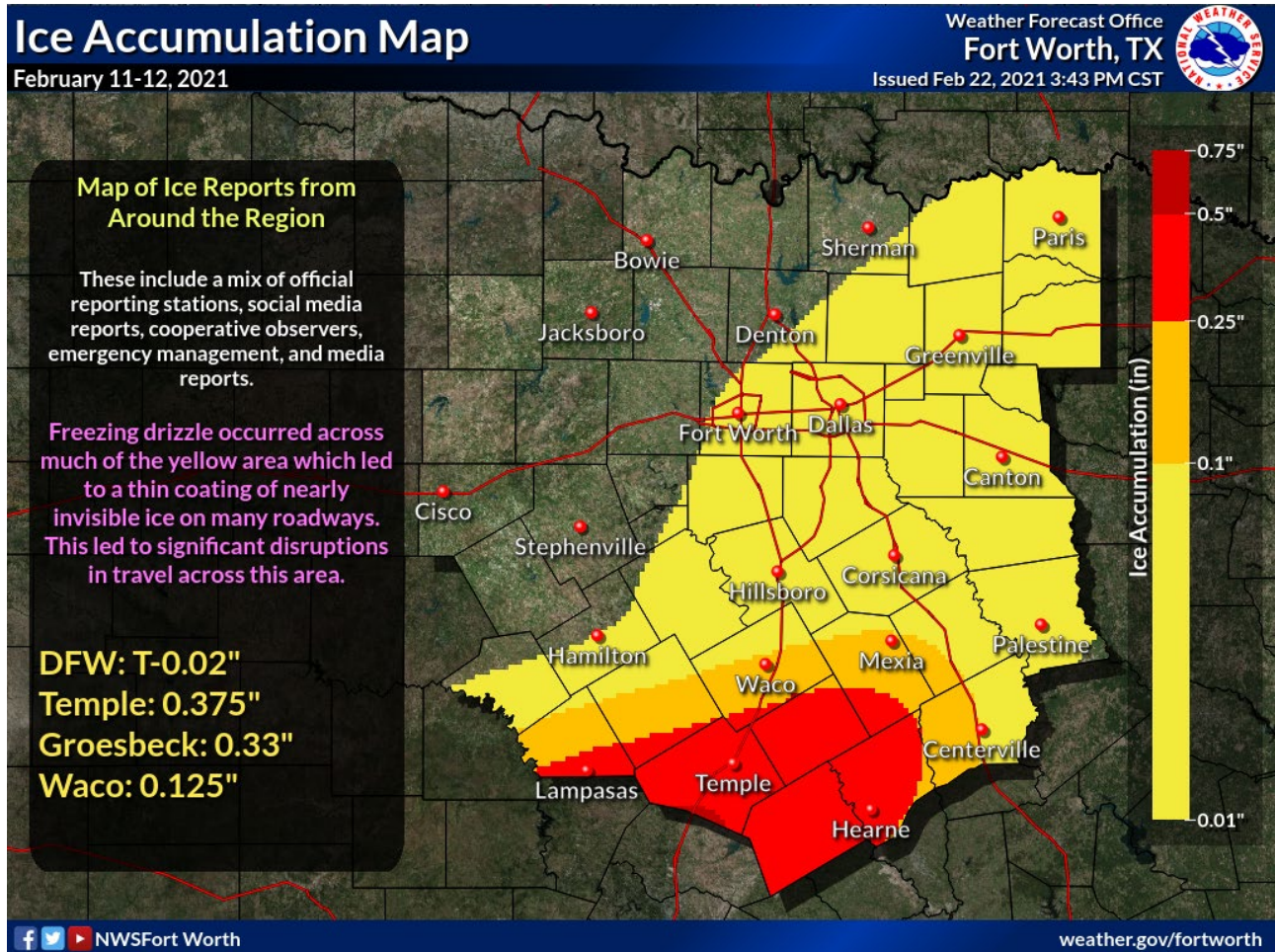


Figure 12 - Fort Worth Summary of the February 11-12, 21021 ice Storm

According to the NWS the highest ice accumulations up to 0.05" occurred across portions of central Texas.

What caused the event? The record cold spell and extended period of wintry weather was caused by the upper-level polar vortex²² dropping south from the north pole and then lingering over south-central Canada for more than a week. This allowed cold arctic air to gradually spill southward into Texas. At the same time several upper-level disturbances riding the jet stream moved through the area providing lift and moisture for winter precipitation. These disturbances show up as waves or dips in the lines that move in from the west. Ahead of each

²² Polar vortex is a persistent, large-scale, upper-level area of low pressure and cold air surrounding the Earth's poles. The term "vortex" refers to the counter-clockwise flow of air that helps keep the colder air near the Poles. It is a common feature and typically increases in strength during the winter and weakens during the summer as thermal gradients weaken. During winter in the northern hemisphere, the polar vortex will expand, sending cold arctic air southward with the jet stream.

wave upper-level lift increases and moisture is drawn up from the south. Since it was already so cold, this precipitation fell as snow, sleet, and freezing rain.

7.0 Freezing Precipitation Climatology

According to the NWS NCEI Comparative Climate Data Report²³ for the United States through 2018, the Dallas/Fort Worth area for the period from 1939 through 2018 averages 31 days per year with a minimum temperature below 32° F, between November through March. With regards to snowfall the Dallas/Fort Worth area averages 1.50” of snow per year. The annual climatology data does not routinely track the number of days of freezing precipitation.

A search of local climatological information from the NWS Dallas/Fort Worth WFO updated for the period through 2020²⁴ indicated the mean number of days per year with minimum temperature below 32° F at 29 days per year on average, with approximately 5 days a year with snowfall with an average of 1.50” of snowfall. There was no specific breakdown available for days with freezing precipitation in the data summary. A table of the mean days below freezing temperatures, snowfall, and normal snowfall is included below.

	J	F	M	A	M	J	J	A	S	O	N	D	A
Mean Days Below 32°F	10.6	6.2	1.9	0*	0.0	0.0	0.0	0.0	0.0	0.1	2.3	8.1	29.2
Days with Snowfall	1.6	1.4	0.5	0.*	0.0	0.0	0.0	0.0	0.0	0.*	0.3	1.3	5.1
Normal Snowfall	0.50”	0.60”	0.10”	0	0	0	0	0	0	0	0	0.30”	1.50”

*Values rounds to 0.0 but is non-zero

The record of the most consecutive hours at or below freezing temperatures from the Dalles/Fort Worth area was 295 hours was set from December 18-30, 1983. The accident event would stand at a ranking of 8th of the most consecutive hours at or below freezing temperatures with 139 hours between 1700 CST February 13th through 1200 CST February 19, 2021. However, if the additional 93 hours between 1700 CST February 9 through 1400 CST on February 13, 2021, were included, combined with the 139 hours would result in a period of 232 nonconsecutive hours (additional details see section 2.1 above) and would result in the ranking to be the 3rd most consecutive hours at or below freezing event in Dallas/Fort Worth history. The period between 1500-1600 CST on February 13, 2021 would be excluded from this 232 nonconsecutive hour period due to the temperature climbing to 33° F, before dropping below freezing for the rest of the week.

A review of NCEI Climate Atlas of Freezing Rain and Ice Storms²⁵ by S.A. Changnon and S. Karl, from 2003, mapped the average number of days with freezing rain with 0.25” of ice accumulation or more across the United States for the period between 1948-2000 and is included as figure 13. The climatological data indicated that freezing rain occurred on an average of 1-2 days per year. An additional study by Changnon in 2004 provided the average hours of freezing rain for the period from

²³ <https://www.ncdc.noaa.gov/sites/default/files/attachments/CCD-2018.pdf>

²⁴ https://www.weather.gov/fwd/dfw_normals

²⁵ Climate Atlas: Freezing Rain and Ice Storms. Changnon, Stanley A., 2004

1938-2001. Figure 14 is the average number of hours of freezing rain and indicated that the area experienced approximately 3 to 6 hours of freezing rain per year.

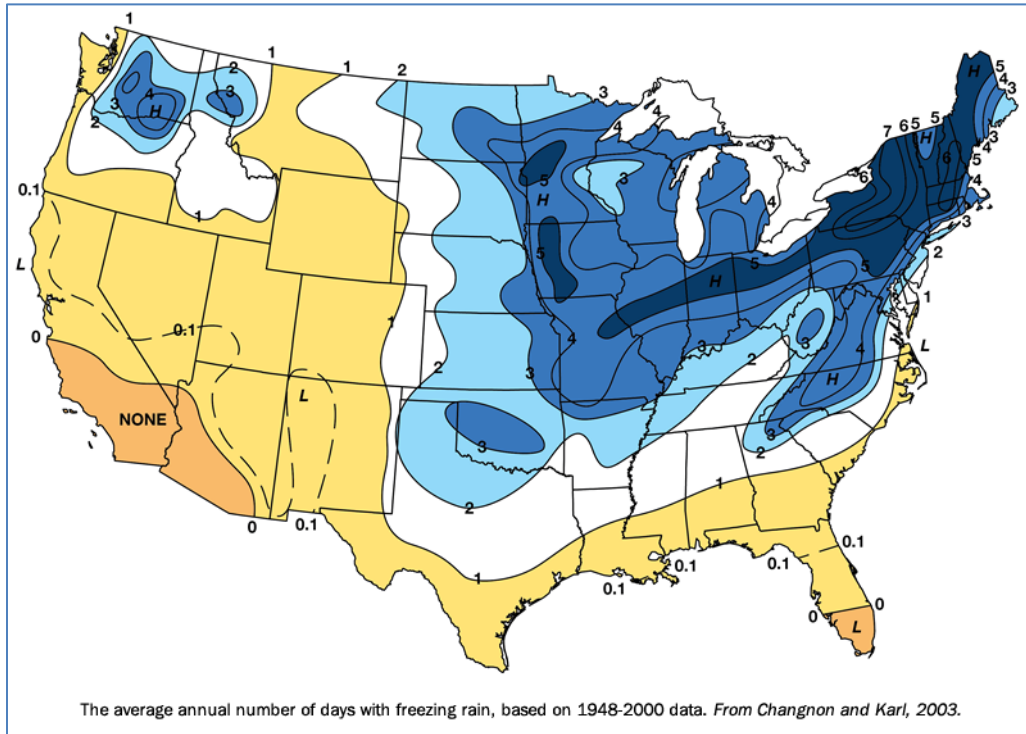


Figure 13 - Average number of days with major ice storms and freezing rain from 1948-2000

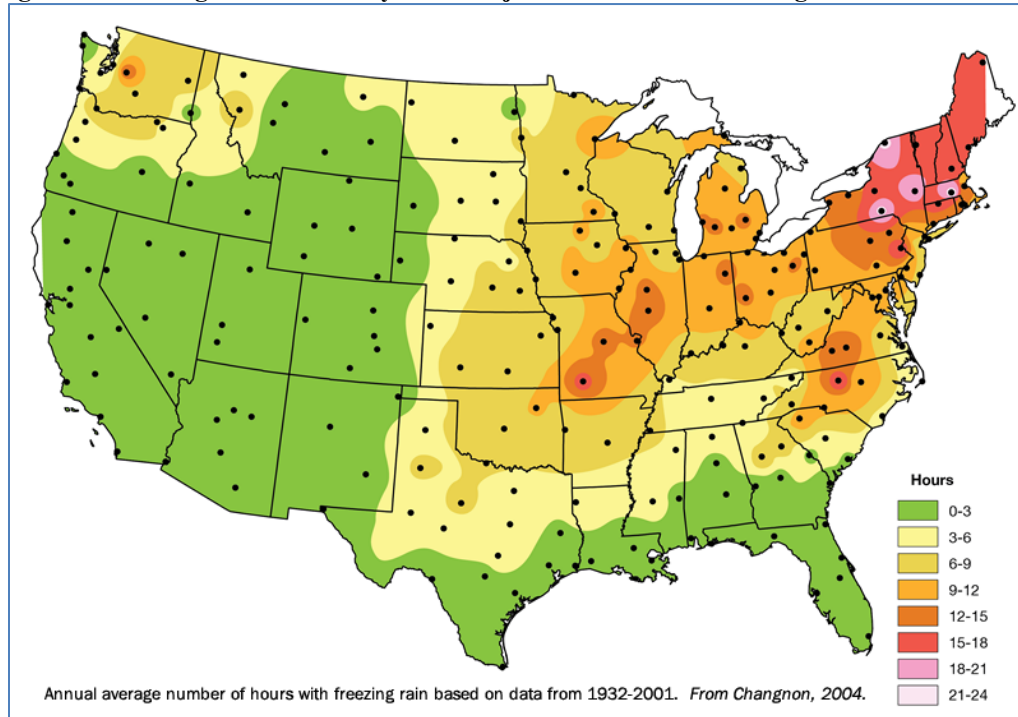


Figure 14 - Average Number of hours with Freezing Rain from 1932-2001

The NCEI average number of days with freezing precipitation²⁶ from 2000 is included as figure 15. The image depicts the Dallas/Fort Worth area with about 5.5 to 10.4 days a year with the occurrence of freezing precipitation, with no specific accumulation of precipitation.

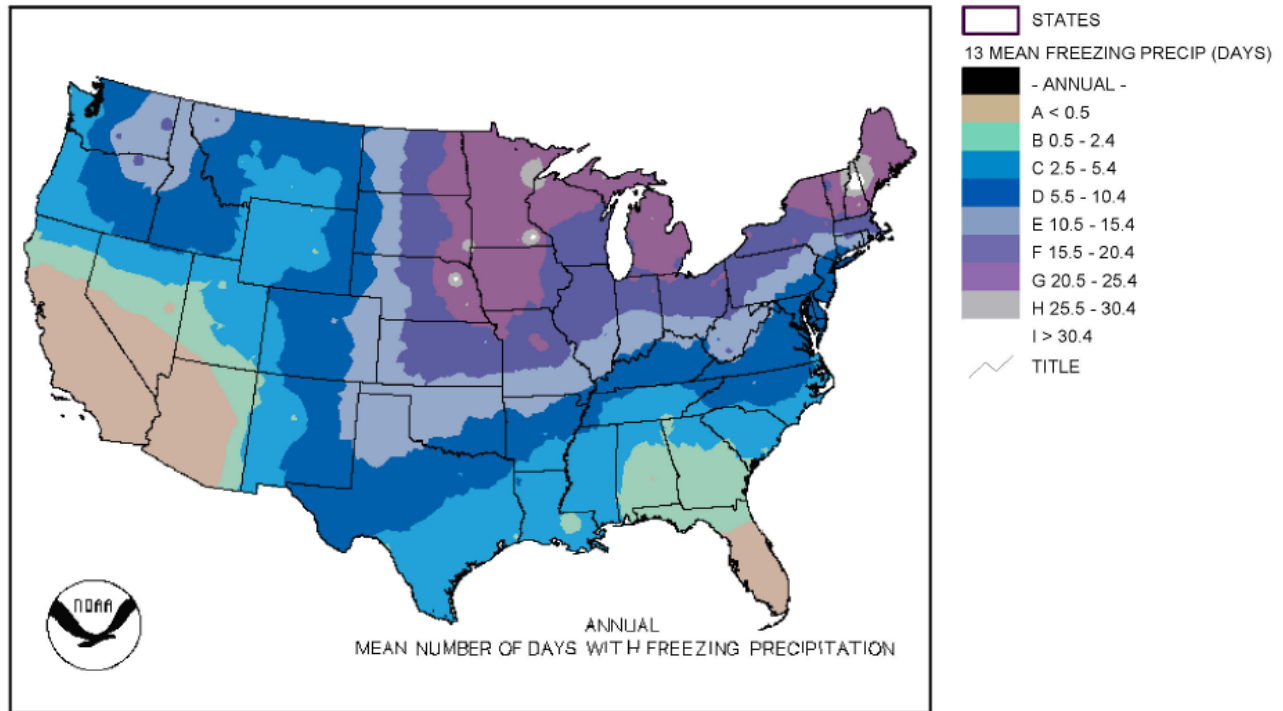


Figure 15 - Mean Number of Days with Freezing Precipitation

8.0 Weather Related Highway Accidents

The United States Department of Transportation (USDOT) Federal Highway Administration (FHWA) estimates on average there are over 5,891,000 vehicle crashes each year. Approximately 21% of these crashes or accidents, or nearly 1,235,000 are weather-related. Weather-related accidents are defined as those crashes that occur in adverse weather (i.e., rain, sleet, snow, fog, severe crosswinds, or blowing snow/sand/debris) or on slick pavement (i.e., wet pavement, snowy/slushy pavement, or icy pavement). On average, nearly 5,000 people are killed and over 418,000 people are injured in weather-related crashes each year²⁷. The FHWA data for a 10-year period between 2007 and 2016 reported 562,182 crashes per year due to snow and ice conditions on highways, which resulted in 1,705 fatalities with over 138,735 injuries, which approximated 11% of the total highways' accidents during that period.

²⁶ Defined as the occurrence of freezing rain, freezing drizzle, or ice pellets (sleet).

²⁷ Based on a 10-year average from 2007 to 2016 analyzed by Booz Allen Hamilton, based on FHWA data.

9.0 NOAA Weather Radio

NOAA Weather Radio (NWR) is a nationwide network of radio stations broadcasting continuous weather information directly from the nearest NWS office, and include Weather Service warnings, watches, forecasts and other hazardous information 24-hours a day, 7-days a week. Working with the Federal Communication Commission's (FCC) Emergency Alert System, the NWR is an "all Hazards" radio network, making it your single source for comprehensive weather and emergency information. In conjunction with Federal, State, and Local Emergency Managers and other public officials, NWR also broadcasts warning and post-event information for all types of hazards – including natural (such as earthquakes or avalanches), environmental (such as chemical releases or oil spills), and public safety (such as AMBER alerts or 911 Telephone outages).

NWR includes more than 1,000 transmitters, covering all 50 states, adjacent coastal waters, Puerto Rico, the U.S. Virgin Islands, and the U.S. Pacific Territories. NWR²⁸ requires a special radio receiver or scanner capable of picking up the signal. Figure 16 is a depiction of the coverage of NWR. Many Emergency Managers in high weather risk areas recommend homeowners and the general public to have emergency radio's which can pick up NWR during times of severe weather and other emergencies for information, and several automobile manufactures (BMW, Mercedes, Range Rover, and Saab) equip their cars with radios capable to receiving Weather Radio broadcasts. Several manufactures of car radios (Audiovox, Clarion, and Panasonic) also sell in-dash units capable of receiving the broadcasts. Other states such as New Jersey broadcast NWR on regular AM/FM radio channels on their Highway Advisory radio stations when there are no other highway or traffic problems to broadcast. There are approximately 24 such low-powered transmitters across New Jersey currently.

²⁸ All NOAA Weather Radio stations broadcast on one of seven frequencies in the VHF Public Service band: 162.400 megahertz (MHz), 162.425 MHz, 162.450 MHz, 162.475 MHz, 162.500 MHz, 162.525 MHz, and 162.550 MHz.

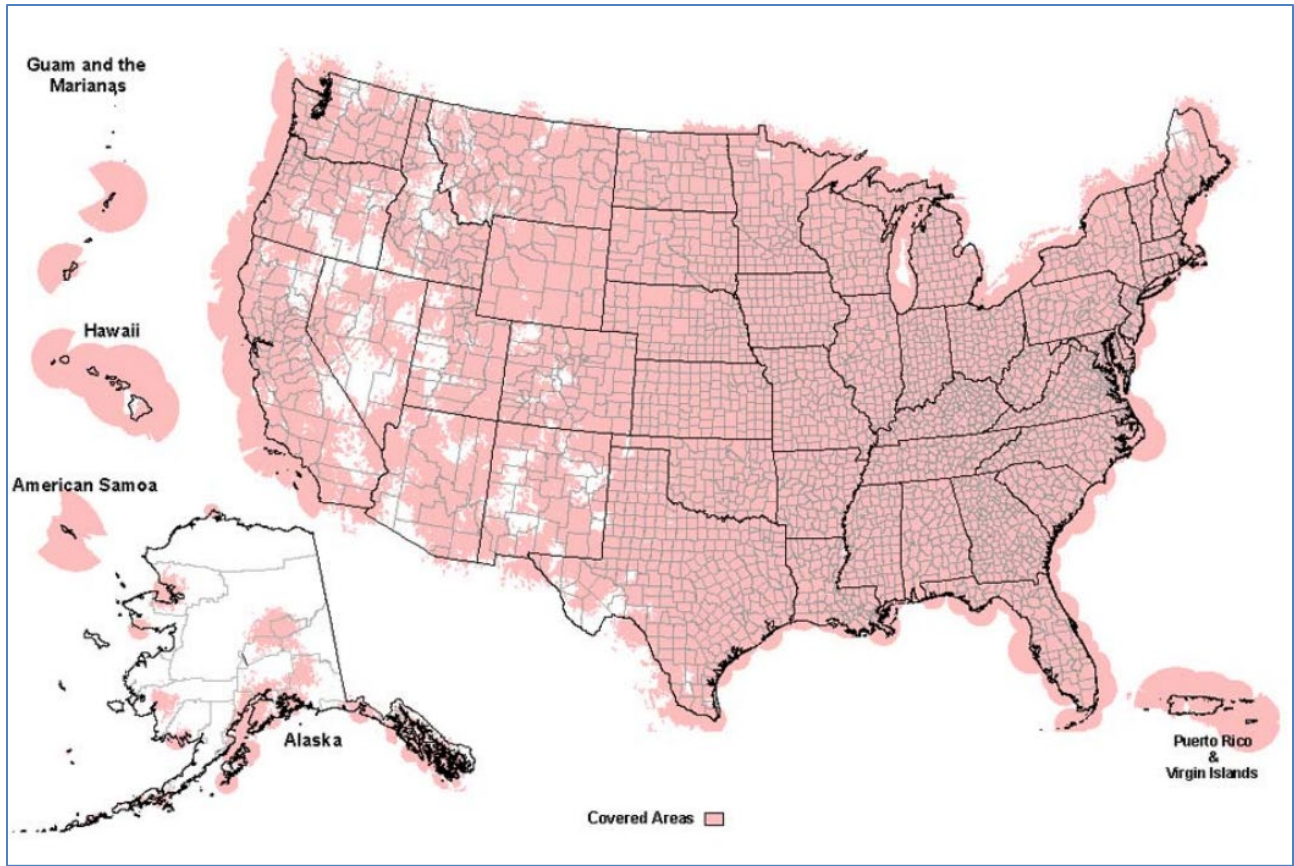


Figure 16 - NOAA Weather Radio coverage

10.0 Astronomical Conditions

The astronomical conditions calculated over the accident site on February 11, 2021 from the United States Naval Observatory's Multiyear Interactive Computer Almanac (MICA) software program provided the following conditions over the accident site. The accident time has been added in bold italic print for reference.

<u>Sun</u>	<u>Time (CST)</u>
<i>Accident</i>	<i>0615 CST</i>
Begin civil twilight	0650 CST
Sunrise	0717 CST
Culmination	1243 CST
Sunset	1811 CST
End civil twilight	1836 CST
<u>Moon</u>	
Moonset	1813 CST on February 10th
<i>Accident</i>	<i>0615 CST</i>
Moonrise	0729 CST

At the time of the accident dark nighttime conditions prevailed with both the Sun and the moon below the horizon, with overcast clouds reported over the area. The Sun was at an altitude of -13.4° and an azimuth of 98° .

Submitted by:

Don Eick
Senior Meteorologist