National Transportation Safety Board

Office of Aviation Safety

Washington, D.C. 20594-2000

July 21, 2011

METEOROLOGICAL FACTUAL REPORT

DCA11IA047

A. Incident

Location: Chicago, Illinois
Date: April 26, 2011
Time: approximately 1333 central daylight time (1833 UTC[1])
Aircraft: Boeing B737-700, registration: N799SW

B. Meteorological Specialist

Paul Suffern
Meteorologist
National Transportation Safety Board
Operational Factors Division, AS-30
Washington, D.C. 20594-2000

C. Summary

At 1333 CDT, Southwest 1919, N799SW, departed the left side of runway 13C after landing at Chicago Midway (MDW). There was minor damage to the airplane and no injuries.

[1] UTC – is an abbreviation for Coordinated Universal Time.

D. Details of Investigation

The National Transportation Safety Board's (NTSB) Meteorologist was not on scene for this investigation and gathered all the weather data for this investigation from the NTSB's Washington D.C. office and from official National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) sources including the National Climatic Data Center (NCDC). All times are central daylight time (CDT) on April 26, 2011, and are based upon the 24-hour clock, where local time is -5 hours from UTC, and UTC=Z. Directions are referenced to true north and distances in nautical miles. Heights are above mean sea level (msl) unless otherwise noted. Visibility is in statute miles and fractions of statute miles.

The incident site was located at latitude 41.79° N, longitude 87.75° W, at an elevation of 620 feet.

1.0 Synoptic Situation

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 located in Camp Springs, Maryland. These are the base products used in describing synoptic weather features and in the creation of forecasts and warnings for the NWS. Reference to these charts can be found in the joint NWS and Federal Aviation Administration (FAA) Advisory Circular "Aviation Weather Services", AC-0045G CHG 1.

1.1 Surface Analysis Chart

The NWS Surface Analysis Chart for 1300 CDT is provided as figure 1, with the approximate location of the incident site marked. The chart depicted a low pressure system with a central pressure of 991-hectopascals (hPa) in eastern Iowa and southern Wisconsin with a cold front stretching southward through Illinois, Missouri, and Arkansas. A warm front stretched eastward north of the incident site from eastern Iowa across the Great Lakes region and into western New York. The station models near the incident site depicted generally southerly winds of 10 to 20 knots, with mostly cloudy skies, temperatures in the low to mid 60's Fahrenheit (F), and dewpoint temperatures from 52° F to 61° F.

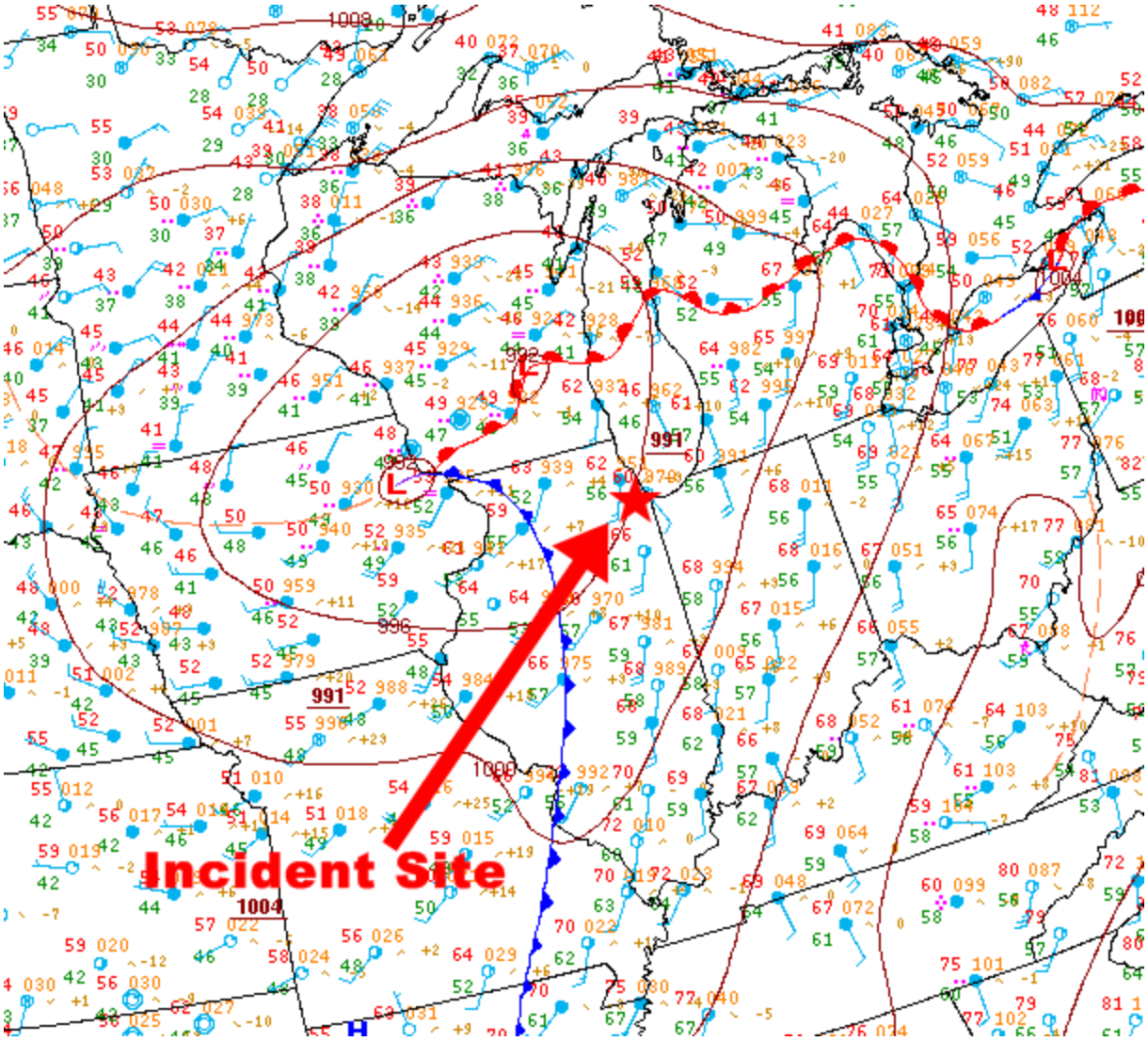


Figure 1 – NWS Surface Analysis Chart for 1300 CDT

1.2 Upper Air Charts

Storm Prediction Center Constant Pressure Charts for 0700 CDT are presented for 850-, 700-, 500-, and 300-hPa in figures 2 through 5. The 850-, 700-, and 500-hPa charts depicted a mid-level trough[2] over Missouri, and this mid level trough was associated with the cold front moving northeastward toward the incident site (figure 1). At 300-hPa an area of upper level divergence[3] was located over the incident site. Areas of upper-level divergence can act as lifting mechanisms to help in the formation of clouds, rain showers, and thunderstorms.

[2] Trough - An elongated area of relatively low atmospheric pressure or heights.
[3] Divergence - The expansion or spreading out of a vector field; usually said of horizontal winds. Divergence at upper levels of the atmosphere enhances upward motion, and hence the potential for precipitation and thunderstorm development.

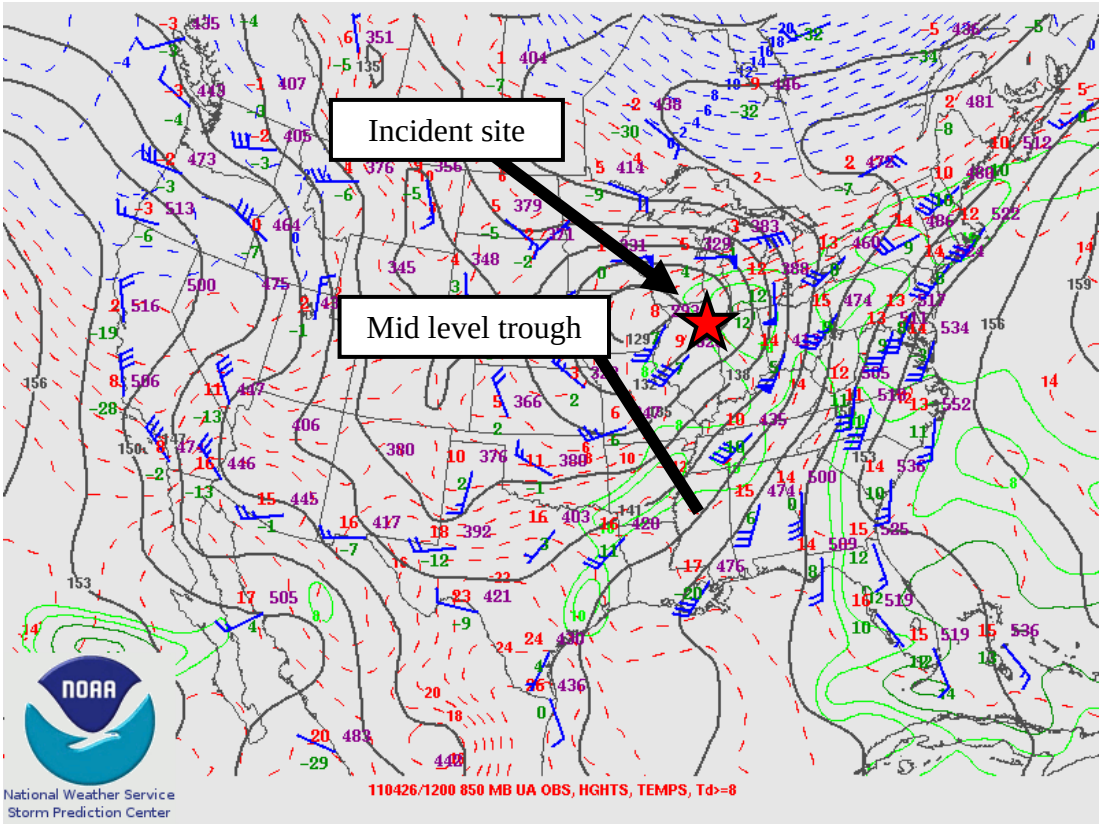


Figure 2 – 850-hPa Constant Pressure Chart for 0700 CDT

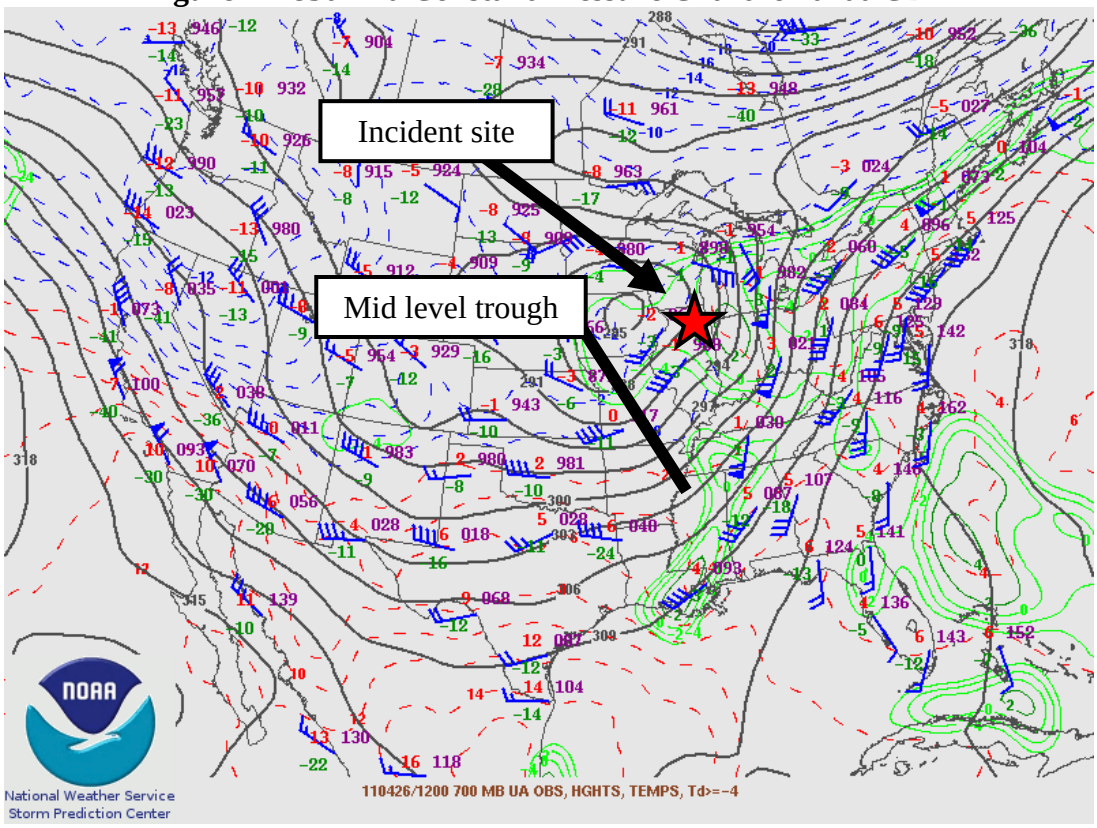


Figure 3 – 700-hPa Constant Pressure Chart for 0700 CDT

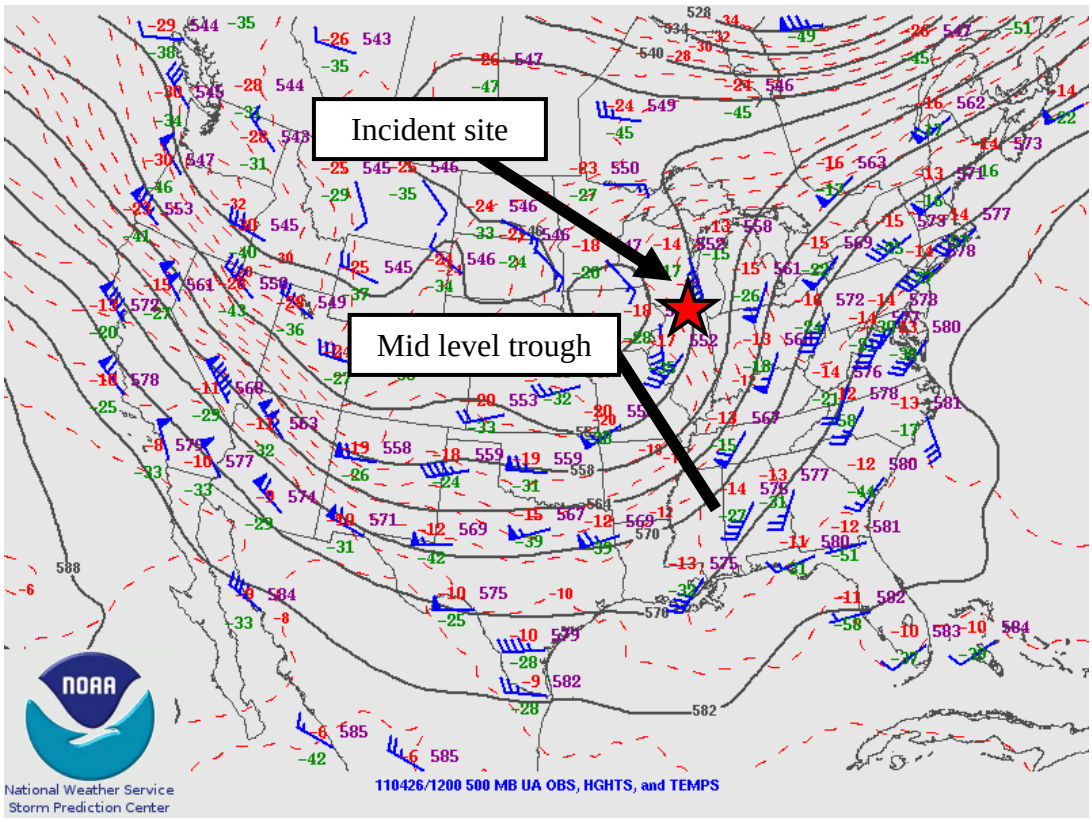


Figure 4 – 500-hPa Constant Pressure Chart for 0700 CDT

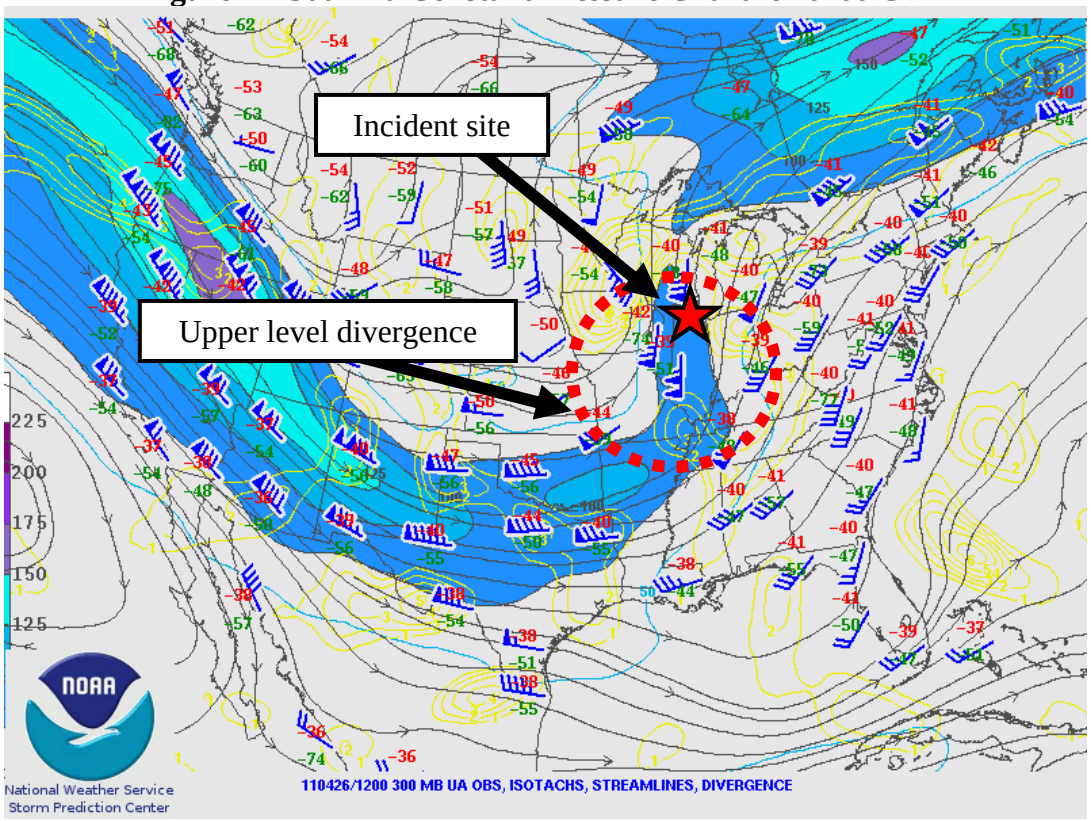


Figure 5 – 300-hPa Constant Pressure Chart for 0700 CDT

2.0 Radar Imagery

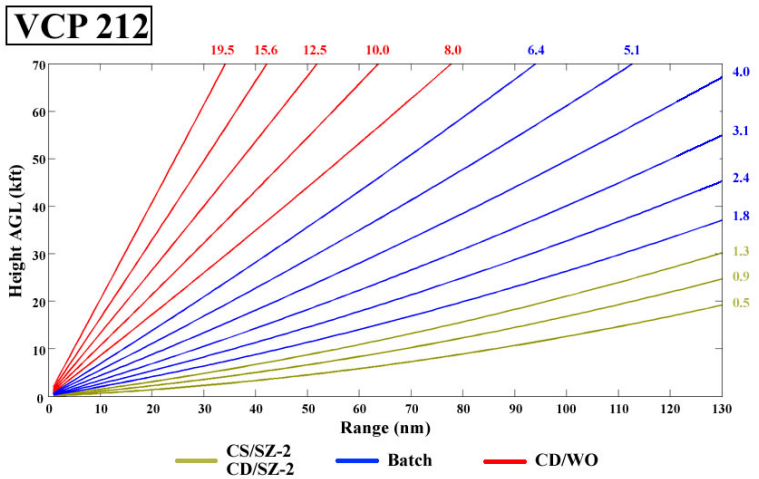
The closest NWS Weather Surveillance Radar-1988, Doppler (WSR-88D) was KLOT located in Romeoville, Illinois, approximately 19 miles west-southwest of the incident site at an elevation of 663 feet. Level II archive radar data was obtained from the NCDC utilizing the Hierarchical Data Storage System (HDSS) and displayed using the NWS NEXRAD Interactive Viewer and Data Exporter software.

The WSR-88D is an S-band 10-centimeter wavelength radar with a power output of 750,000 watts, and with a 28-foot parabolic antenna that concentrates the energy into a 0.95° beam width[4]. The radar produces three basic types of products: base reflectivity, base radial velocity, and base spectral width.

2.1 Volume Scan Strategy

The WSR-88D is a computer-controlled radar system, which automatically creates a complete series of specific scans in a specific sequence known as a volume scan. Individual elevation scans are immediately available on the WSR-88D's Principle Users Processor (PUP). Products that require data from multiple elevation scans are not available until the end of the five to ten minute volume scan.

The WSR-88D operates in several different scanning modes, identified as Mode A and Mode B. Mode A is the precipitation scan and has two common scanning strategies. The most common is where the radar makes 14 elevation scans from 0.5° to 19.5° every four and a half minutes. This particular scanning strategy is documented as volume coverage pattern 212 (VCP-212). Mode B is the clear-air mode, where the radar makes 5 elevation scans during a ten minute period. During the period surrounding the incident, the KLOT WSR-88D radar was operating in the normal precipitation mode (Mode A, VCP-212). The following chart provides an indication of the different elevation angles in this VCP, and the approximate height and width of the radar beam with distance from the radar site.



VCP-212 Precipitation Mode Scan Strategy

[4] Beam width – A measure of the angular width of a radar beam.

2.2 Beam Height Calculation

Assuming standard refraction[5] of the WSR-88D 0.95° wide radar beam, the following table shows the approximate beam height and width information of the radar display over the site of the incident. The heights have been rounded to the nearest 10 feet.

ANTENNA ELEVATION	BEAM CENTER	BEAM BASE	BEAM TOP	BEAM WIDTH
0.5°	1,930 feet	990 feet	2,870 feet	1870 feet

Based on the radar height calculations, the 0.5° elevation scan depicts the conditions between 990 feet to 2,870 feet msl over the incident site.

2.3 Reflectivity

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors[6] it is a function of the drop size distribution, number of particles per unit volume, physical state (ice or water), shape, and aspect. Reflectivity is normally displayed in decibels (dBZ[7]), and is a general measure of echo intensity. The chart below relates the NWS video integrator and processor (VIP) intensity levels versus the WSR-88D's display levels, precipitation mode reflectivity in decibels, and rainfall rates.

[5] Standard Refraction in the atmosphere is when the temperature and humidity distributions are approximately average, and values set at the standard atmosphere.

[6] Hydrometeors are any product of condensation or sublimation of atmospheric water vapor, whether formed in the free atmosphere or at the earth's surface; also, any water particles blown by the wind from the earth's surface. Hydrometeors are classified as; (a) Liquid or solid water particles suspended in the air: cloud, water droplets, mist or fog. (b) Liquid precipitation: drizzle and rain. (c) Freezing precipitation: freezing drizzle and freezing rain. (d) Solid (frozen) precipitation: ice pellets, hail, snow, snow pellets, and ice crystals. (e) Falling particles that evaporate before reaching the ground: virga. (f) Liquid or solid water particles lifted by the wind from the earth's surface: drifting snow, blowing snow, blowing spray. (g) Liquid or solid deposits on exposed objects: dew, frost, rime, and glazed ice.

[7] dBZ – A non-dimensional "unit" of radar reflectivity which represents a logarithmic power ratio (in decibels , or dB) with respect to radar reflectivity factor, Z.

NWS VIP/DBZ CONVERSION TABLE

NWS VIP	WSR-88D LEVEL	PREC MODE DBZ	RAINFALL
0	0 1 2	< 5 5 to 9 10 to 14	
1 Very Light	3 4 5	15 to 19 20 to 24 25 to 29	.01 in/hr .02 in/hr .04 in/hr
2 Light to Moderate	6 7	30 to 34 35 to 39	.09 in/hr .21 in/hr
3 Strong	8	40 to 44	.48 in/hr
4 Very Strong	9	45 to 49	1.10 in/hr
5 Intense	10	50 to 54	2.49 in/hr
6 Extreme	11 12 13 14 15	55 to 59 60 to 64 65 to 69 70 to 74 > 75	>5.67 in/hr

2.4 Base Reflectivity

Figures 6 through 9 present the KLOT WSR-88D base reflectivity image for the 0.5° elevation scans initiated at 1318, 1323, 1327, and 1332 CDT with a resolution of 1° X 1 kilometer. In addition, lightning flash[8] data from 1303 to 1335 CDT is plotted on each radar image as black dots. The images depicted a thunderstorm moving eastward over the incident site 5 to 6 minutes before the incident, with light to moderate echoes between 990 and 2,870 feet one minute before the incident above KMDW.

[8] Lightning Flash – This is one contiguous conducting channel and all the current strokes/pulses that flow through it. There are two types of flashes: ground flashes and cloud flashes.

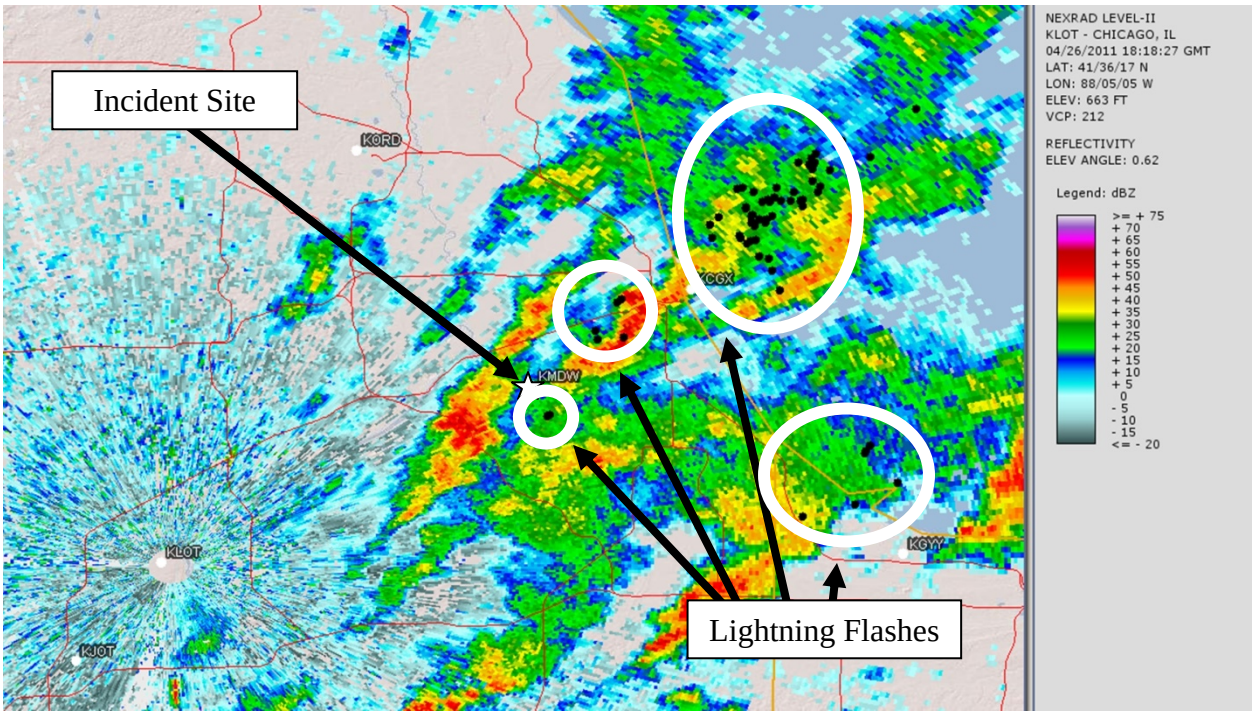


Figure 6 – KLOT WSR-88D 0.5° elevation scan for 1318 CDT with lightning data

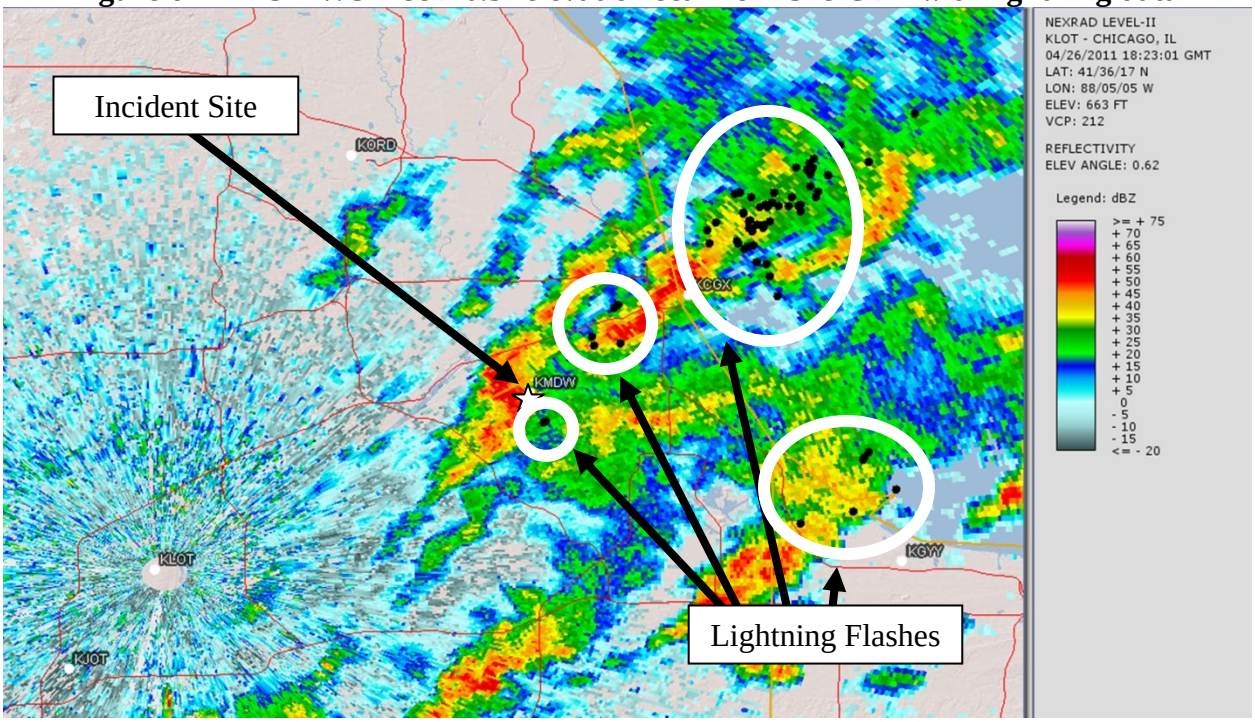


Figure 7 – KLOT WSR-88D 0.5° elevation scan for 1323 CDT with lightning data

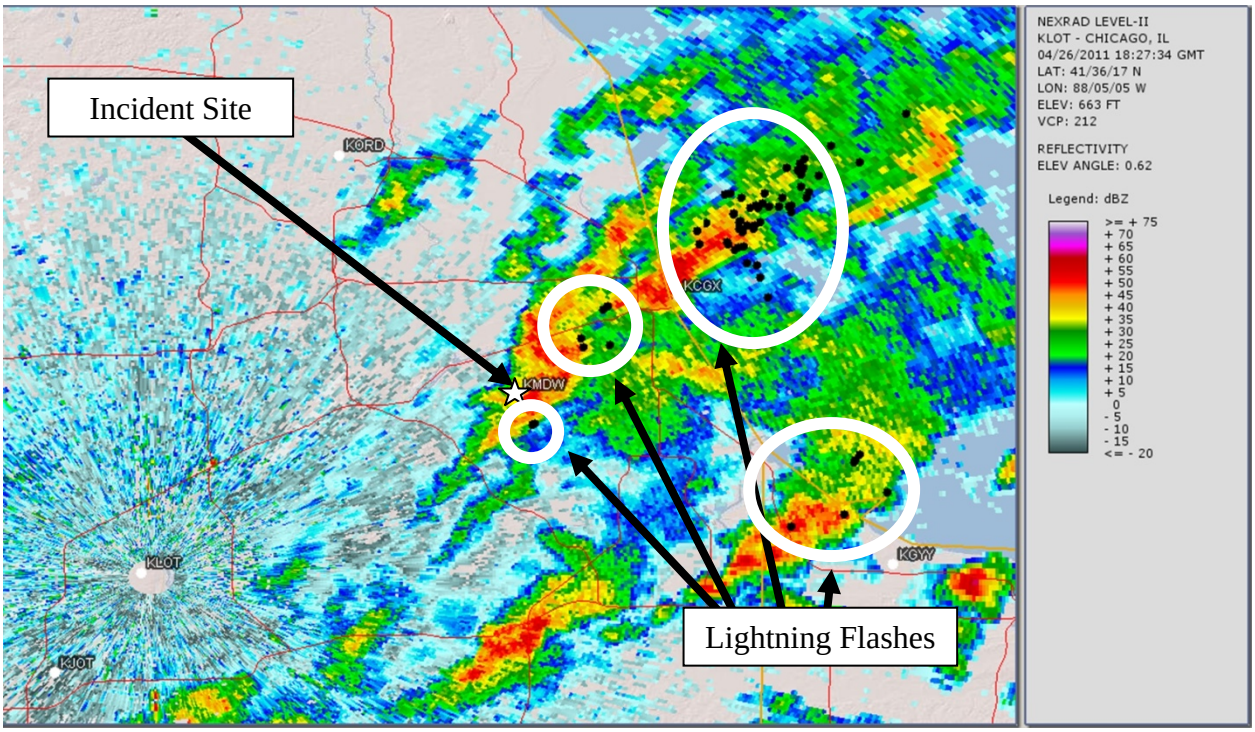


Figure 8 – KLOT WSR-88D 0.5° elevation scan for 1327 CDT with lightning data

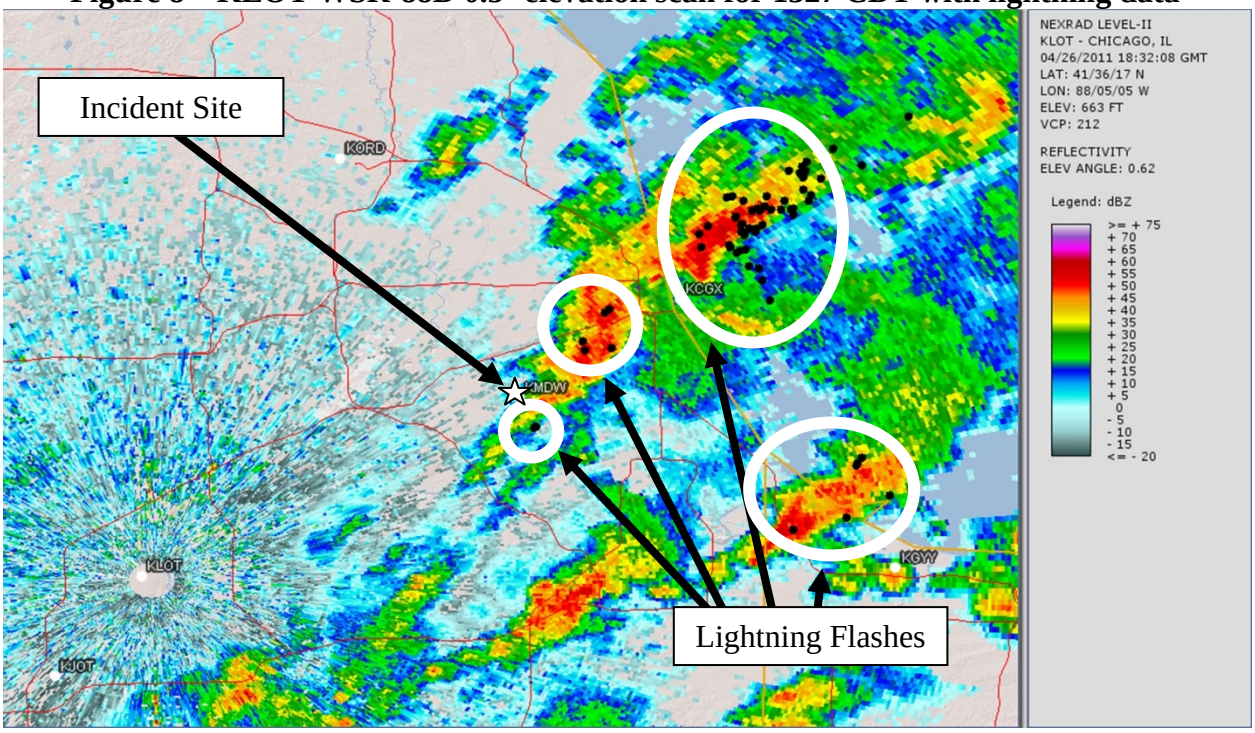


Figure 9 – KLOT WSR-88D 0.5° elevation scan for 1332 CDT with lightning data

2.5 Terminal Weather Radar

The closest Terminal Doppler Weather Radar (TDWR) was TMDW located approximately 8 miles south of the incident site at an elevation of 763 feet. Level III archive radar data was obtained from the NCDC utilizing the Hierarchical Data Storage System (HDSS) and displayed using the NWS NEXRAD Interactive Viewer and Data Exporter software.

The TDWR is a 5-centimeter wavelength radar that concentrates the energy into a 0.55° beam width.

Assuming standard refraction of the TDWR 0.55° wide radar beam, the following table shows the approximate beam height and width information of the radar display over the site of the incident. The heights have been rounded to the nearest 10 feet.

ANTENNA ELEVATION	BEAM CENTER	BEAM BASE	BEAM TOP	BEAM WIDTH
0.3°	1,060 feet	830 feet	1,290 feet	470 feet

Based on the radar height calculations, the 0.3° elevation scan depicts the conditions between 830 to 1,290 feet msl over the incident site.

Figure 10 and 11 present the TMDW TDWR base reflectivity image for the 0.3° elevation scan initiated at 1322 and 1334 CDT with a resolution of 1.25° X 250 meters. In addition, lightning flash data from 1303 to 1335 CDT is plotted on each radar image as black dots. Figure 10 depicted an area of higher reflectivity west of the incident site at 1322 CDT with the area of higher reflectivity having moved east of the incident site by 1334 CDT (figure 11). Only light echoes remain between 830 and 1,290 feet over the incident site one-minute after the incident.

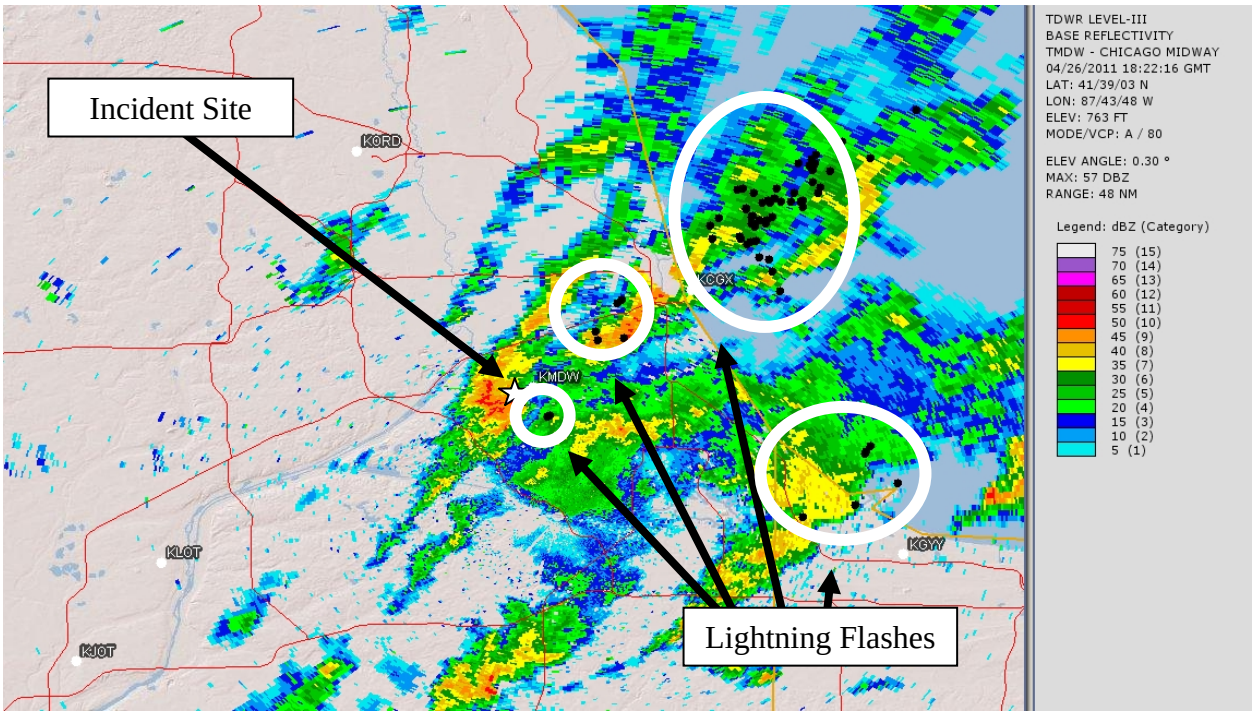


Figure 10 – TMDW TDWR 0.3° elevation scan for 1322 CDT with lightning data

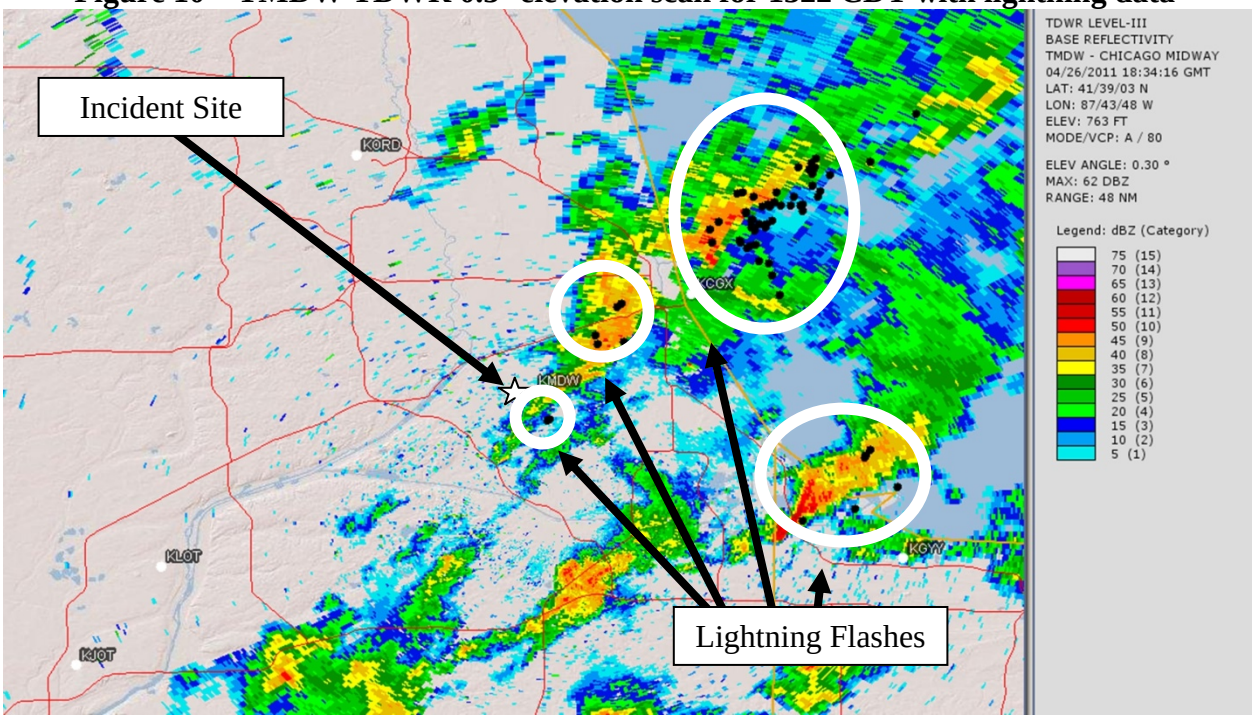


Figure 11 – TMDW TDWR 0.3° elevation scan for 1334 CDT with lightning data

3.0 Surface Observations

The area surrounding the incident site was documented utilizing official NWS Meteorological Aerodrome Reports (METARs) and Specials (SPECIs). The following observations were taken from standard code and are provided in plain language.

Chicago Midway International Airport (KMDW), located 9 miles southwest of the city of Chicago, Illinois, had an Automated Surface Observing System (ASOS[9]) (figure 12) whose reports were augmented by NWS certified weather observers. KMDW has an elevation of 620 feet. The following observations were taken and disseminated during the times surrounding the incident. These observations were made while a human observer was logged into the ASOS system.

[9] ASOS – Automated Surface Observing System is equipped with meteorological instruments to observe and report wind, visibility, ceiling, temperature, dewpoint, altimeter, and barometric pressure.

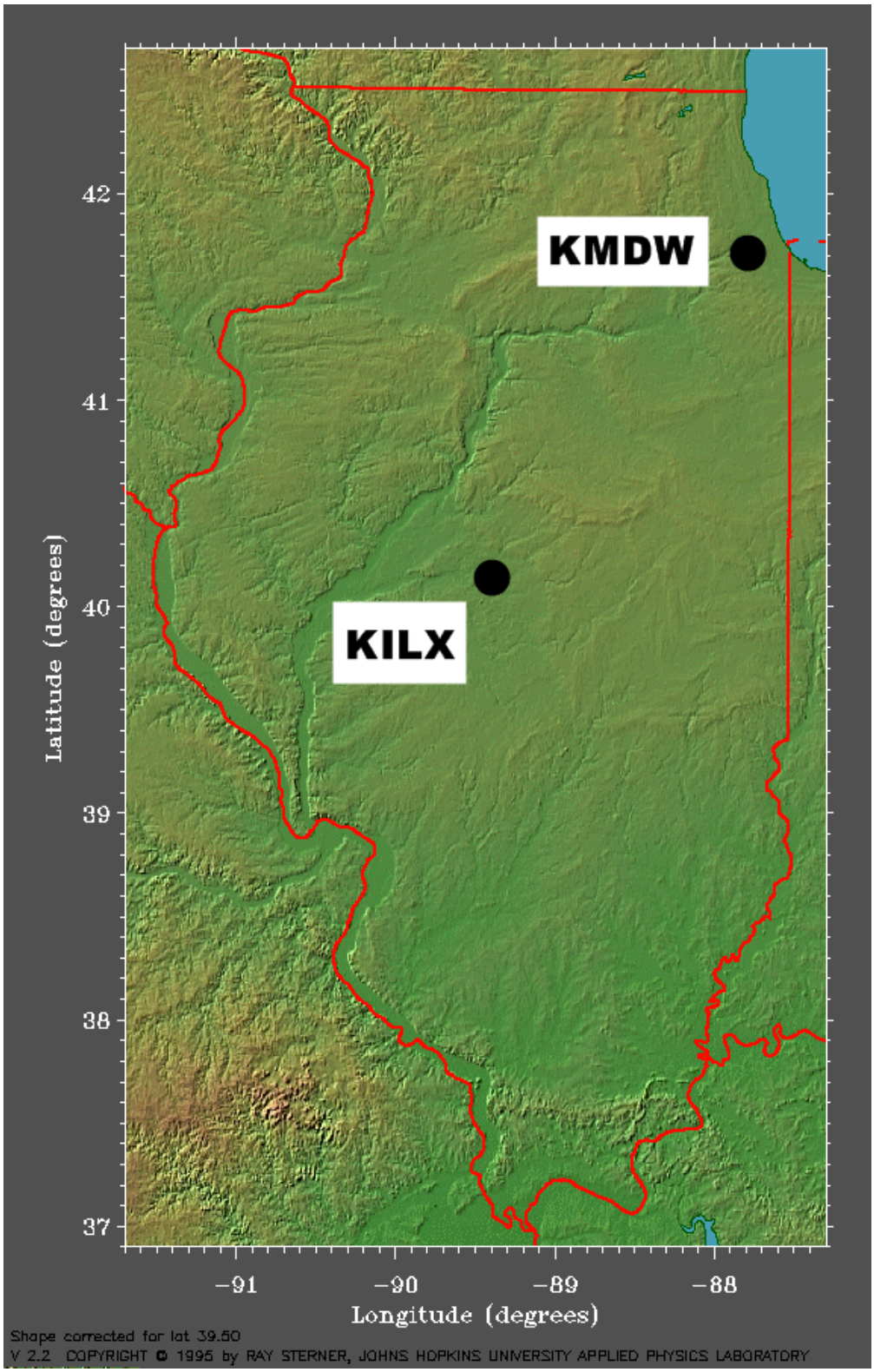


Figure 12 – Map of Illinois with the location of KMDW (surface observations and incident site) and KILX (upper air sounding site)

[1151 CDT] KMDW 261651Z 20011G21KT 2SM -RA BR FEW007 BKN010 OVC017 16/14 A2941 RMK AO2 RAB03 SLP958 P0003 T01560139 $

[1240 CDT] KMDW 261740Z 18014G20KT 5SM BR SCT008 BKN014 OVC022 16/14 A2941 RMK AO2 RAE40 P0005 $

[1251 CDT] KMDW 261751Z 19016G23KT 6SM -RA BR SCT008 BKN014 OVC022 16/14 A2940 RMK AO2 SLP954 P0005 60008 T01610144 10167 20128 50001 $

[1328 CDT] KMDW 261828Z 22010G17KT 1 1/2SM RA BR SCT009 BKN015CB OVC034 16/14 A2941 RMK AO2 CB SW MOV E P0011 $

Incident Time 1333 CDT

[1344 CDT] KMDW 261844Z 21012G21KT 7SM -RA FEW009 BKN015CB OVC034 16/14 A2941 RMK AO2 CB SE MOV E P0013 $

[1348 CDT] KMDW 261848Z 21013G21KT 7SM -RA FEW009 BKN015CB OVC034 16/14 A2941 RMK AO2 CB NE MOV E P0013 $

[1351 CDT] KMDW 261851Z 21015G21KT 10SM FEW009 BKN012CB OVC034 16/14 A2941 RMK AO2 RAE49 SLP958 CB NE MOV E P0013 T01610139 $

[1411 CDT] KMDW 261911Z 21009KT 10SM BKN015CB BKN065 BKN250 17/14 A2942 RMK AO2 CB E MOV NE $

[1434 CDT] KMDW 261934Z 21010G20KT 10SM SCT016 BKN080 BKN250 17/14 A2942 RMK AO2 SHRA DSNTNE-E-SE $

[1451 CDT] KMDW 261951Z 21015G24KT 10SM SCT016 SCT080 BKN140 BKN250 18/14 A2941 RMK AO2 SLP958 SHRA DSNT ALQDS T01780144 $

KMDW weather at 1251 CDT, wind from 190° at 16 knots with gusts to 23 knots, visibility 6 miles, light rain and mist, scattered clouds at 800 feet above ground level (agl), a broken ceiling at 1,400 feet agl, overcast skies at 2,200 feet agl, temperature of 16° Celsius (C), dew point temperature of 14° C, and an altimeter setting of 29.40 inches of mercury. Remarks: automated station with a precipitation discriminator, sea level pressure 995.4 hPa, 1-hourly precipitation of 0.05 inches, 6-hourly precipitation amount of 0.08 inches, temperature 16.1° C, dew point temperature 14.4° C, 6-hourly maximum temperature of 16.7° C, 6-hourly minimum temperature of 12.8° C, a 3-hourly pressure increase then decrease of 0.1 hPa, and maintenance is needed on the system.

KMDW weather at 1328 CDT, wind from 220° at 10 knots with gusts to 17 knots, visibility 1 and a half miles, moderate rain and mist, scattered clouds at 900 feet agl, a broken ceiling of cumulonimbus clouds at 1,500 feet agl, overcast skies at 3,400 feet agl, temperature of 16° C, dew point temperature of 14° C, and an altimeter setting of 29.41 inches of mercury. Remarks: automated station with a precipitation discriminator, cumulonimbus clouds southwest of the reporting site moving east, 1-hourly precipitation amount of 0.11 inches, and maintenance is needed on the system.

KMDW weather at 1344 CDT, wind from 210° at 12 knots with gusts to 21 knots, visibility 7 miles, light rain, few clouds at 900 feet agl, a broken ceiling of cumulonimbus clouds at 1,500 feet agl, overcast skies at 3,400 feet agl, temperature of 16° C, dew point temperature of 14° C, and an altimeter setting of 29.41 inches of mercury. Remarks: automated station with a precipitation discriminator, cumulonimbus clouds southeast of the reporting site moving east, 1-hourly precipitation amount of 0.13 inches, and maintenance is needed on the system.

3.1 One Minute Wind Observations

The one-minute KMDW ASOS surface data was provided by the NWS for the time surrounding the incident. One-minute raw wind data was provided with two separate magnitudes and wind directions[10]. The first wind data in table 1 is the two-minute average wind speed, which was updated every 5 seconds and reported once a minute. The second source of one-minute wind data is the five-second maximum wind average, which was updated every five seconds and reported once every minute. The present weather column provides the one-minute present weather sensed by the precipitation identification sensor. The one-minute present weather intensity was determined based on the past five minutes of one-minute samples, with the intensity determined from the highest common intensity from three or more of those samples.[11] The one-minute precipitation accumulation column provides the one-minute total precipitation accumulation from KMDW. The right two columns provide the one-minute temperature and dew point temperature in degrees Fahrenheit at KMDW. The following chart provides the meteorological data in local time (CDT) as well as UTC time as the incident aircraft landed on runway 13C.

[10] The wind directions are in reference to true north.

[11] For example, if rain is the determined precipitation type, and there are three moderate rain samples and one light rain sample detected in the past five minutes, then the ASOS will report moderate rain in the METAR/SPECI report.

Time (UTC)	Time (CDT)	Dir of 2min avg wind	Speed of 2 min avg wind (knots)	Dir of max 5 sec avg wind	Speed of max 5 sec avg wind (knots)	Present weather	One-minute precipitation accumulation (inches)	Temperature (F)	Dew point temperature (F)
1811	1311	197	7	197	11	?2	0	61	58
1812	1312	193	8	185	10	?2	0	60	58
1813	1313	192	8	196	11	R-	0	60	58
1814	1314	196	7	200	9	R-	0	60	58
1815	1315	196	9	189	14	R-	0	60	58
1816	1316	199	9	215	11	?1	0	60	58
1817	1317	206	8	193	11	?1	0.01	60	58
1818	1318	207	8	216	9	R-	0	60	58
1819	1319	207	9	216	14	R-	0	60	58
1820	1320	210	9	224	14	R-	0	60	58
1821	1321	207	9	200	12	P	0	60	58
1822	1322	200	10	201	13	P	0	60	58
1823	1323	207	10	208	13	M	0.01	60	58
1824	1324	215	9	223	17	P	0.01	60	58
1825	1325	213	10	209	17	P	0.02	60	58
1826	1326	215	11	223	13	P	0.03	60	58
1827	1327	221	11	229	14	R+	0.01	60	58
1828	1328	220	10	229	15	R+	0.01	60	58
1829	1329	216	8	214	11	M	0	60	58
1830	1330	215	8	212	11	M	0	60	58
1831	1331	215	8	227	11	R+	0.01	60	58
1832	**1332**	**216**	**10**	**229**	**17**	**R+**	**0.01**	**60**	**58**
1833	**1333**	**218**	**12**	**231**	**16**	**R+**	**0**	**60**	**57**
1834	**1334**	**221**	**11**	**225**	**16**	**R**	**0**	**60**	**58**
1835	1335	220	11	227	16	R-	0	60	57
1836	1336	214	12	211	20	R-	0	60	57
1837	1337	213	12	212	13	M	0	61	58
1838	1338	213	11	205	14	?3	0	61	58
1839	1339	211	11	214	13	M	0	61	58
1840	1340	209	11	217	16	NP	0	61	58
1841	1341	207	12	206	18	?1	0	61	58
1842	1342	208	11	199	17	?1	0	61	58
1843	1343	210	12	212	21	NP	0	61	57
1844	1344	208	12	219	14	NP	0	61	58
1845	1345	212	11	223	15	NP	0	61	58

Table 1 – One-minute KMDW ASOS data for the time surrounding the incident

At 1332 CDT, KMDW reported the two-minute average wind from 216° at 10 knots, a five-second maximum average wind from 229° at 17 knots, heavy rain, a one-minute precipitation accumulation of 0.01 inches, a temperature 60° F, and a dew point temperature of 58° F.

At 1333 CDT, KMDW reported the two-minute average wind from 218° at 12 knots, a five-second maximum average wind from 231° at 16 knots, heavy rain, a temperature 60° F, and a dew point temperature of 57° F.

At 1334 CDT, KMDW reported the two-minute average wind from 221° at 11 knots, a five-second maximum average wind from 225° at 16 knots, moderate rain, a temperature 60° F, and a dew point temperature of 58° F.

4.0 Upper Air Data

The closest upper air sounding to the incident site was from Lincoln, Illinois (KILX), which was approximately 121 miles southwest of the incident site (figure 12), with a site number 74560 and a station elevation of 584 feet. The 0700 CDT sounding from KILX was plotted on a standard Skew-T log P diagram[12], which is presented along with the derived stability parameters in figure 13 (with data from the surface to 600-hPa, or approximately 14,000 feet). These data were analyzed utilizing the RAOB[13] software package. The sounding depicted a moist vertical environment with the Lifted Condensation Level (LCL)[14] at 1,249 feet, a Convective Condensation Level (CCL)[15] at 3,073 feet, and a Level of Free Convection (LFC)[16] at 3,402 feet. The freezing level was located at 9,239 feet. The tropopause height was identified at 40,105 feet. The precipitable water value was 0.98 inches.

[12] Skew T log P diagram – is a standard meteorological plot 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 complete Rawinsonde Observation program) is an interactive sounding analysis program developed by Environmental Research Services, Matamopras, Pennsylvania.

[14] Lifting Condensation Level (LCL) - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.

[15] Convective Condensation Level (CCL) – The level in the atmosphere to which an air parcel, if heated from below, will rise dry adiabatically, without becoming colder than its environment just before the parcel becomes saturated.

[16] Level of Free Convection (LFC) – The level at which a parcel of saturated air becomes warmer than the surrounding air and begins to rise freely. This occurs most readily in a conditionally unstable atmosphere.

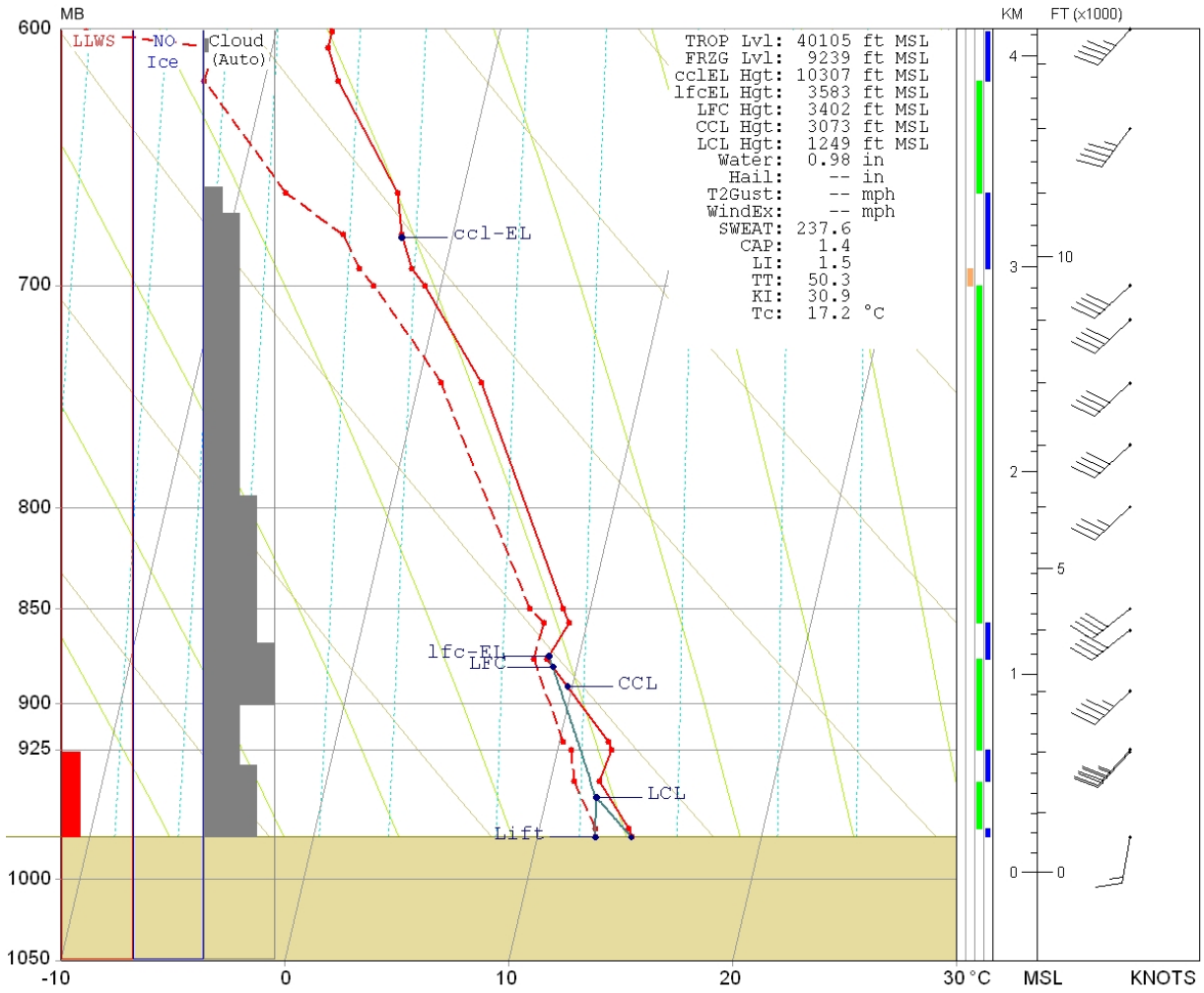


Figure 13 –KILX 0700 CDT sounding

The sounding parameters indicated a moist and conditionally unstable environment from the surface to approximately 10,000 feet. Such conditions are considered supportive for vertical cloud formation and precipitation, and RAOB indicated the potential for the presence of clouds from the surface to 11,000 feet. No areas of icing were identified by RAOB.

The sounding wind profile indicated there was a surface wind from 190° at 13 knots and that the wind veered[17] to the west while increasing in speed with height to 46 knots near 11,000 feet. RAOB indicated areas of low level wind shear (LLWS) on the KILX sounding from the surface to 2,000 feet and this supported the potential of turbulence.

[17] Veering wind – Wind which changes in a clockwise direction with time at a given location, or which changes direction in a clockwise sense with height.

5.0 Satellite Data

Visible and infrared data from the Geostationary Operational Environmental Satellite number 13 (GOES-13) data was obtained from the NCDC and processed with the NTSB's Man-computer Interactive Data Access System (McIDAS) workstation. Visible and infrared imagery (GOES-13 band 1 and 4), at wavelengths of 0.65 microns (μm) and 10.7 μm, respectively, retrieved brightness temperatures for the scene. Satellite imagery surrounding the time of the incident, from 1130 CDT through 1430 CDT at approximately 15-minute intervals, were reviewed and the closest images to the time of the incident are documented here.

Figures 14 and 15 present the GOES-13 visible imagery from 1315 and 1332 CDT at 3X magnification with the incident site highlighted with a red square. Inspection of the visible imagery indicated that the clouds associated with higher reflectivities from figures 10 and 11 near the incident site were moving in a northeasterly direction. Figure 16 presents the GOES-13 infrared imagery from 1332 CDT at 3X magnification with the incident site highlighted with a red square. Based on the brightness temperatures above the incident site and the vertical temperature profile provided by the 0700 CDT KILX sounding (figure 13), the approximate cloud-top heights over the incident site were 31,000 feet.

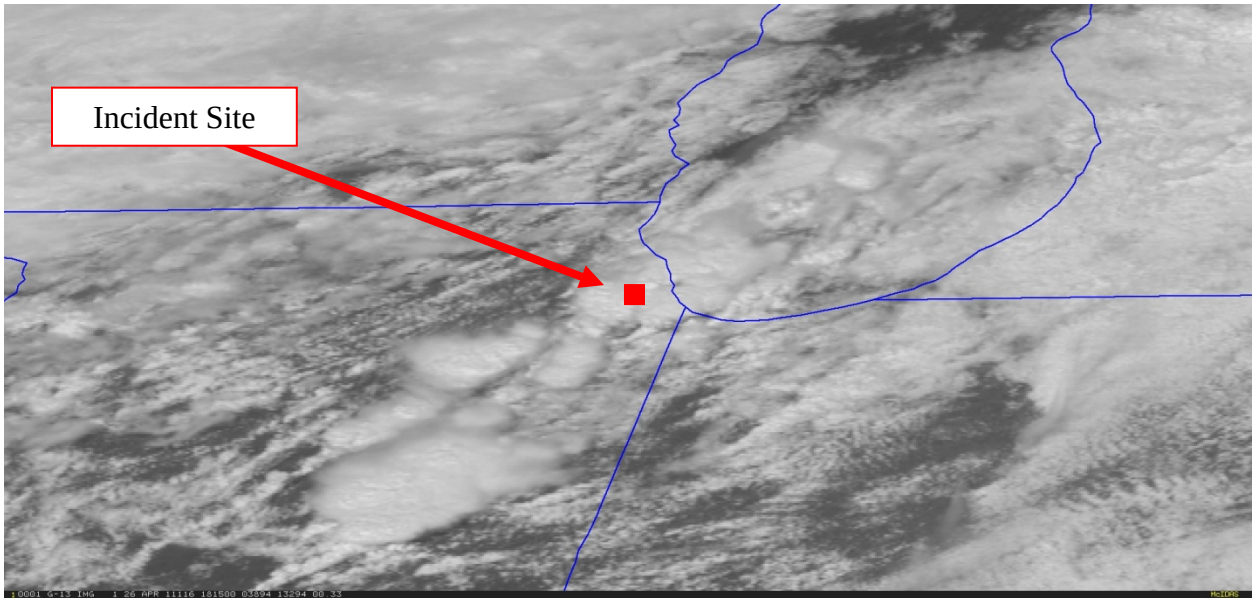


Figure 14 – GOES-13 visible image at 1315 CDT

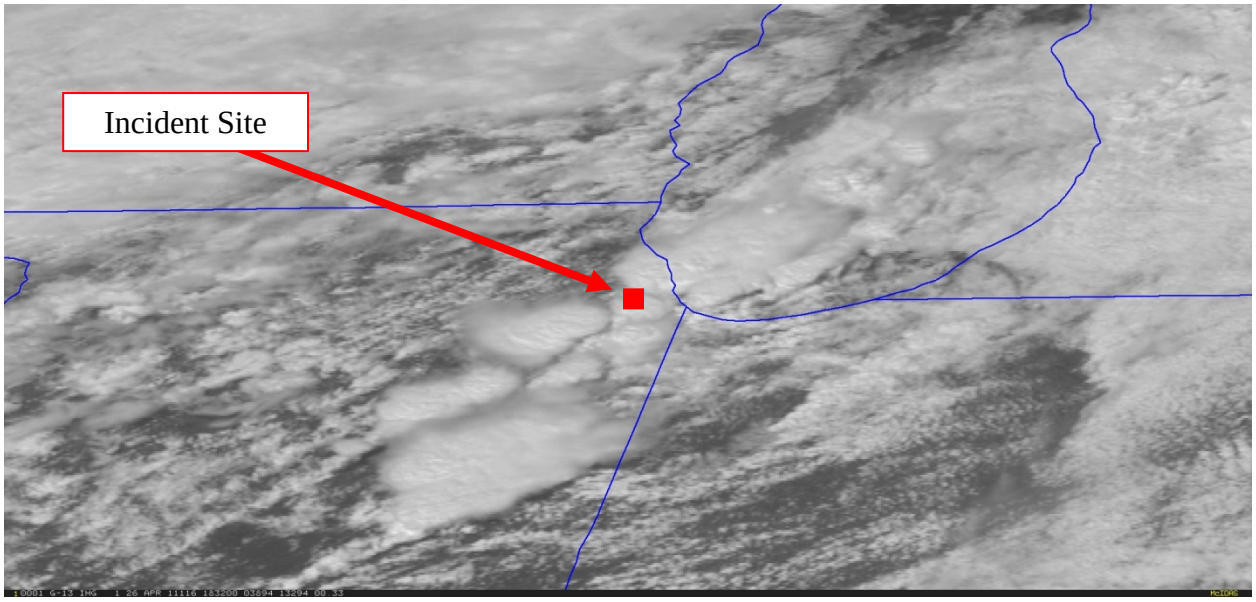


Figure 15 – GOES-13 visible image at 1332 CDT

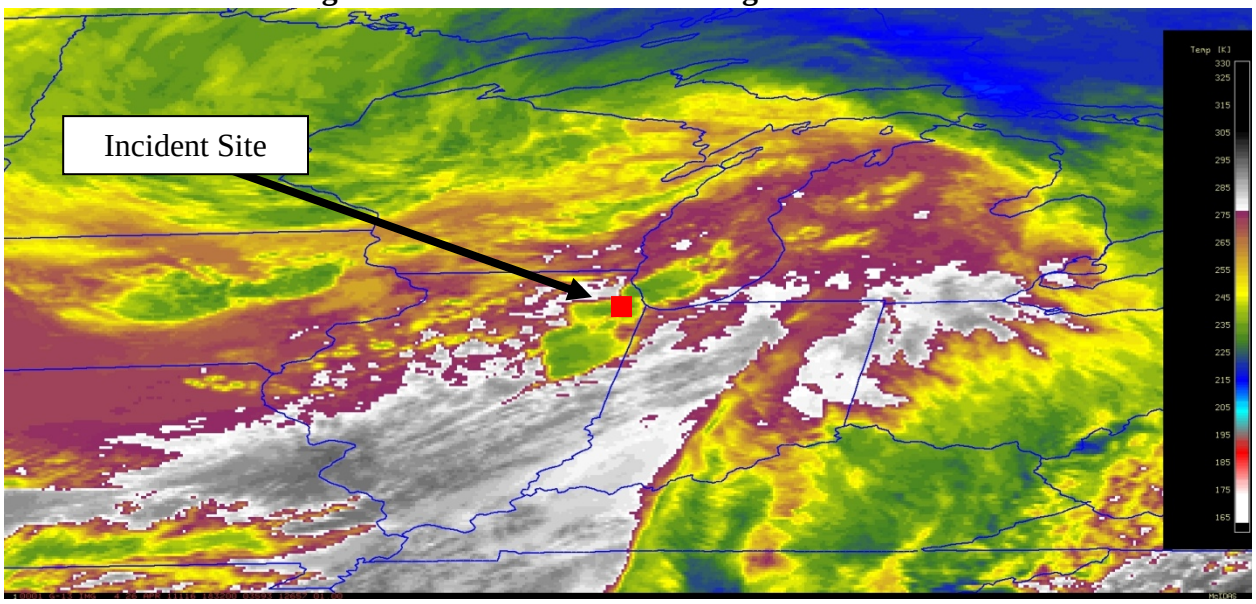
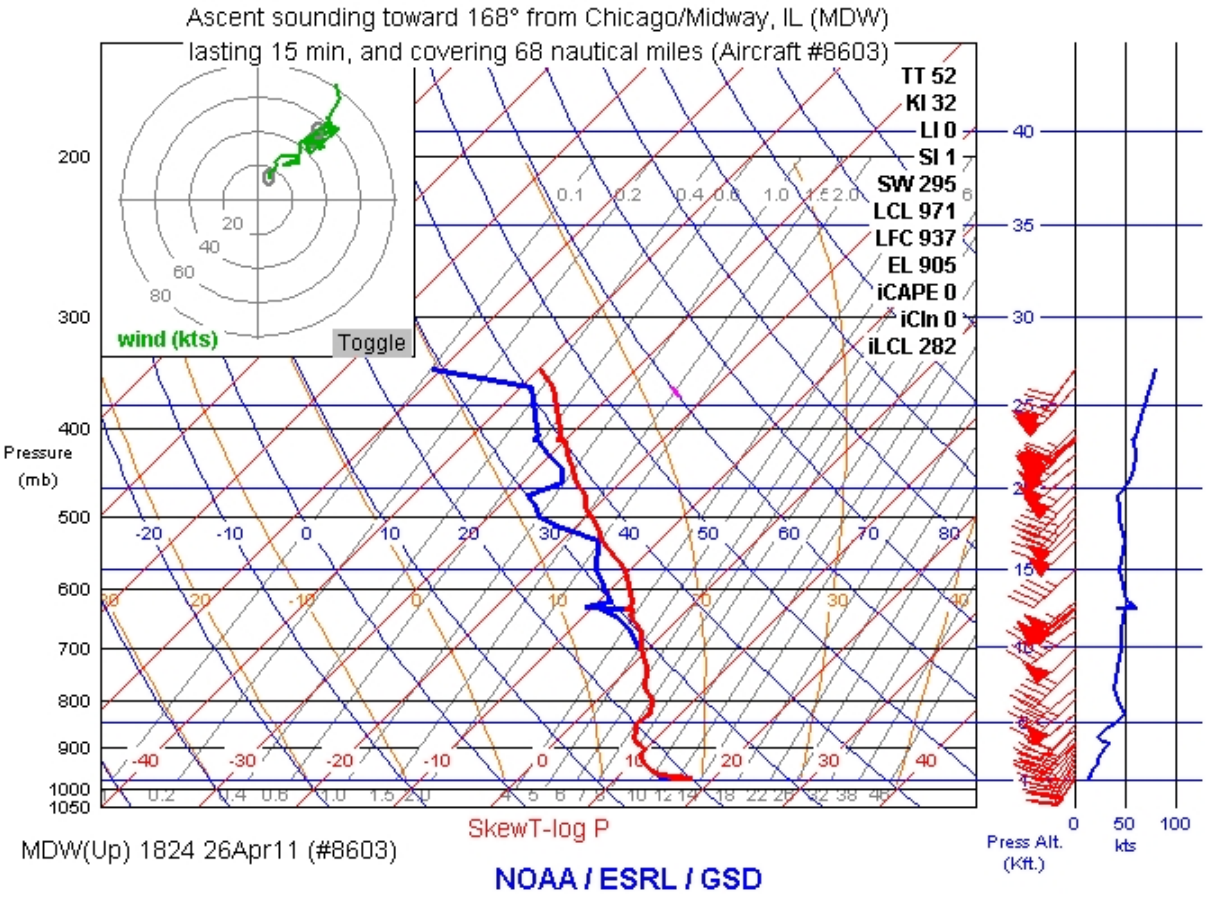


Figure 16 – GOES-13 infrared image at 1332 MDT

6.0 AMDAR Data

An aircraft that provided AMDAR data identified as aircraft #8603[18] departed KMDW (figure 17) at 1324 CDT (1824Z) approximately nine minutes prior to the incident time and retrieved meteorological data on its departure (table 2):

[18] Aircraft #8603 – The aircraft number was determined by the AMDAR data display from the Earth System Research Laboratory's Global Systems Division (ESRL/GSD).



P_alt[19] (ft)	hPa	t/td[20] (°C)	w_dir/w_spd[21] (kts)	Time (UTC)	Lat/Lon[22] (°)
1100	**974**	**15.8/15.3**	**213°/014**	**1824**	**41.791/-87.747**
1100	**974**	**17.8/14.6**	**210°/015**	**1824**	**41.801/-87.747**
1360	**964**	**14.1/14.1**	**207°/017**	**1824**	**41.791/-87.757**
2120	938	11.5/11.5	211°/024	1824	41.781/-87.767
2890	912	10.0/10.0	211°/028	1825	41.771/-87.767
3370	904	9.3/9.3	221°/033	1825	41.761/-87.767

Table 2 – AMDAR meteorological data on a flight departing KMDW nine minutes prior to the incident time

[19] P_alt – Pressure altitude is the indicated altitude when an altimeter is set to an agreed baseline pressure setting. The baseline pressure setting is 1013.25 hPa or 29.92 inches of mercury

[20] t/td – Air temperature and dew point temperature in degrees Celsius.

[21] w_dir/w_spd – Wind direction (reference to true north) and wind speed in knots.

[22] Lat/Lon – Latitude and longitude.

At 1324 CDT and with a pressure altitude of 1,100 feet, the pressure was 974 hPa, the air temperature was 15.8° C, the dew point temperature was 15.3° C, the wind was from 213° at 14 knots, the latitude was 41.791° N, and the longitude was 87.747° W.

At 1324 CDT and with a pressure altitude of 1,100 feet, the pressure was 974 hPa, the air temperature was 17.8° C, the dew point temperature was 14.6° C, the wind was from 210° at 15 knots, the latitude was 41.801° N, and the longitude was 87.747° W.

At 1324 CDT and with a pressure altitude of 1,360 feet, the pressure was 964 hPa, the air temperature was 14.1° C, the dew point temperature was 14.1° C, the wind was from 207° at 17 knots, the latitude was 41.791° N, and the longitude was 87.757° W.

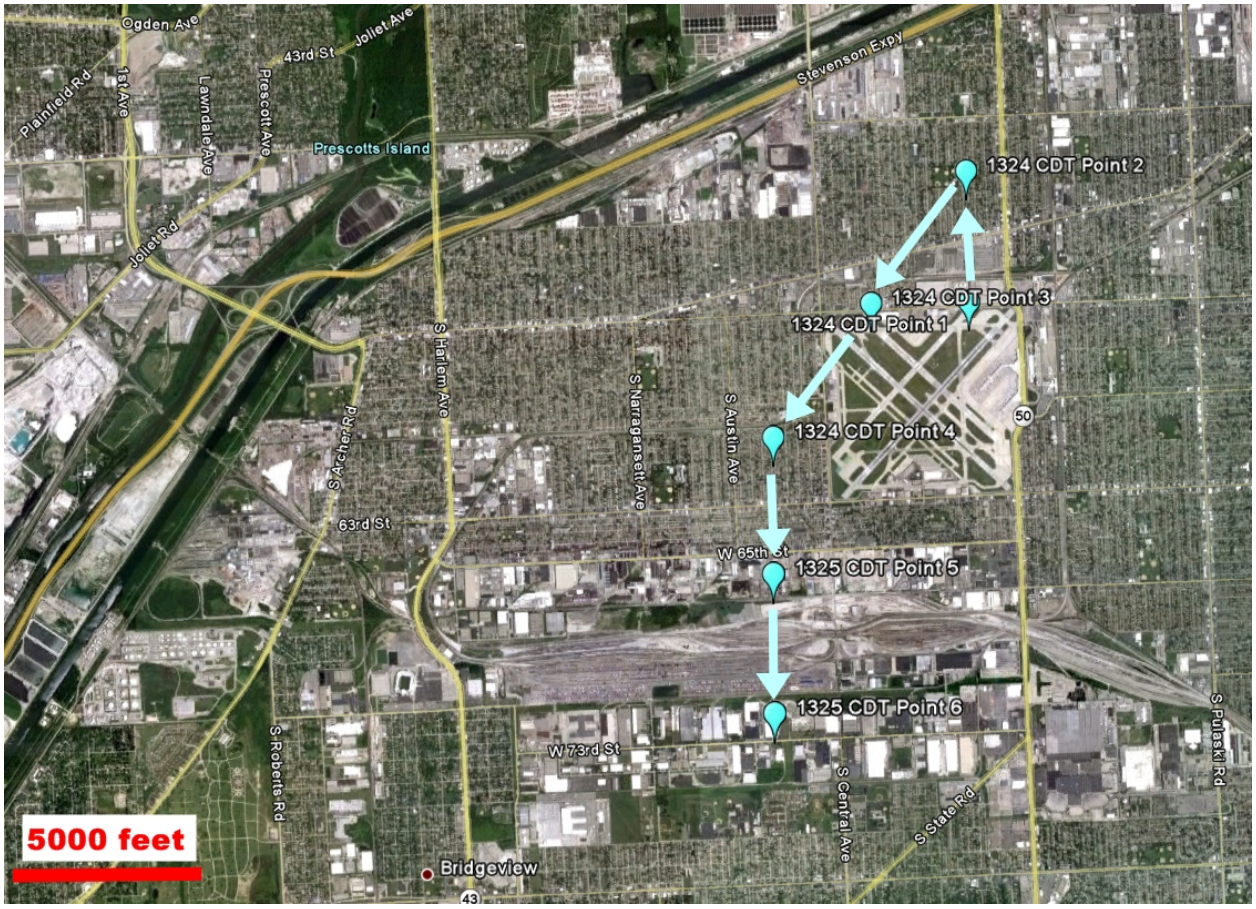


Figure 17 – Google Earth image with flight track of aircraft #8603

7.0 Pilot Reports

Pilot reports (PIREPs) were reviewed from one hour prior to the incident time to one hour after the incident time and these three PIREPs were disseminated:

DEC UA /OV AXC/TM 1750/FL450/TP CL30/SK TOP 410/RM ZKCFD=

SPI UA /OV SPI/TM 1811/FL360/TP B737/TB LGT/RM ZKCFD=

PIA UA /OV PIA360003 /TM 1930 /FL063 /TP E145 /SK
OVC036-TOP063=

Routine pilot report (UA); Over Decatur, Illinois; Time – 1250 CDT (1750Z); Flight level[23] – FL450; Type aircraft – Canadair CT-133 (CL30); Sky – Tops at 41,000 feet.

Routine pilot report (UA); Over Springfield, Illinois; Time – 1311 CDT (1811Z); Flight level – FL360; Type aircraft – Boeing 737 (B737); Turbulence – Light.

Routine pilot report (UA); 3 miles from Peoria, Illinois on the 360° radial; Time – 1430 CDT (1930Z); Altitude – 6,300 feet; Type aircraft – Embraer ERJ 145 (E145); Sky – Overcast 3,600 feet with tops at 6,300 feet.

8.0 SIGMET and CWSU Advisory

A SIGMET valid at the time of the incident advised of a 25 mile-wide line of thunderstorms bounded from 50 miles north-northeast of Decatur, Illinois to 25 miles southwest of Decatur, that was moving from 230° at 35 knots with thunderstorm tops to FL400 (figure 18):

MKCC WST 261755
CONVECTIVE SIGMET 51C
VALID UNTIL 1955Z
IL
FROM 50NNE AXC-20SW AXC
LINE TS 25 NM WIDE MOV FROM 23035KT. TOPS TO FL400.

[23] Flight Level – A Flight Level (FL) is a standard nominal altitude of an aircraft, in hundreds of feet. This altitude is calculated from the International standard pressure datum of 1013.25 hPa (29.92 inHg), the average sea-level pressure, and therefore is not necessarily the same as the aircraft's true altitude either above mean sea level or above ground level.

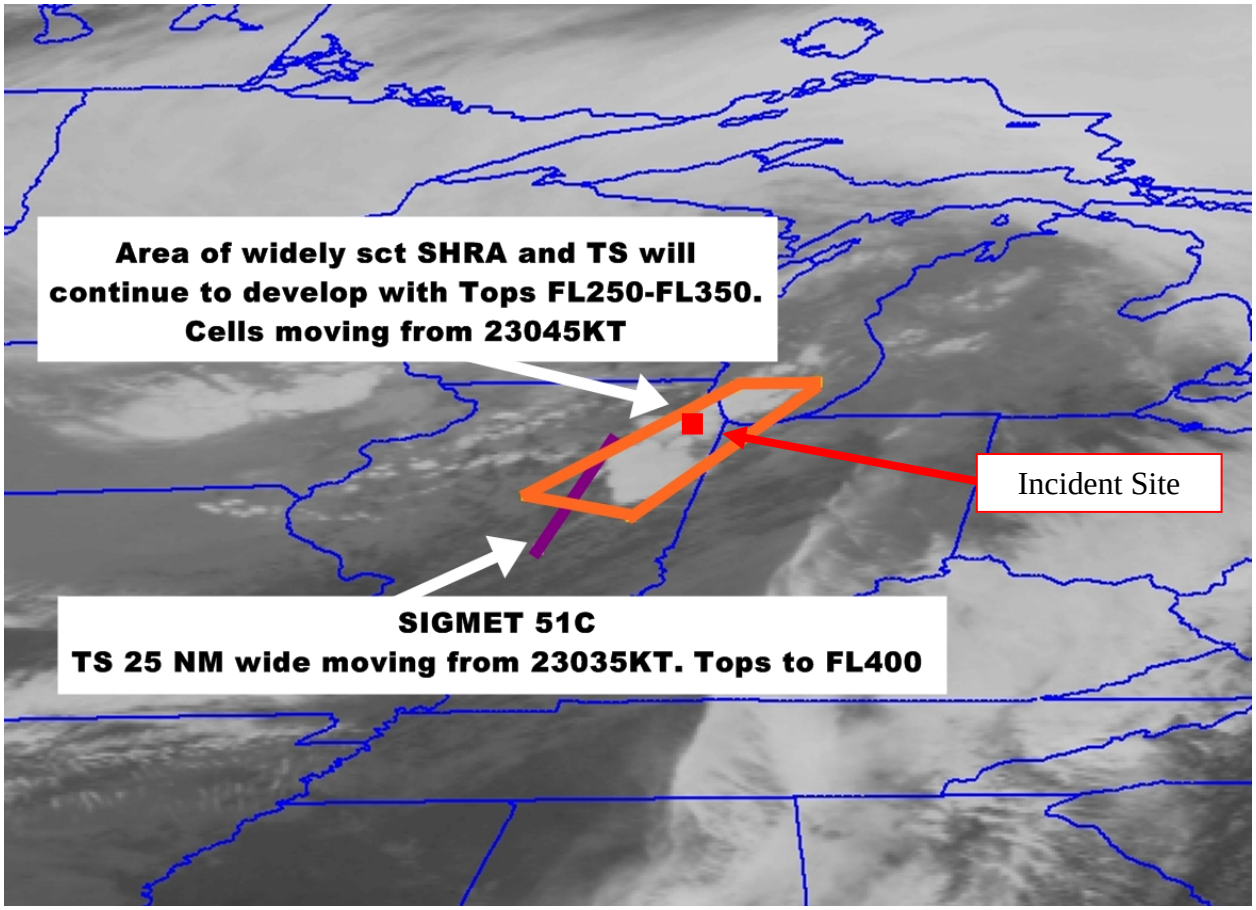


Figure 18 – SIGMET 51C and CWSU advisory valid at the time of the incident

A CWSU advisory issued at 1300 CDT valid through 1400 CDT forecasted that an area of scattered showers and thunderstorms would continue to develop around the incident site with cloud tops to FL250 to FL350. The showers and thunderstorms were forecasted to move from 230° at 45 knots (figure 17):

FAUS21 KZAU 261800
ZAU1 CWA 261800
ZAU CWA 102 VALID UNTIL 261900
FROM 31NE ORD-35W PMM-29NE AXC-27NW AXC-31NE ORD
AREA OF WIDELY SCT SHRA AND TS WILL CONTINUE TO DEVELOP WITH TOPS FL250-FL350. CELLS MOVE FROM 23045KT. ALSO SEE CONVECTIVE SIGMET 51C.
=

9.0 AIRMETs

AIRMETs active for the time of the incident for 5,000 feet and below were reviewed and the two AIRMETs active for the incident site at the incident time advised of IFR[24] conditions with precipitation and mist, and moderate turbulence below 10,000 feet (figure 19).

WAUS43 KKCI 261816 AAA
WA3S
_CHIS WA 261816 AMD
AIRMET SIERRA UPDT 3 FOR IFR AND MTN OBSCN VALID UNTIL 262100
.
AIRMET IFR...MN IA MO WI LM MI LH IL IN...UPDT
FROM 20ENE SSM TO YVV TO 30SE ECK TO 20SSE DXO TO 60ESE DBQ TO TTH TO STL TO RZC TO FSD TO RWF TO 50NNW RHI TO 20ENE SSM
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 21Z THRU 03Z.
.
AIRMET MTN OBSCN...KY
FROM HNN TO HMV TO 40WSW LOZ TO HNN
MTNS OBSC BY CLDS/PCPN/BR. CONDS DVLPG 15-18Z. CONDS CONTG BYD 21Z ENDG 21-00Z.
.
OTLK VALID 2100-0300Z...IFR MN IA WI LM LS MI LH IL...UPDT
BOUNDED BY 20NE INL-60SE YQT-SSM-YVV-30SE ECK-20ENE DXO-20ESE DBQ-20S DSM-20NW FOD-FSD-40NE RWF-20WSW BRD-20NE INL
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG THRU 03Z.
....
WAUS43 KKCI 261445
WA3T
_CHIT WA 261445
AIRMET TANGO UPDT 3 FOR TURB VALID UNTIL 262100
.
AIRMET TURB...MN IA MO WI LM LS MI LH IL IN KY AR TN
FROM INL TO YQT TO SSM TO YVV TO 30SE ECK TO 20ESE DXO TO FWA TO CVG TO BWG TO LIT TO INL
MOD TURB BTN FL280 AND FL400. CONDS CONTG BYD 21Z THRU 03Z.
.
AIRMET TURB...ND SD MN IA MO WI LM LS MI LH IL IN KY AR TN
FROM 50SSE YWG TO 30N INL TO YQT TO SSM TO YVV TO 30SE ECK TO DXO TO FWA TO CVG TO HNN TO HMV TO GQO TO MEM TO IOW TO 20S ABR TO 50SSE YWG
MOD TURB BLW 100. CONDS CONTG BYD 21Z THRU 03Z.
....

[24] Instrument Flight Rules (IFR) – Refers to the general weather conditions pilots can expect at the surface and IFR criteria means a ceiling less than 1,000 feet agl and/or visibility less than 3 miles.

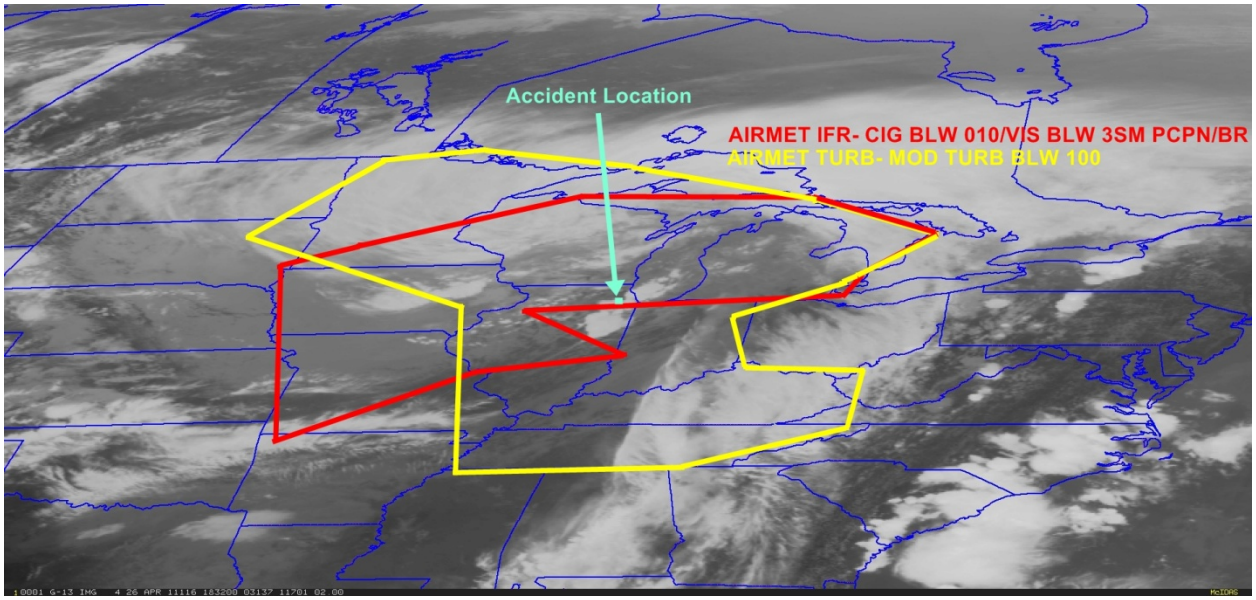


Figure 19 – AIRMET SIERRA and TANGO valid at the time of the incident

10.0 Terminal Aerodrome Forecast

The NWS Terminal Aerodrome Forecast (TAF) for the incident location was issued at 1240 CDT and was valid for a 24-hour period beginning at 1300 CDT. The TAF forecast for KMDW was as follows:

KMDW 261740Z 2618/2718 21017G28KT 6SM -SHRA SCT015 BKN025 OVC035
TEMPO 2618/2622 3SM SHRA SCT015 OVC025CB
FM270000 23014G22KT P6SM BKN025
FM270400 22004KT 6SM BR SCT015 OVC025
FM271000 03005KT 4SM BR SCT008 OVC015
FM271300 35006KT 5SM -SHRA BR BKN007 OVC012=

The forecast expected wind from 210° at 17 knots with gusts to 28 knots, 6 miles visibility with light rain showers, scattered clouds at 1,500 feet agl, a broken ceiling at 2,500 feet agl, overcast skies at 3,500 feet agl. Temporary conditions of 3 miles visibility and moderate rain showers, scattered clouds at 1,500 feet agl, and an overcast ceiling of cumulonimbus clouds at 2,500 feet agl were expected between 1300 CDT and 1700 CDT.

11.0 Area Forecast

The Area Forecast issued at 0445 CDT forecasted MVFR[25] conditions with scattered light rain showers and isolated thunderstorms for northern Illinois (which includes KMDW). Cumulonimbus cloud tops were forecast to reach FL380.

FAUS43 KKCI 260945

[25] Marginal Visual Flight Rules (MVFR) – Refers to the general weather conditions pilots can expect at the surface and MVFR criteria means a ceiling between 1,000 and 3,000 feet and/or 3 to 5 miles visibility inclusive.

FA3W
_CHIC FA 260945
SYNOPSIS AND VFR CLDS/WX
SYNOPSIS VALID UNTIL 270400
CLDS/WX VALID UNTIL 262200...OTLK VALID 262200-270400
ND SD NE KS MN IA MO WI LM LS MI LH IL IN KY
.
SEE AIRMET SIERRA FOR IFR CONDS AND MTN OBSCN.
TS IMPLY SEV OR GTR TURB SEV ICE LLWS AND IFR CONDS.
NON MSL HGTS DENOTED BY AGL OR CIG.
.
SYNOPSIS...NONE
.
ND
WRN...SCT CI. 21Z BKN080 TOP 160. ISOL -SHRA. OTLK...VFR SHRA.
ERN...BKN100 TOP FL140. 19Z ISOL SHRA. OTLK...VFR SHRA.
.
SD
NW...SCT CI. 21Z BKN080 TOP 140. OTLK...VFR.
SW...SCT CI. 15Z BKN100 TOP FL180. 18Z BKN070. SCT SHRA/TSRA. CB
TOP FL380. OTLK...VFR SHRA TSRA.
CNTRL...BKN080 TOP 120. 15Z OVC050. OTLK...VFR 03Z MVFR CIG.
NERN...OVC080 TOP FL180. 21Z OVC030. VIS 3-5SM -RA BR.
OTLK...MVFR CIG RA BR.
SE...OVC050 TOP 140. OCNL -RA. 18Z OVC030. OCNL -RA. OTLK...MVFR
CIG RA BR.
.
NE
PNHDL...SCT CI. 16Z BKN100 TOP FL180. 21Z OVC080. SCT -SHRA/WDLY
SCT TSRA. CB TOP FL400. OTLK...VFR SHRA TSRA.
NCNTRL...BKN050 TOP 080. OTLK...VFR.
SCNTRL...BKN050 TOP 080. 21Z WDLY SCT -SHRA/TSRA. CB TOP
FL400. OTLK...VFR SHRA TSRA.
NERN...OVC030 TOP 120. 21Z BKN050 TOP 080. OTLK...VFR.
SE...OVC025 TOP 120. VIS 3-5SM BR. 18Z BKN050 TOP 080.
OTLK...VFR.
.
KS
W...SCT050 SCT CI. BECMG 1618 OVC050 TOP FL180. SCT -SHRA/TSRA.
OTLK...VFR SHRA TSRA.
CNTRL...BKN040 TOP 060. 15Z SCT030. 21Z OVC100 TOP FL240.
OTLK...VFR SHRA TSRA.
E...OVC025 TOP 040. VIS 3-5SM BR. 18Z BKN030 TOP 080. OTLK...VFR.
.
MN
N HLF...SCT100 BKN CI. 14Z BKN100 TOP FL240. OTLK...VFR.

SW...OVC050 TOP FL180. VIS 3-5SM -RA BR. 15Z OVC030. VIS 3-5SM -RA BR. OTLK...OTLK...MVFR CIG RA BR.
SE...OVC030 TOP FL240. VIS 3-5SM -RA BR. 21Z OVC020. VIS 3-5SM -RA BR. OTLK...IFR CIG RA BR.
.
IA
W...OVC025 TOP FL240. VIS 3-5SM -RA BR. 21Z OVC035 TOP 080. OTLK...MVFR CIG.
CNTRL...OVC020 TOP FL240. VIS 3-5SM -RA BR. 21Z OVC030 TOP 100. OCNL -RA NRN PTN. OTLK...MVFR CIG.
E...OVC020 TOP FL240. VIS 3-5SM -RA BR. 21Z OVC030 TOP 120. VIS 3-5SM -RA BR. OTLK...MVFR CIG.
.
MO
NW...OVC020 TOP 120. 16Z OVC025. 21Z SCT050. OTLK...VFR.
NERN...OVC020 TOP 100. OCNL -RA. 18Z OVC030. 21Z SCT050. OTLK...VFR.
SW...OVC020 TOP 070. 18Z BKN030. 21Z SCT050. OTLK...VFR.
SE...OVC040 TOP 100. 18Z SCT050. OTLK...VFR 00Z SHRA TSRA.
.
WI
NRN...OVC120 TOP FL240. 12Z VIS 3-5SM -RA BR. WND NE G30KT. 18Z OVC025. VIS 3-5SM -RASN BR. WND NE G30KT. OTLK...IFR CIG RA SN BR.
SRN...OVC020 TOP FL240. VIS 3-5SM -RA BR. OTLK...MVFR CIG.
.
LS UPR MI
BKN CI. 15Z OVC100 TOP FL240. 18Z OVC025 TOP FL240. VIS 3-5SM -RA BR. WND NE G25KT. OTLK...IFR CIG RA BR.
.
LM LWR MI LH
NRN...OVC100 TOP FL240. BECMG 1214 OVC020. VIS 3-5SM -RA BR. 18Z SCT -SHRA/TSRA. CB TOP FL400. OTLK...IFR CIG SHRA TSRA.
SRN...OVC020 TOP FL240. VIS 3-5SM -RA BR. 12Z SCT -SHRA/TSRA. CB TOP FL380. WND SE G25KT. 21Z BKN040. SCT -SHRA/TSRA. TS POSS SEV. WND SW G30KT. OTLK...VFR SHRA TSRA.
.
IL
N...OVC020 TOP FL240. VIS 3-5SM BR. SCT -SHRA. 15Z SCT -SHRA/ISOL TSRA. CB TOP FL380. 21Z BKN-OVC030 TOP 100. SCT -SHRA/WDLY SCT TSRA. OTLK...MVFR CIG 00Z VFR.
CNTRL...OVC020 TOP 140. WDLY SCT -SHRA/ISOL TSRA. CB TOP FL380. 15Z WND SW G30KT. 21Z SCT050. OTLK...VFR.
S...OVC025 TOP 100. SCT -SHRA/TSRA. CB TOP FL400. 16Z SCT050. OTLK...VFR 03Z SHRA TSRA.
.

IN
N...OVC020 TOP FL240. SCT -SHRA/TSRA. CB TOP FL400. 21Z BKN040
TOP 100. WDLY SCT SHRA/ISOL TSRA. OTLK...VFR SHRA TSRA.
S...BKN-OVC050 TOP FL180. SCT -SHRA/TSRA. CB TOP FL400. 18Z
BKN050 TOP 080. WDLY SCT SHRA/TSRA. OTLK...VFR SHRA TSRA.
.
KY
W...BKN-OVC050 TOP 160. SCT -SHRA/TSRA. CB TOP FL400. TS POSS
SEV. 18Z BKN050 TOP 080. WDLY SCT SHRA/TSRA. OTLK...VFR SHRA
TSRA.
CNTRL...BKN050 TOP 080. BECMG 1214 OVC040 TOP FL180. SCT -
SHRA/TSRA. CB TOP FL400. OTLK...VFR SHRA TSRA.
E...SCT050 BKN CI. BECMG 1618 BKN050 TOP 120. SCT -SHRA/TSRA. CB
TOP FL400. OTLK...VFR SHRA TSRA.
....

12.0 National Weather Service Area Forecast Discussion

The National Weather Service Office in Chicago/Romeoville, Illinois, issued the following Area Forecast Discussion at 1237 CDT which discussed the gusty surface winds, prevailing MVFR conditions, and chances for thunderstorm activity near Chicago in the afternoon:

FXUS63 KLOT 261737
AFDLOT
AREA FORECAST DISCUSSION
NATIONAL WEATHER SERVICE CHICAGO/ROMEOVILLE IL
1237 PM CDT TUE APR 26 2011
.DISCUSSION...
335 AM CDT
GOOD MORNING. WEATHER THROUGH ABOUT THE NEXT 72 HRS WILL BE CHARACTERIZED AS RATHER DISMAL WITH FREQUENT SHOWERS AS CLOSED LOW OVER THE MID MO VALLEY THIS MORNING DEEPENS A BIT AS IT DRIFTS NEWD...THEN WOBBLES AROUND THE UPPER MS VALLEY THROUGH MD WEEK BEFORE EJECTING EAST ACROSS THE GREAT LAKES REGION.
SATELLITE IMAGERY SHOWS THE FIRST OF SERIES OF SHORT WAVES NOW ROTATING NNEWD THROUGH THE MID MS VALLEY. THIS FEATURE WILL MAINTAIN A STEADIER RAIN/RAIN SHOWER AREA TO START THE FORECAST PERIOD. JET MAX ASSD WITH THIS WAVE HAS PUNCHED NNEWD FROM THE SRN PLAINS TO SRN IL...AND HAS PUSHED THE PLUME OF HEAVIER SHOWERS/T-STORMS GENERALLY E OF IL. RADAR LOOPS ALSO SHOW THE MORE CONVECTIVE AREA OF THIS PRECIPITATION SHIELD...FOR THE MOST PART...ALREADY EAST OF THE FORECAST AREA...FROM WEST CENTRAL THROUGH NORTH CENTRAL INDIANA. THIS WOULD BE THE ZONE OF HEAVIER RAINFALL THROUGH MID DAY...SO PRIMARY HYDROLOGIC CONCERNS LIE ACROSS THE KANKAKEE BASIN THIS MORNING. SURFACE LOW CENTER IS NOW OVER SERN IA...JUST SOUTH OF OTM BASED ON RADAR/SATELLITE FIX. THIS

LOW WILL BE TRACKING WEST OF THE REGION TODAY ALLOWING WINDS TO VEER TO S AND SW LATER TODAY. AS REGION GETS DRY SLOTTED AND ENTERS THIS MILDER POST OCCLUSION AIR...LOW LEVEL LAPSE RATES BECOME RATHER STEEP. THEREFORE...EXPECT MORE SHOWERS/THUNDER TO DEVELOP BY EARLY AFTERNOON. DID HAVE SOME CONCERN EARLIER THAT SOME OF THESE SHALLOW TOPPED STORMS COULD BEGIN TO ROTATE GIVEN SOMEWHAT OF A TYPE D PATTERN...BUT THIS THREAT IS EXPECTED TO BE JUST OFF TO THE E AND SE OF THE REGION BY 18Z...WITH FLOW OVER NRN IL/MOST OF NWRN INDIANA BECOMING MORE SUPPORTIVE OF SHORT...LINEAR CONVECTIVE ORGANIZATION. A LULL IN PRECIPITATION IS EXPECTED TO DEVELOP DURING THE COURSE OF THIS EVENING GIVEN LOSS OF DIURNAL HEATING. HOWEVER...MODELS ARE CONSISTENT IN BRINGING ANOTHER SHORT WAVE ACROSS THE SRN PLAINS TUE NIGHT...THEN WRAPPING IT NNEWD ACROSS THE MIDWEST ON WEDNESDAY RESULTING IN THE DEVELOPMENT OF A FRONTAL WAVE...FORECAST TO DEEPEN AS IT REACHES WEST CENTRAL INDIANA BY WED EVENING. THIS WILL SPREAD ANOTHER ROUND OF RAIN NWD ACROSS MOST OF THE FORECAST AREA LATE TONIGHT AND WEDNESDAY. LOW LEVEL CONVERGENCE ALONG AND AHEAD OF THE PATH OF THIS WAVE SHOULD SUPPORT SOME EMBEDDED THUNDER...MAINLY FROM E CENTRAL IL-NRN INDIANA. COLDER AIR WILL WRAP IN BEHIND THE WEDNESDAY SYSTEM...AND WITH COLD POOL ALOFT SETTLING ACROSS THE FORECAST AREA ON THURSDAY...EXPECT SHOWER THREAT TO CONTINUE ON THURSDAY ACCOMPANIED BY SOMEWHAT BLUSTERY AND RAW CONDITIONS.

UPPER LOW IS FINALLY PROGGED TO EJECT EAST ACROSS THE EASTERN GREAT LAKES BY FRIDAY ALLOWING FOR A SURFACE RIDGE TO SHIFT EAST ACROSS THE REGION. RETURN OF SUNSHINE...LIGHT WINDS...AND TEMPERATURES REBOUNDING TO WITHIN ABOUT 5 DEGREES OF NORMAL FOR LATE APRIL SHOULD MAKE FRIDAY THE MOST PLEASANT DAY THIS WEEK. MORE SHOWERS EXPECTED ON SATURDAY...BUT WITH THIS SYSTEM FORECAST TO MOVE WELL TO THE NORTH OF THE REGION...AT LEAST THE TEMPERATURES WILL BE WARMER AND PRECIPITATION SHOULD BE LIMITED TO A MUCH NARROWER WINDOW.

MERZLOCK

&&

.AVIATION...

//ORD AND MDW CONCERNS...UPDATED 18Z...

***MVFR CEILINGS**

***GUSTY SSW WINDS**

***POTENTIAL FOR SHRA/TSRA**

TRS

//DISCUSSION...UPDATED 18Z...

WARM FRONT HAD LIFTED NORTH INTO FA SOUTHERN WI BY MID MORNING TAKING WIDESPREAD RAIN WITH IT. WITH MOIST LOW LEVELS /SURFACE DEW POINTS IN MID AND UPPER 50S/ ANY HOLES THAT OPENED IN THE

SUBSIDENCE ZONE BEHIND THE SHORT WAVE TROUGH THAT ROTATED NORTH INTO SOUTHERN WI EARLIER THIS MORNING HAD QUICKLY FILLED DUE TO SURFACE HEATING.
WHILE THIS MOIST BOUNDARY LAYER AND SOME MID LEVEL COOLING FOLLOWING THE SHORT WAVE TROUGH PASSAGE RESULT IN INCREASED LOW LEVEL CAPE VALUES AND SOMEWHAT STEEPER MID LEVEL LAPSE RATES RESPECTIVELY...THE 700HPA ND 500HPA LOW CENTERS ARE PROGGED TO LIFT NORTH-NORTHEAST AND TAKING THE POOL OF COOLEST MID LEVEL TO AIR WITH IT TO OVER SOUTHEAST MN AND WEST CENTRAL WI WITH TIME DURING THE AFTERNOON.
STRONG SURFACE HEATING LIMITED BY EXTENSIVE CLOUDINESS...MID LEVEL COLD POOL MOVING TO OVER THE UPPER MIDWEST...AND BEGINNING OF DRYING OF BOUNDARY LAYER WITH SURFACE DEW POINTS FALLING OFF TO THE LOWER 50S LOCALLY AS SURFACE LOW IN CENTRAL IA MOVES NORTHEAST TO CENTRAL WI THIS AFTERNOON VEERING WINDS TO SOUTHWESTERLY ARE NEGATIVES FOR WIDESPREAD SHRA AND/OR TSRA DEVELOPMENT WHILE LOW LEVEL CAPE VALUES AND UVV PROGGED TO MOVE OVER NORTHERN IL DURING THE AFTERNOON PRECEDING THE NEXT SHORT WAVE TROUGH TO ROTATE NORTHEAST FROM IA AND MO ARE POSITIVES. WITH BEST CONVECTIVE PARAMETERS CENTERED TO THE EAST THROUGH SOUTH OF KORD AND KMDW FROM NORTH CENTRAL IN TO EAST CENTRAL IL BY LATER AFTERNOON FEEL THREAT OF TS DIMINISHED FROM EARLIER THINKING AND THAT ONLY SCATTERED SHRA WILL OCCUR IN CHI AREA. CLOUDINESS SOMEWHAT INHIBITING STRONG MIXING IN THE BOUNDARY LAYER SO WIND GUSTS CURRENTLY BEING LIMITED TO AROUND 25KT THOUGH DO OCCASIONALLY GET UP TO AROUND 30 KT. CONTINUED MIXING THIS AFTERNOON WILL ALLOW 25-30KT GUSTS TO PERSIST REST OF AFTERNOON.

TRS
//ORD AND MDW CONFIDENCE...UPDATED 18Z...
***HIGH CONFIDENCE CIGS REMAIN PREVAILING MVFR THROUGH AFTERNOON.**
***HIGH CONFIDENCE SSW WINDS GUST 25-30KT THIS AFTERNOON.**
***MODERATE CONFIDENCE IN SCATTERED SHOWER COVERAGE LOCALLY WHILE MAIN TS THREAT TO BE RESTRICTED TO EAST THROUGH SOUTH OF CHI AREA.**

TRS
//OUTLOOK FOR ORD/MDW FOR 00Z THURSDAY-12Z TUESDAY...UPDATED 12Z...
WEDNESDAY...MVFR CIGS POSSIBLE. CHC -RA AT NIGHT.
THURSDAY...MVFR CIGS LIKELY.
FRIDAY...VFR.
SATURDAY...CHC TSRA.
SUNDAY...SLIGHT CHC -SHRA OTHERWISE VFR.
SHEA

&&
.MARINE...
315 AM CDT
...MAIN CONCERNS WILL BE THE GALE FORCE WINDS ACROSS
THE NORTHERN PORTIONS OF LAKE MICHIGAN THROUGH LATE THIS
AFTERNOON
AND SMALL CRAFT ADVISORY CONDITIONS FOR THE NEARSHORE WATERS
THROUGH THIS EVENING...
LOW PRESSURE OVER NORTHERN MISSOURI WILL TRACK NORTHEASTWARD TO
CENTRAL WISCONSIN BY THIS AFTERNOON. MEANWHILE...HIGH PRESSURE
WILL BUILD ACROSS ONTARIO TO QUEBEC. THIS HAS GENERATED A
STRENGTHENING PRESSURE GRADIENT OVER LAKE MICHIGAN...WITH
NORTHEASTERLY TO EASTERLY WINDS INCREASING TO GALE FORCE OVER THE
NORTHERN PORTION OF THE LAKE BY EARLY THIS MORNING. FARTHER
SOUTH AND WEST...A SECOND AREA OF LOW PRESSURE IS FORECAST TO
MOVE ACROSS THE OZARKS TUESDAY NIGHT BEFORE MOVING NORTHEAST
ACROSS THE OHIO VALLEY AND THE EASTERN GREAT LAKES ON WEDNESDAY
INTO WEDNESDAY NIGHT.
&&
.LOT WATCHES/WARNINGS/ADVISORIES...
IL...NONE.
IN...NONE.
LM...GALE WARNING...LMZ261-LMZ362-LMZ364-LMZ366-LMZ563-LMZ565 UNTIL 6
PM TUESDAY.
SMALL CRAFT ADVISORY...NEARSHORE WATERS
UNTIL 10 PM TUESDAY.
&&
$$

13.0 Weather Watches

No weather watches were active for Illinois at the time of the incident.

14.0 Storm Prediction Center Products

The Storm Prediction Center issued the following day 1 Convective Outlook at 1127 CDT with thunderstorms forecasted over the incident site with a slight risk for severe weather forecasted east of the incident site (figure 20):

SPC AC 261627

DAY 1 CONVECTIVE OUTLOOK
NWS STORM PREDICTION CENTER NORMAN OK
1127 AM CDT TUE APR 26 2011

VALID 261630Z - 271200Z

...THERE IS A HIGH RISK OF SVR TSTMS LATE THIS AFTERNOON INTO TONIGHT FOR NE TX...FAR SE OK...EXTREME NW LA...THE SRN HALF OF AR...SOUTHWEST TN...AND NORTHWEST MS...

...THERE IS A MDT RISK OF SVR TSTMS SURROUNDING THE HIGH RISK...FROM NE TX/SE OK TO THE CONFLUENCE OF THE MS/OH RIVERS...

...THERE IS A SLGT RISK OF SVR TSTMS FROM SRN OK/EAST TX INTO MUCH OF THE LOWER/MID MS VALLEY...TN AND OH VALLEYS...AND INTO PA/NY...

...AN OUTBREAK OF SEVERE THUNDERSTORMS INCLUDING STRONG TORNADOES AND WIDESPREAD DAMAGING WINDS IS FORECAST TO OCCUR LATER TODAY AND TONIGHT...

MORNING WATER VAPOR LOOPS SHOW A BROAD UPPER TROUGH OVER MUCH OF THE UNITED STATES...WITH TWO SIGNIFICANT SHORTWAVE FEATURES TRACKING ACROSS THE NATION. THE FIRST TROUGH IS CURRENTLY OVER THE MID MS AND OH VALLEY AND WILL EJECT NORTHEASTWARD TODAY INTO THE NORTHEAST STATES. THIS WILL LEAD TO A RELATIVELY LARGE AREA OF POTENTIAL FOR ISOLATED SEVERE THUNDERSTORMS AS FAR NORTHEAST AS PORTIONS OF NY/PA. ANOTHER SHORTWAVE TROUGH IS OVER CO/NM AND WILL QUICKLY TRANSLATE INTO OK/TX BY EVENING. THIS FEATURE IS EXPECTED TO RESULT IN SIGNIFICANT SEVERE WEATHER OVER THE ARKLATEX AND LOWER/MID MS VALLEY.

...OK/TX INTO THE LOWER/MID MS VALLEY...
LOW LEVEL MOISTURE IS RAPIDLY RETURNING NORTHWARD THIS MORNING ACROSS THIS REGION...WITH MID/UPPER 60S DEWPOINTS NOW AS FAR NORTH AS SOUTHERN AR. THE 12Z FWD RAOB SHOWED A PRONOUNCED CAPPING INVERSION...WHICH SHOULD INHIBIT STRONG CONVECTIVE DEVELOPMENT UNTIL MID AFTERNOON. BY THAT TIME...STRONG DAYTIME HEATING AND CONTINUED MOISTENING OF THE BOUNDARY LAYER WILL YIELD MLCAPE VALUES OF 3000-4000 J/KG AND A WEAKENED CAP OVER NORTHEAST TX/NORTHWEST LA/SOUTHWEST AR. ISOLATED DISCRETE SUPERCELL THUNDERSTORMS ARE EXPECTED TO FORM IN THIS REGION...WHICH SHOULD TRACK NORTHEASTWARD ACROSS SOUTHERN AR/NORTHERN LA DURING THE EVENING. LOW LEVEL WINDS WILL BE STRENGTHENING DURING THIS PERIOD AS SURFACE CYCLOGENESIS OCCURS OVER TX...LEADING TO INCREASINGLY FAVORABLE SHEAR PROFILES FOR TORNADIC ACTIVITY.

MOST MODEL SOLUTIONS SUGGEST A SECOND ROUND OF INTENSE SUPERCELLS DEVELOP NEAR THE DRYLINE ACROSS NORTH TX AND SOUTHEAST OK BY EARLY EVENING. THESE STORMS WILL ALSO TRACK EAST-NORTHEASTWARD INTO AR/LA
/ROUGHLY THE SAME AXIS AS THE FIRST WAVE OF STORMS/ AND WILL BE IN A

MUCH MORE FAVORABLE VERTICAL SHEAR PROFILE FOR RISKS OF STRONG/DAMAGING TORNADOES.

TONIGHT...VERY STRONG LOW LEVEL WINDS ARE FORECAST TO DEVELOP OVER EASTERN AR/NORTHWEST MS/WEST TN NORTHWARD INTO IL/IND. THERE IS CONSIDERABLE UNCERTAINTY REGARDING THE EVOLUTION OF STORMS AS THEY PROGRESS INTO THIS ENVIRONMENT. THE STORMS MAY REMAIN DISCRETE ACROSS AR WITH A RISK OF STRONG/VIOLENT TORNADOES...OR THEY MAY GROW UPSCALE INTO A FAST-MOVING BOW ECHO WITH THE RISK OF WIDESPREAD SIGNIFICANT WIND DAMAGE AND ISOLATED TORNADOES. IN EITHER CASE...CONDITIONS ARE CLEARLY FAVORABLE A HIGH-END SEVERE WEATHER EVENT WELL INTO THE NIGHT. FOR THESE REASONS...HAVE EXTENDED THE HIGH RISK FARTHER EAST.

...TN/OH VALLEY INTO THE NORTHEAST STATES...
THE LEAD SHORTWAVE TROUGH EXTENDS FROM IL/IND INTO MS/AL. A BAND OF THUNDERSTORMS ASSOCIATED WITH THIS TROUGH HAS BEEN SLOWLY DIMINISHING THIS MORNING...BUT IS LIKELY TO REJUVENATE BY EARLY AFTERNOON. WIDESPREAD STRONG MID LEVEL WINDS AND MODERATE CAPE WILL LEAD TO A RISK OF HAIL AND LOCALLY DAMAGING WINDS OVER A RELATIVELY BROAD AREA FROM AL/GA NORTHEASTWARD INTO PA/NY.

DETAILS ON SPECIFIC AREAS OF THIS THREAT WILL BE ADDRESSED THROUGH THE DAY IN FORTHCOMING MESOSCALE DISCUSSIONS.

..HART/GRAMS.. 04/26/2011

CLICK TO GET WUUS01 PTSDY1 PRODUCT

NOTE: THE NEXT DAY 1 OUTLOOK IS SCHEDULED BY 2000Z

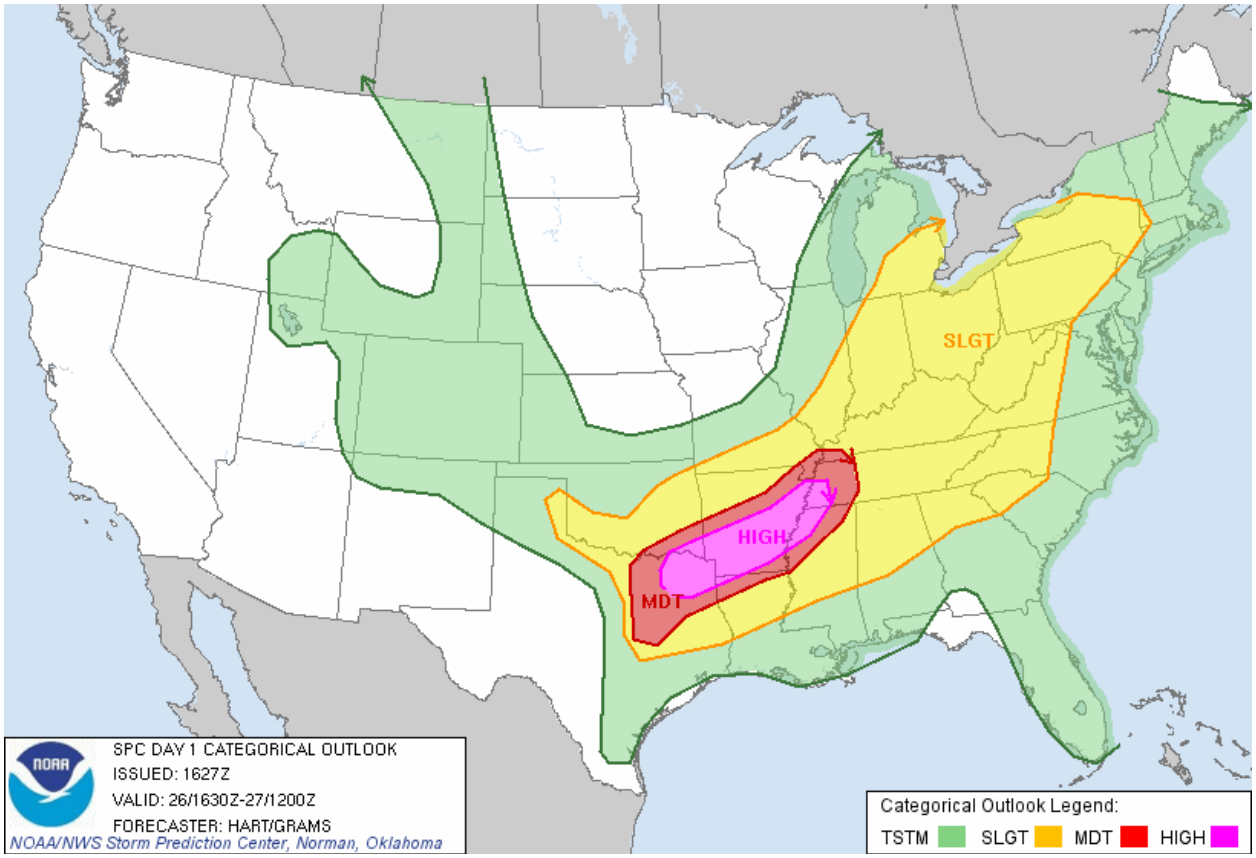


Figure 20 – Storm Prediction Center day 1 Convective Outlook valid at the time of the incident

The Storm Prediction Center also issued Mesoscale Discussion #0587 at 1226 CDT forecasting an increase in the threat of severe weather just east of the incident site (figure 21):

MESOSCALE DISCUSSION 0587
NWS STORM PREDICTION CENTER NORMAN OK
1226 PM CDT TUE APR 26 2011

AREAS AFFECTED...EASTERN IL INTO MUCH OF INDIANA/WESTERN OH AND SOUTHERN LOWER MI

CONCERNING...SEVERE POTENTIAL...WATCH POSSIBLE

VALID 261726Z - 261900Z

THE SEVERE THREAT IS EXPECTED TO GRADUALLY INCREASE THROUGH THE AFTERNOON FROM EASTERN IL INTO MUCH OF INDIANA/SOUTHERN LOWER MI AND EVENTUALLY WESTERN OH. A WATCH MAY BE NEEDED FOR AT LEAST PORTIONS OF THE REGION.

AS THE BRUNT OF A LEAD SHORTWAVE TROUGH CONTINUES TO PIVOT

NORTHEASTWARD TOWARD THE UPPER GREAT LAKES REGION...MIDDAY SURFACE ANALYSIS REFLECTS A SURFACE LOW OVER THE UPPER MS VALLEY...WITH AN ASSOCIATED COLD FRONT EXTENDING SOUTH-SOUTHWESTWARD INTO THE MIDDLE MS VALLEY. ALONG/EAST OF A COLD FRONT AMID A REGION OF LOW LEVEL CONFLUENCE...TSTMS ARE EXPECTED TO CONTINUE TO DEVELOP WITHIN AN INCREASINGLY UNSTABLE/WEAKLY CAPPED BOUNDARY FROM EASTERN IL INTO MUCH OF INDIANA/WESTERN OH AND SOUTHERN LOWER MI...WHERE MODEST CLOUD BREAKS ARE OCCURRING COINCIDENT WITH UPPER 50S F SURFACE DEWPOINTS. AS STORMS MATURE...STRONG LOW-MID TROPOSPHERIC SOUTHWESTERLY FLOW WILL YIELD FAST NORTHEASTWARD-MOVING TSTMS...INCLUDING A FEW SUPERCELLS/ORGANIZED LINE SEGMENTS...CAPABLE OF DAMAGING WINDS/SEVERE HAIL AND PERHAPS A TORNADO. CONVECTIVE TRENDS WILL CONTINUE TO BE MONITORED FOR THE POSSIBILITY OF A WATCH.

..GUYER.. 04/26/2011

ATTN...WFO...CLE...ILN...DTX...IWX...GRR...IND...LOT...ILX...

LAT...LON 39028813 40498840 41428708 42508592 43338535 42958335 41298337 38988492 39028813

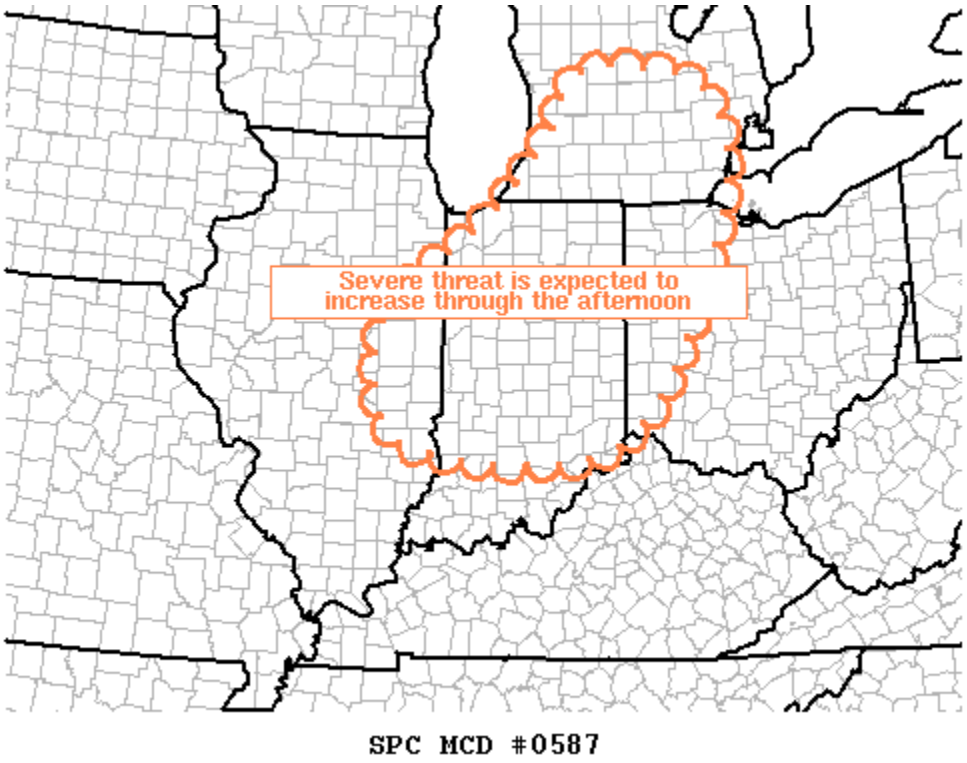


Figure 21 – Areal extent of Mesoscale Discussion #0587

15.0 Southwest Dispatch Weather Briefing

A Southwest weather briefing was provided to the incident pilots by dispatch before departure and this briefing is provided as attachment one to this report. The weather briefing provided the incident pilots with the METARs from KMDW at the time of departure, the TAF forecast valid at the time of departure for KMDW, AIRMETs and SIGMETs valid at the time of departure, a turbulence forecast valid at the time of departure, PIREPs along the planned route of flight, and a wind and temperature aloft forecast.

16.0 Astronomical Data

The astronomical data obtained from the United States Naval Observatory for Chicago, Illinois, on April 26, 2011, indicated the following:

SUN	
Begin civil twilight	0524 CDT
Sunrise	0554 CDT
Sun transit	1249 CDT
Sunset	1944 CDT
End civil twilight	2013 CDT

Paul Suffern
NTSB Meteorologist