

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



CEN24LA100

METEOROLOGY

Specialist's Factual Report

March 4, 2024

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A. ACCIDENT

Location: DeRidder, Louisiana
Date: January 26, 2024
Time: 1755 central standard time
2355 universal coordinated time (UTC)
Airplane: Beechcraft BE58; Registration: N811CW

B. METEOROLOGY SPECIALIST

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C. SUMMARY

On January 26, 2024, about 1755 central standard time, a Beechcraft BE58, N811CW, was substantially damaged when it was involved in an accident near DeRidder, Louisiana. The pilot and passenger were not injured. The airplane was operated as a Title 14 Code of Federal Regulations Part 91 personal flight.

The pilot reported that the airplane was in cruise flight at 11,000 ft above mean sea level (msl), near DeRidder, Louisiana, when he asked for and received a new heading from Air Traffic Control (ATC) to avoid weather ahead. While on the new heading the airplane entered instrument conditions and a short time later experienced a strong updraft, heavy rain, hail, and severe turbulence. During the encounter with weather, the airplane suffered substantial damage from hail to the leading edges of both wings, the vertical, and horizontal stabilizers. The pilot diverted to Chennault International Airport (KCWF), Lake Charles, Louisiana, and landed without further incident.

D. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's Senior Meteorologist was not on scene for this investigation and conducted the meteorology phase of the investigation remotely, collecting data from official National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) sources including the

Weather Prediction Center (WPC) and the National Center for Environmental Information (NCEI). This report documents the general weather products and forecasts over the region during the period and the pertinent meteorological parameters related to the accident. All times are reported as CST based upon the 24-hour clock, local time is -6 hours from UTC, and UTC=Z. NWS airport and weather station identifiers use the standard International Civil Aviation Organization 4-letter station identifiers versus the International Air Transport Association 3-letter identifiers, which deletes the initial country code designator "K" for U.S. airports. 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.

The accident site was based on the location of the hail encounter, which was estimated to be at latitude 30.8461° North and longitude 93.7109° West at an altitude of 11,000 ft.

E. FACTUAL 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) and the WPC 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 can be found in the Federal Aviation Administration (FAA) "Aviation Weather Handbook", FAA-H-8083-28¹.

1.1 Surface Analysis Chart

The southcentral NWS Surface Analysis Chart for 1800 CST with the approximate accident site marked is included as figure 1. The chart depicted a stationary front extending from North Carolina southwest across Georgia, Alabama and Louisiana, to the Texas Gulf coast. A second dissipating frontal system was located in southcentral Texas with a low-pressure system at 1014-hectopascals (hPa)² to the west of the accident site. The accident site was located immediately north of the stationary front, on the cool air side of the front.

¹ <https://www.faa.gov/regulationspolicies/handbooksmanuals/aviation/faa-h-8083-28-aviation-weather-handbook>

² Hectopascal (hPa) is the standard unit for reporting pressure and is interchangeable with the former term millibar (mb) with the same units. In the standard atmosphere, in which aircraft performance is based, standard sea-level pressure is 1013.25-hPa at sea level with a temperature of 59° Fahrenheit (F) or 15° Celsius (C).

The station models surrounding the accident site on the surface analysis chart depicted generally east-northeasterly winds around 5 knots, and overcast cloud cover with temperatures in the low 60's degrees Fahrenheit (°F) and temperature-dew point spreads of 3°F or less. Several stations in Texas along the route of flight reported light to heavy rain, with thunderstorms reported at Lake Charles, Louisiana. South of the stationary front temperatures were depicted in the low 70's °F with temperature-dew point spreads greater than 4°F.

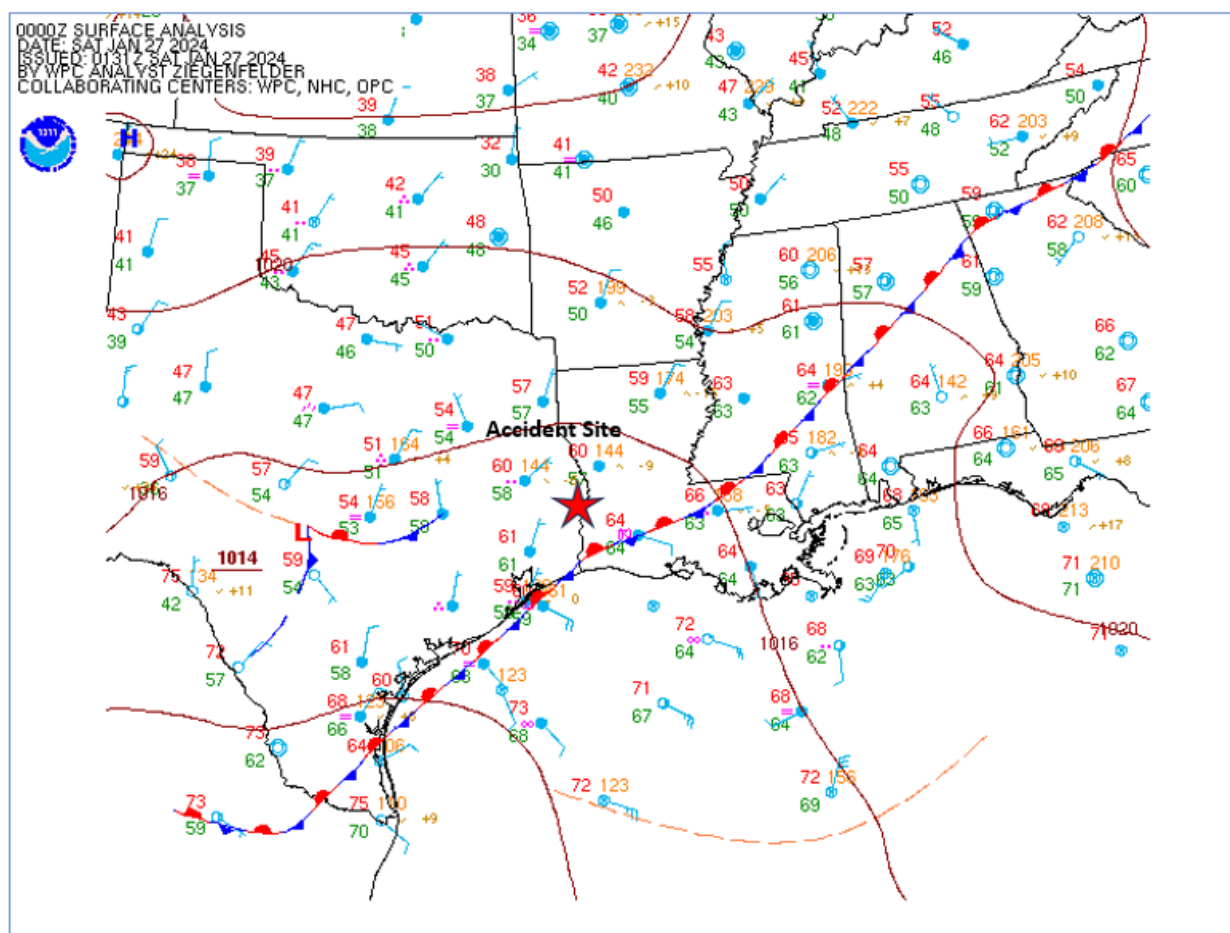


Figure 1 - Southcentral NWS Surface Analysis Chart for 1800 CST with the accident site marked.

1.2 Convective Outlook

The NWS Storm Prediction Center's (SPC) afternoon Convective Outlook³ issued at 1357 CST for the anticipated locations of organized thunderstorms is included as figure 2. The chart depicted locations where general thunderstorms were expected by a green shaded area (TSTM), and more likely areas of severe thunderstorms⁴ as areas

³ The Convective Outlook (AC) Day 1 is issued five times a day at 0100Z, 1200Z, 1300Z, 1630Z, and 2000Z and provides an outlook of where, when, and why organized convection is expected to form.

⁴ A severe thunderstorm is defined as one that produces surface wind gusts of 50 knots or greater, large

of a marginal risk (MRGL), slight risk (SLGT), enhanced risk (ENH), moderate risk (MDT), or high risk (HIGH) of severe weather by various color shadings and markings. The accident site occurred in an area where general thunderstorms were expected, with a marginal risk⁵ of severe thunderstorms over the destination area in Louisiana immediately east of the hail encounter.

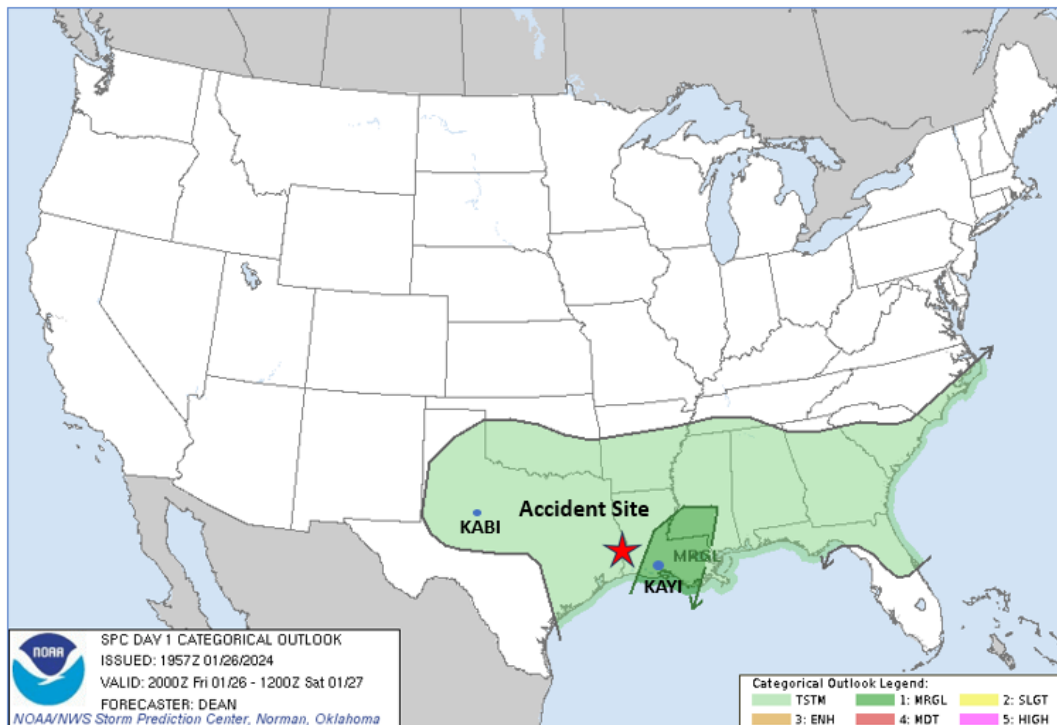


Figure 2 - NWS Storm Prediction Center's Convective Outlook graphic issued at 1357 CST.

The accompanying text to the forecast is included below. The text indicated that the main threat of severe thunderstorms was expected over Louisiana and southern Mississippi during the early morning hours on January 27th, as a line of thunderstorms was expected to develop during the overnight period and move eastward.

SPC AC 261957

Day 1 Convective Outlook
NWS Storm Prediction Center Norman OK
0157 PM CST Fri Jan 26 2024

Valid 262000Z - 271200Z

*...THERE IS A MARGINAL RISK OF SEVERE THUNDERSTORMS PRE-DAWN
SATURDAY MORNING OVER PORTIONS OF LOUISIANA AND SOUTHERN*

hail over 1 inch in diameter, or a tornado.

⁵ A marginal risk - is defined as some severe thunderstorms could be capable of producing damaging winds and severe hail, with a localized threat of a tornado. With regards to coverage in a forecast, a marginal risk would be expressed as an isolated threat of severe storms are possible.

MISSISSIPPI...

...SUMMARY...

Isolated strong to severe thunderstorms are possible early Saturday morning over parts of Louisiana and southern Mississippi.

...20Z Update...

*The Marginal Risk has been expanded slightly northeastward based on the latest short-term guidance, but otherwise no major changes have been made. **A line of storms is expected to develop across parts of LA overnight and spread eastward, with some threat for locally damaging wind and possibly a tornado.** See the previous discussion below for more information.*

..Dean.. 01/26/2024

1.3 Constant Pressure Charts

The NWS SPC constant pressure charts for 700- and 500-hPa for 1800 CST are included as figures 3 and 4 respectively with the approximate hail encounter marked by the red star. The 700-hPa chart (figure 3) depicted the conditions at approximately 10,000 ft near the accident airplane's cruising level and indicated a closed low-pressure system over north central Texas with a short wave trough extending southwestward from the low. The chart also depicted indications of moisture (green contour lines) with the temperature-dew point temperatures less than 12°C, which reflected high moisture contents over southeast Texas and Louisiana and continuing along the southeast gulf coast region. The station models depicted southwesterly wind of 30 knots with a temperature of 4°C. While the chart for 500-hPa (figure 4) depicted the conditions of the mean atmosphere⁶ at about 18,000 ft and depicted the short wave trough extending across Texas with southeasterly winds over the hail encounter of 45 knots and a temperature of -13°C. The accident site was located near the apex ahead of the upper level low and short wave trough to the ridge, this area typically supports upward vertical motion with clouds and precipitation formation if sufficient moisture is present.

⁶ Mean atmosphere is assumed to be 500-hPa based on the surface pressure near 1000-hPa and the tops of the atmosphere at 0-hPa, since pressure decreases logarithmically with height, the 500-hPa level typically is found near 18,000 ft.

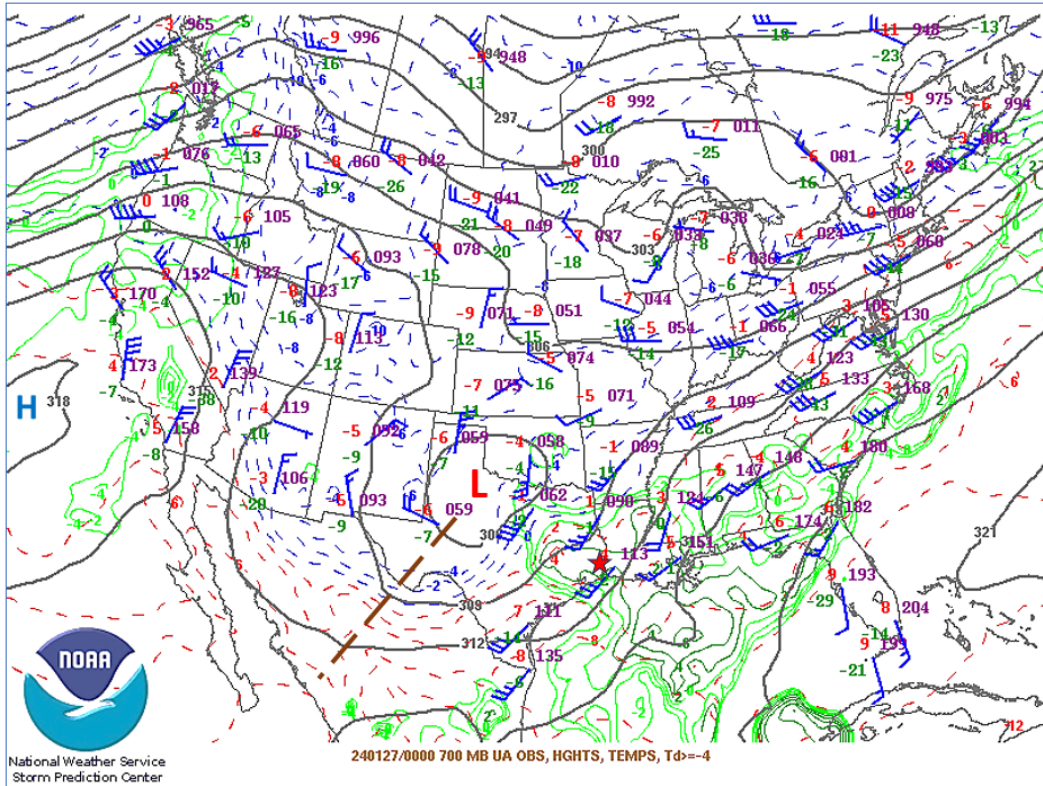


Figure 3 - NWS SPC 700-hPa constant pressure chart for 1800 CST with the accident site.

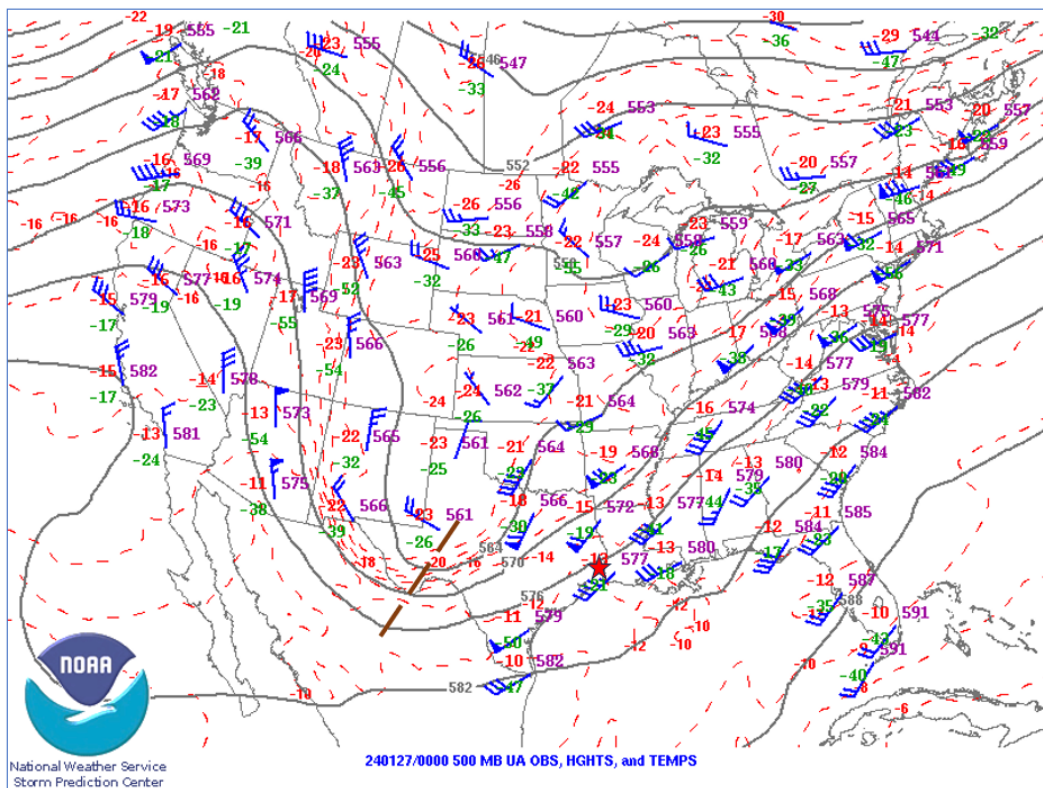


Figure 4 - NWS SPC 500-hPa constant pressure chart for 1800 CST with the accident site.

1.4 Surface Prognostic chart

The NWS 12-hour Surface Prognostic Chart issued during the morning prior to the flight's departure and valid for 1800 CST is included as figure 5. The chart depicted a low-pressure system along a frontal wave⁷ over the southeast Texas gulf coast with a warm front extending east-northeast across Louisiana. A large area of "likely" rain (dark green shading) with a probability between 60% to 70% coverage and thunderstorms were depicted over eastern Texas and Louisiana and extended over the accident site.

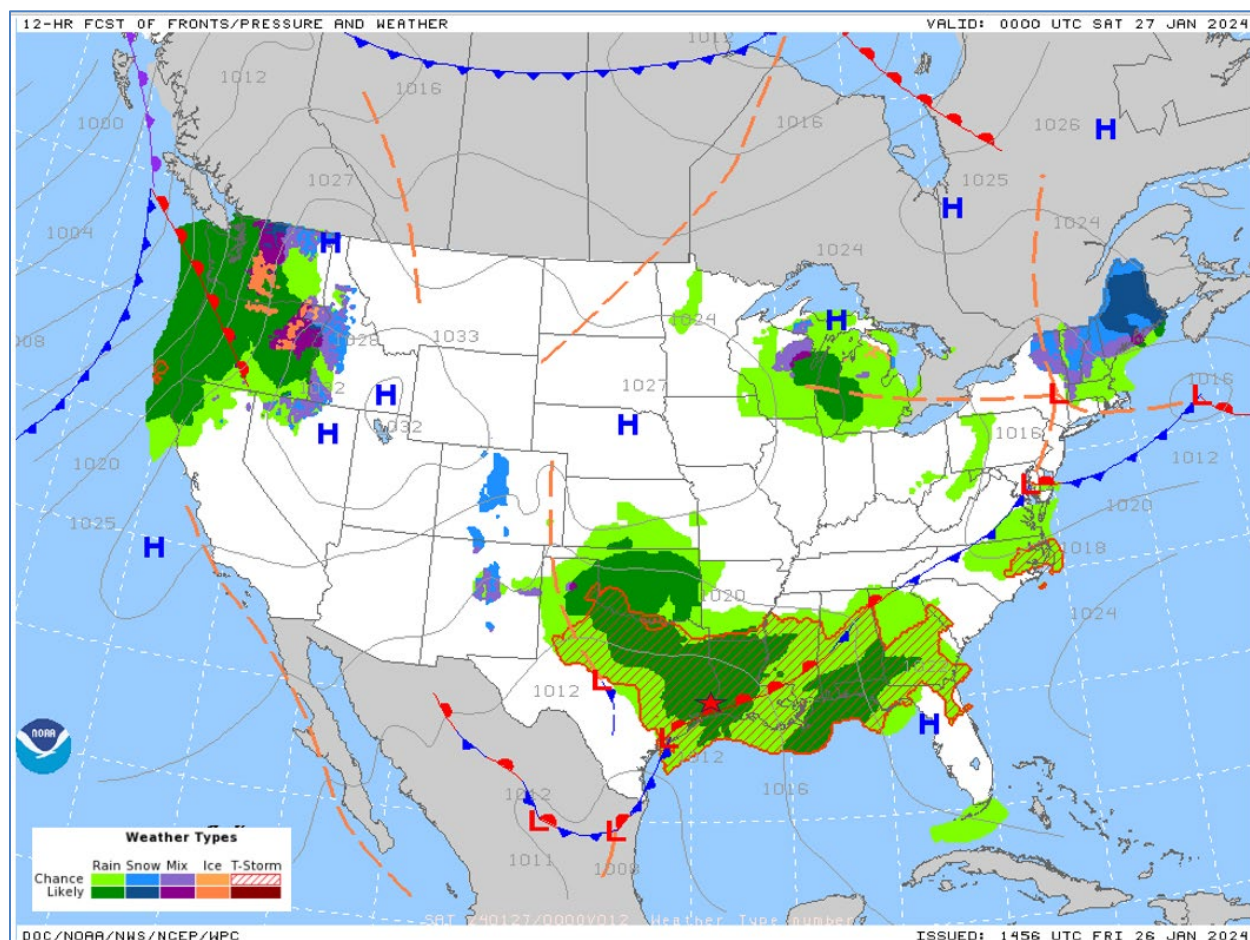


Figure 5 - NWS 12-hour Surface Prognostic Chart valid for 1800 CST with accident site noted.

2.0 Observations

The official observations issued surrounding the accident site were documented using Aviation Routine Weather Reports (METAR⁸) and Aviation Select Special Weather

⁷ Frontal wave - is a wave-like deformation of the line of a front between two air masses. The wave develops from the northward incursion of warm air and usually travels along the front, with colder air ahead and to the rear.

⁸ METAR - is an abbreviation for METeorological Aerodrome Report and is the international standard

Reports (SPECI). Cloud heights are reported above ground level (agl) in the following section, and the magnetic variation was estimated at 1° east based on the latest sectional chart for the area.

2.1 DeRidder, Louisiana

The closest weather observation to where the aircraft encountered the hail was from Beauregard Regional Airport (KDRI), DeRidder, Louisiana, located about 18 miles east of the hail encounter at an elevation of 202 ft. The airport had an Automated Weather Observation System (AWOS) and issued observations every 20-minutes and was not augmented by human observers. At the time of the hail encounter the following conditions were reported.

Weather observation for KDRI at 1755 CST, automated, wind from 070° at 8 knots, visibility 9 miles in light rain, thunderstorms in the vicinity⁹, ceiling¹⁰ broken at 400 ft agl, overcast at 1,100 ft, temperature 17°C, dew point temperature 17°C, altimeter setting 29.95 inches of mercury. Remarks: automated station with a precipitation discriminator, ceiling 400 ft variable 600 ft, hourly precipitation less than 0.01 inches (trace), temperature 16.5°C, dew point 16.5°C, maintenance indicator on (\$).

The general flight categories¹¹ and raw observations disseminated surrounding the period from 1400 through 2200 CST were as follows:

MVFR METAR KDRI 262035Z AUTO VRB06KT 9SM OVC020 19/18 A2999 RMK AO2 CIG 018V023 T01870176 \$=

MVFR METAR KDRI 262055Z AUTO 12007KT 6SM -RA BR OVC018 18/18 A3000 RMK AO2 CIG 016V022 P0000 T01780177 \$=

for reporting weather for aviation.

⁹ Vicinity - is defined as being the area from 5 and 10 statute miles from the station.

¹⁰ Ceiling - is the lowest layer of clouds reported as broken or overcast, or the vertical visibility into a surface based obscuration.

¹¹ As defined by the NWS and the FAA Aeronautical Information Manual (AIM) section 7-1-7 defines the following general flight categories to describe general ceiling and visibility conditions:

- LIFR (Low Instrument Flight Rules*). Ceiling less than 500 feet and/or visibility less than 1 mile.
- IFR (Instrument Flight Rules). Ceiling 500 to less than 1,000 feet and/or visibility 1 to less than 3 miles.
- MVFR (Marginal Visual Flight Rules**). Ceiling 1,000 to 3,000 feet and/or visibility 3 to 5 miles inclusive.
- VFR. (Visual Flight Rules) Ceiling greater than 3,000 feet and visibility greater than 5 miles; includes sky clear.

* By definition, IFR is a ceiling less than 1,000 ft agl and/or visibility less than 3 miles while LIFR is a sub-category of IFR.

**By definition, VFR is a ceiling greater than or equal to 3,000 ft agl and visibility greater than 5 miles while MVFR is a sub-category of VFR.

IFR METAR KDRI 262115Z AUTO 19005KT 1 3/4SM -RA BR FEW006 BKN016 OVC025 17/17 A3001
RMK AO2 P0005 T01690169 \$=

MVFR METAR KDRI 262135Z AUTO 06004KT 4SM -RA BR FEW006 SCT018 OVC039 17/17 A2999 RMK
AO2 LTG DSNT SE AND S FEW V SCT P0018 T01660166 \$=

MVFR METAR KDRI 262155Z AUTO 07006KT 6SM -RA BR BKN014 OVC040 17/17 A2998 RMK AO2
LTG DSNT NW AND SE - SW P0000 T01650165 \$=

MVFR METAR KDRI 262215Z AUTO 06006KT 7SM -RA FEW006 OVC012 17/17 A2998 RMK AO2 LTG
DSNT E - SW CIG 009V015 P0000 T01650165 \$=

IFR METAR KDRI 262235Z AUTO 06006KT 7SM -RA BKN005 OVC011 17/17 A2999 RMK AO2 LTG
DSNT N AND E - SW CIG 004V007 P0001 T01660166 \$=

IFR METAR KDRI 262255Z AUTO 04006KT 5SM -RA BR OVC005 17/17 A2998 RMK AO2 LTG DSNT
E - SW RAB2251 P0000 T01650165 \$=

LIFR METAR KDRI 262315Z AUTO 05008KT 7SM -RA OVC004 16/16 A2996 RMK AO2 LTG DSNT NE
- S AND W RAB2251 CIG 003V007 P0001 T01650165 \$=

LIFR METAR KDRI 262335Z AUTO 06008KT 9SM OVC004 17/17 A2996 RMK AO2 LTG DSNT E AND
S AND SW RAB2251E2317 CIG 003V006 P0001 T01650165 \$=

Hail encounter 2355Z

**LIFR METAR KDRI 262355Z AUTO 07008KT 9SM -RA VCTS BKN004 OVC011 17/17 A2995 RMK
AO2 CIG 004V006 P0000 T01650165 \$=**

IFR METAR KDRI 270015Z AUTO 09007KT 7SM -RA VCTS OVC005 17/17 A2995 RMK AO2 CIG
004V009 P0000 T01650165 \$=

LIFR METAR KDRI 270035Z AUTO 11006KT 7SM -RA VCTS OVC004 17/17 A2996 RMK AO2 LTG
DSNT S AND W - N CIG 004V006 P0001 T01660166 \$=

LIFR METAR KDRI 270055Z AUTO 29008KT 4SM -RA BR VCTS OVC004 17/17 A2998 RMK AO2 CIG
003V005 PRESRR P0001 T01660166 \$=

LIFR METAR KDRI 270115Z AUTO 07004KT 3SM TSRA BR BKN004 OVC014 16/16 A2998 RMK AO2
TSB0105 BKN V SCT P0012 T01640164 \$=

IFR METAR KDRI 270135Z AUTO 04003KT 2 1/2SM +RA BR VCTS BKN007 OVC014 16/16 A2999
RMK AO2 TSB0105E0120 P0023 T01640164 \$=

IFR METAR KDRI 270155Z AUTO 08005KT 5SM RA BR OVC007 16/16 A2997 RMK AO2 P0002
T01640164 \$=

IFR METAR KDRI 270215Z AUTO 09007KT 10SM BKN007 OVC015 17/17 A2994 RMK AO2 LTG
DSNT E - S RAE0215 P0011 T01660166 \$=

IFR METAR KDRI 270235Z AUTO VRB03KT 10SM BKN005 BKN012 OVC017 17/17 A2995 RMK AO2
LTG DSNT E - SW RAE0215 CIG 004V007 P0011 T01680168 \$=

IFR METAR KDRI 270255Z AUTO 08004KT 10SM OVC005 17/17 A2996 RMK AO2 LTG DSNT SE AND S CIG 004V008 T01690169 \$=

IFR METAR KDRI 270315Z AUTO 08007KT 9SM -RA OVC005 17/17 A2994 RMK AO2 LTG DSNT E - W RAB0310 CIG 004V007 P0000 T01690169 \$=

LIFR METAR KDRI 270335Z AUTO 05009KT 8SM -RA VCTS OVC004 17/17 A2994 RMK AO2 RAB0310 TSB0320E0335 CIG 004V006 P0000 T01690169 \$=

LIFR METAR KDRI 270355Z AUTO 08004KT 7SM -RA VCTS BKN004 OVC010 17/17 A2994 RMK AO2 P0000 T01690169 \$=

A review of the observations indicated that MVFR conditions generally prevailed prior to 1600 CST over the area with IFR to LIFR conditions prevailing afterwards and at the time of the accident due to rain, thunderstorms, and low overcast cloud cover.

2.2 NWS Depiction of the Observations

The NWS Aviation Weather Center's (AWC) depiction of the observations¹² over the area for 1800 CST is included as figure 6 with the location of the hail encounter marked by the star and the plot of the pilot report (PIREP) in red subsequently entered by air traffic control from the accident flight. The surface features or fronts are also overlaid. Figure 7 is the same depiction of the surface observations with the regional radar mosaic overlaid. The images depicted generally VFR and MVFR conditions over central Texas with deteriorating conditions to IFR and LIFR conditions over Louisiana and southeast Texas, with numerous stations reporting rain surrounding the hail location. The radar overlay depicted several areas of heavy to extreme intensity echoes embedded within the larger areas of echoes.

¹² <https://aviationweather.gov/gfa/#obs>

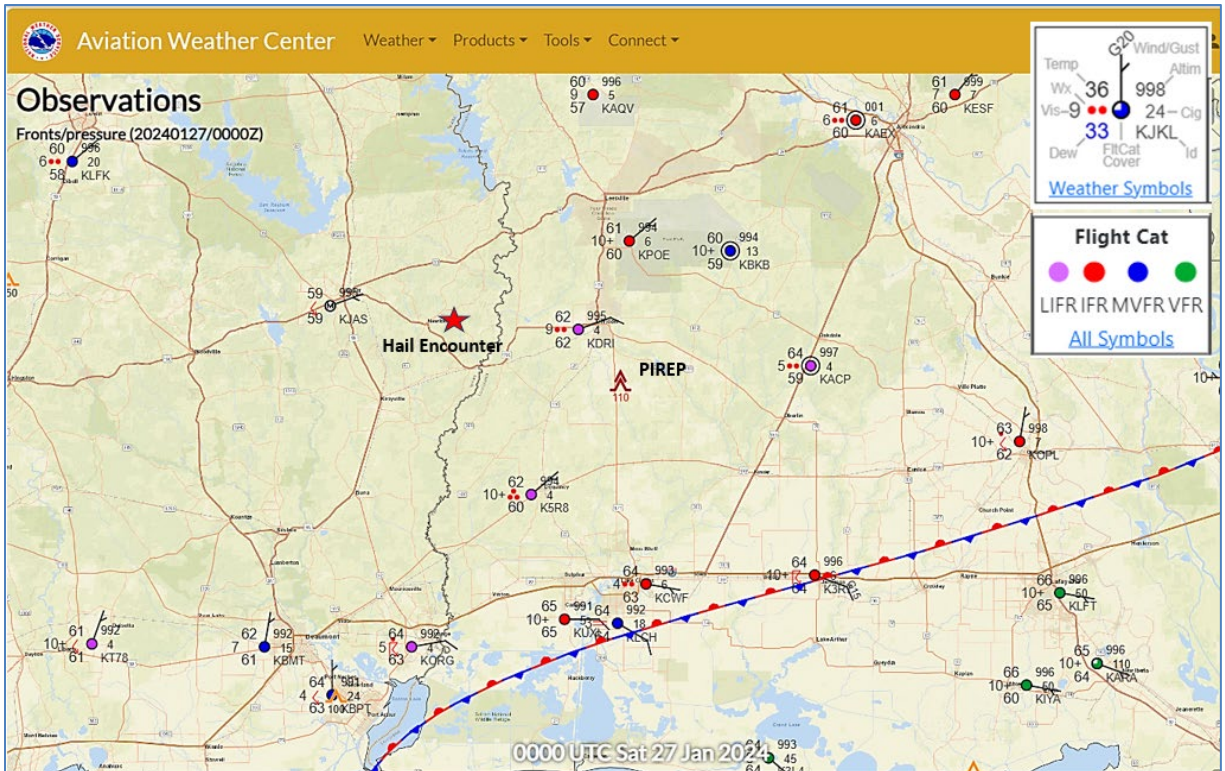


Figure 6 - NWS AWC METAR depiction with fronts overlaid for 1800 CST with the location of the hail encounter and PIREP location plotted.

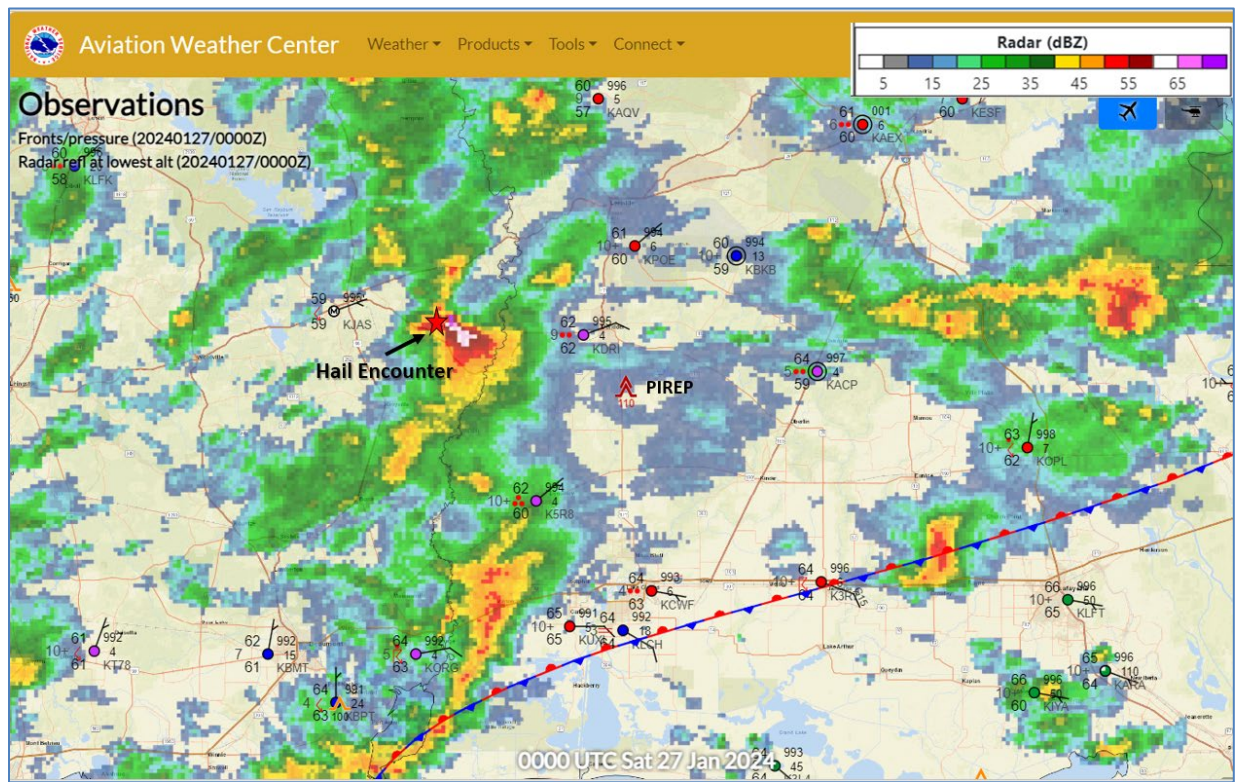


Figure 7 - NWS AWC METAR depiction with fronts and radar mosaic overlaid for 1800 CST with the location of the hail encounter and PIREP location noted.

3.0 Upper Air Sounding

The NWS Lake Charles (KLCH), Louisiana, site #72240, upper air sounding was obtained from the University of Wyoming¹³ archive website. The sounding location was about 47 miles south-southeast of the hail encounter and provided another observation of the conditions surrounding the period. The sounding was then plotted on a standard Skew T log P diagram¹⁴ using the RAOB Analysis software¹⁵. The sounding for 1800 CST¹⁶ is included as figure 8 from the surface to 450-hPa or about 22,000 ft.

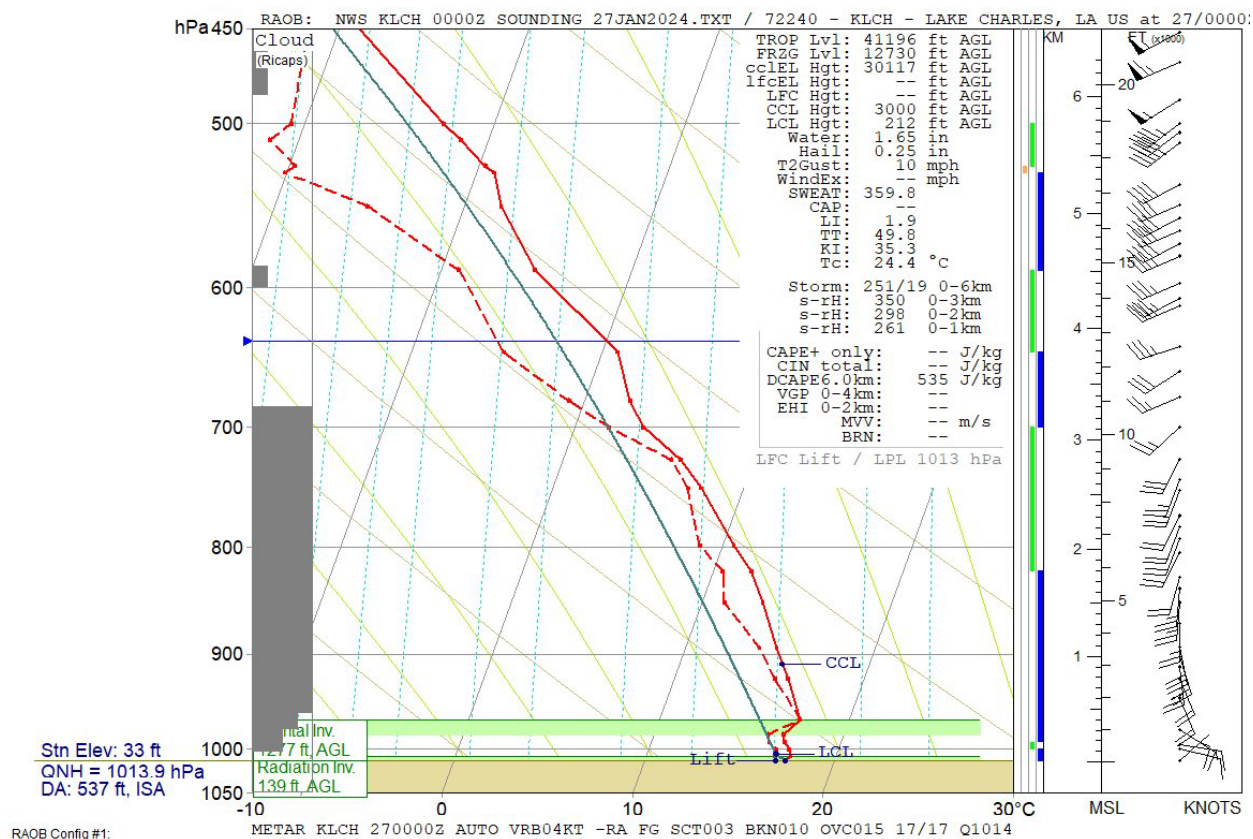


Figure 8 - NWS Lake Charles, LA, sounding for 1800 CST from the surface to about 22,000 ft.

The sounding depicted an elevation of 33 ft at the launch point with a near temperature of 17.4°C (63°F), a dew point temperature of 16.9°C (62°F), with a relative

¹³ <https://weather.uwyo.edu/upperair/sounding.html>

¹⁴ 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.

¹⁵ RAOB -The Universal RAOBsonde Observation program is an interactive sounding analysis program developed by Eosonde Research Services (ERS) previously known as Environmental Research Services, The Villages, Florida.

¹⁶ The actual launch time varies from 30 minutes prior to the launch time to account for the ascent rate of the sounding.

humidity of 97%, and supported rain at the surface. The lifted condensation level (LCL)¹⁷ was identified at 212 ft agl, and the convective condensation level (CCL)¹⁸ was at 3,000 ft, with the equilibrium level (CCL-EL)¹⁹ at 30,120 ft. A frontal inversion was noted between the surface and 1,277 ft (depicted by the green horizontal bar). The Lifted Index (LI)²⁰ was 1.9 with a K-index²¹ of 35.2 and no positive areas of convective available potential energy (CAPE)²² were identified. The most unstable LI²³ was -1.7 with a CAPE of 342 Joules/kilogram, and a maximum vertical velocity (MVV)²⁴ of potential updrafts of 26 meters/second or about 5,140 feet per minute (fpm). The precipitable water content was 1.65 inches. The wet bulb temperature (WBZ) was at 670-hPa or 11,407 ft with the -20°C level at about 22,000 ft. Outside of any thunderstorms the RAOB analysis program supported a broken to overcast layer of nimbostratus type clouds from the LCL or 300 ft agl through 11,000 ft. At the accident airplane's cruising level of 11,000 ft the sounding depicted a temperature of 2°C, with the freezing level identified at 12,730 ft. The tropopause was identified at 41,170 ft.

The KLCH sounding wind profile depicted a surface wind from 045° at 4 kts with winds veering²⁵ to the south above the inversion and continuing to the southwest and then west with height with increasing speeds with height. The mean 0 to 6 kilometer (or 18,000 ft) wind was from 220° at 26 knots. At the aircraft altitude at 11,000 ft the wind was from wind from 240° at 23 knots.

¹⁷ Lifted Condensation Level (LCL) - the level at which a lifted parcel becomes saturated. The LCL height corresponds to cloud base height for forced ascent.

¹⁸ 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.

¹⁹ Equilibrium Level (EL) - is the level above the LFC or CCL at which the temperature of a rising air parcel again equals the temperature of the environment. The height of the EL is the height at which thunderstorm updrafts no longer accelerate upward. Thus, to a close approximation, it represents the height of expected thunderstorm tops.

²⁰ Lifted Index (LI) - A common measure of atmospheric instability. Its value is obtained by computing the temperature that air near the ground would have if it were lifted to 500-hPa or approximately 18,000 feet and comparing that temperature to the actual temperature at that level. Negative values indicate instability - the more negative, the more unstable the air is, and the stronger the updrafts are likely to be with any developing thunderstorms.

²¹ K-Index - The measure of thunderstorm potential based on the vertical temperature lapse rate, the moisture content of the lower atmosphere and the vertical extent of the moist layer. The higher the K-Index value the greater the probability of air mass type thunderstorm development across the region.

²² Convective Available Potential Energy (CAPE) - A measure of the amount of energy available for convection. CAPE is directly related to the maximum potential vertical speed within an updraft thus, higher values indicate greater potential for severe weather.

²³ Most Unstable Lifted Index (MULI) calculated from 858- to 500-hPa to account for elevated thunderstorms or to account for storm support immediately above the surface that is often hidden due to frontal boundaries.

²⁴ MVV - is the Maximum Vertical Velocity of the potential convective updrafts and is a function of positive CAPE. Vertical velocities in the updraft of most unorganized thunderstorms are typically around half of the MVV, since water loading and mixing become significant limiting factors.

²⁵ Veering - is a clockwise shift in wind direction (for example, south winds shifting to the west).

4.0 Satellite Imagery

NOAA Geostationary Operational Environmental Satellite number 16 (GOES-16) infrared and visible imagery were obtained from an archive at the Space Science Engineering Center (SSEC) at the University of Wisconsin-Madison in Madison, Wisconsin, and processed using the Man-computer Interactive Data Access System (McIDAS) software²⁶. The infrared band 13 at a wavelength of 10.3 microns (μm) provided a resolution of 2 kilometers (km) with radiative cloud top temperatures, and the visible band 2 imagery at a wavelength of 0.64 μm provided a resolution of 0.5 km. However, due to the low light at the time of the accident near twilight, the visible imagery were not useful at the time of the accident and thus were not reproduced here. The images have not been corrected for parallax error.

Figure 9 is the NWS AWC satellite depiction with the surface observations, pilot reports, and front for 1800 CST with the hail encounter noted. The image depicted an extensive area of low clouds extending over southeastern Texas and Louisiana, with several defined convective clouds embedded in the low clouds and over the hail encounter near the Texas and Louisiana border.

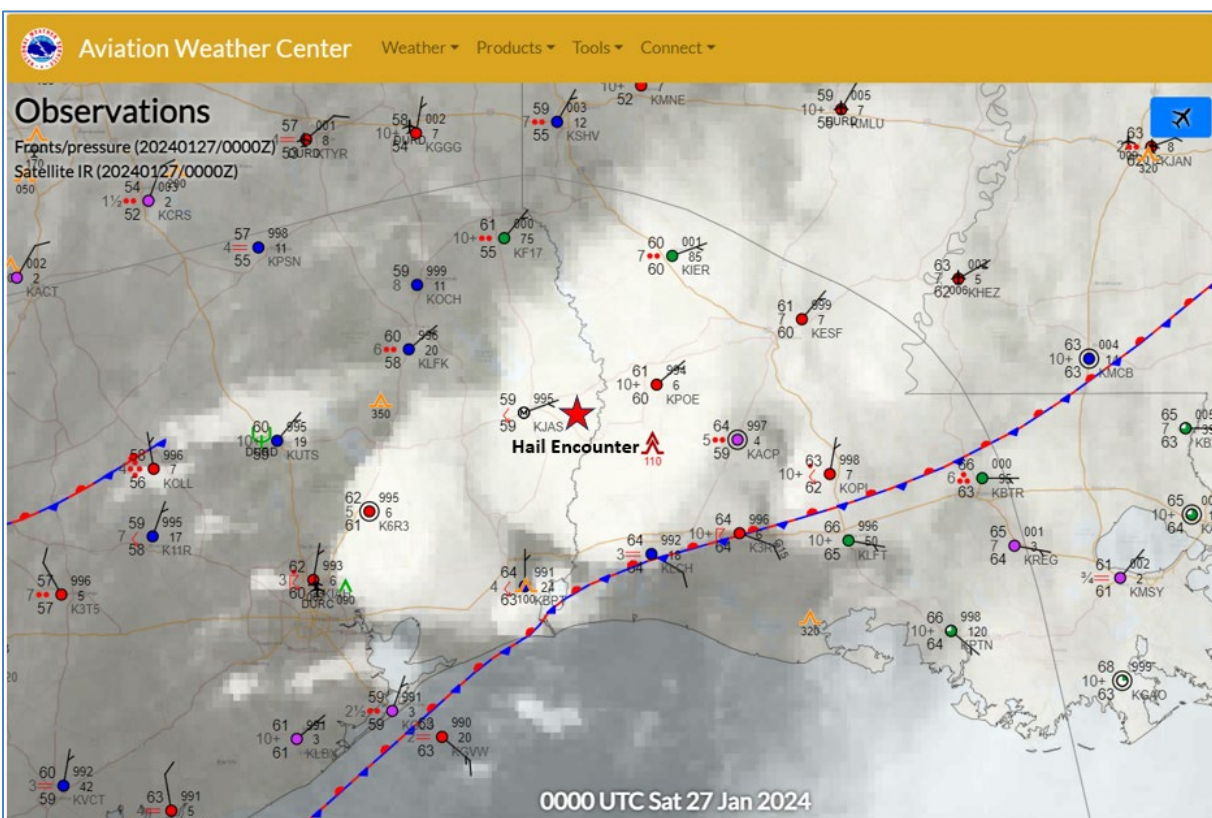


Figure 9 - GOES16 satellite image over the surface observations for 1800 CST with the accident site noted by the star.

²⁶ <https://www.ssec.wisc.edu/mcidas/>

Figure 10 is the GOES-16 infrared image for 1751 CST at 4X magnification with a standard MB temperature enhancement curve applied over the region to highlight the higher clouds typically associated with deep convection. The image depicted several areas of cumulonimbus type clouds over the area, with the most organized over the hail encounter. The radiative cloud top temperature ranged from 214 to 208 Kelvin or from -59° to -65°C, which corresponded to cloud tops between 39,000 ft to 42,000 ft based on the KLCH sounding. Attachment 1 is an animation of the GOES-16 infrared imagery from 1700 through 1756 CST over the region.

Figure 11 is the GOES-16 infrared image with Geostationary Lightning Mapper (GLM) overlaid for the same period of 1751 EST, with the lightning areas indicated in white. The image depicted a cluster of lightning over the area in the immediate vicinity of the hail and severe turbulence encounter. Attachment 2 is the GOES-16 infrared imagery with the GLM overlaid for the period from 1700 through 1756 CST.

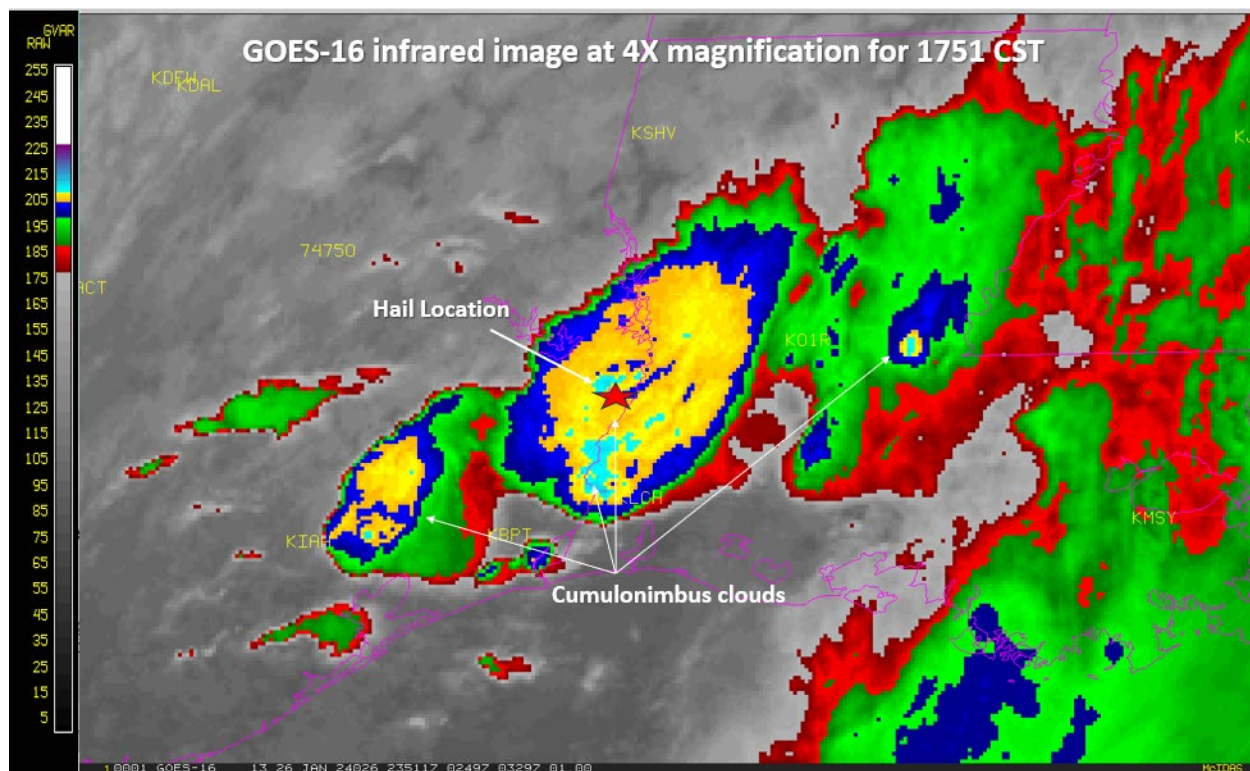


Figure 10 - GOES-16 infrared image for 1751 CST at 4X magnification with a standard MB temperatures enhancement curve applied.

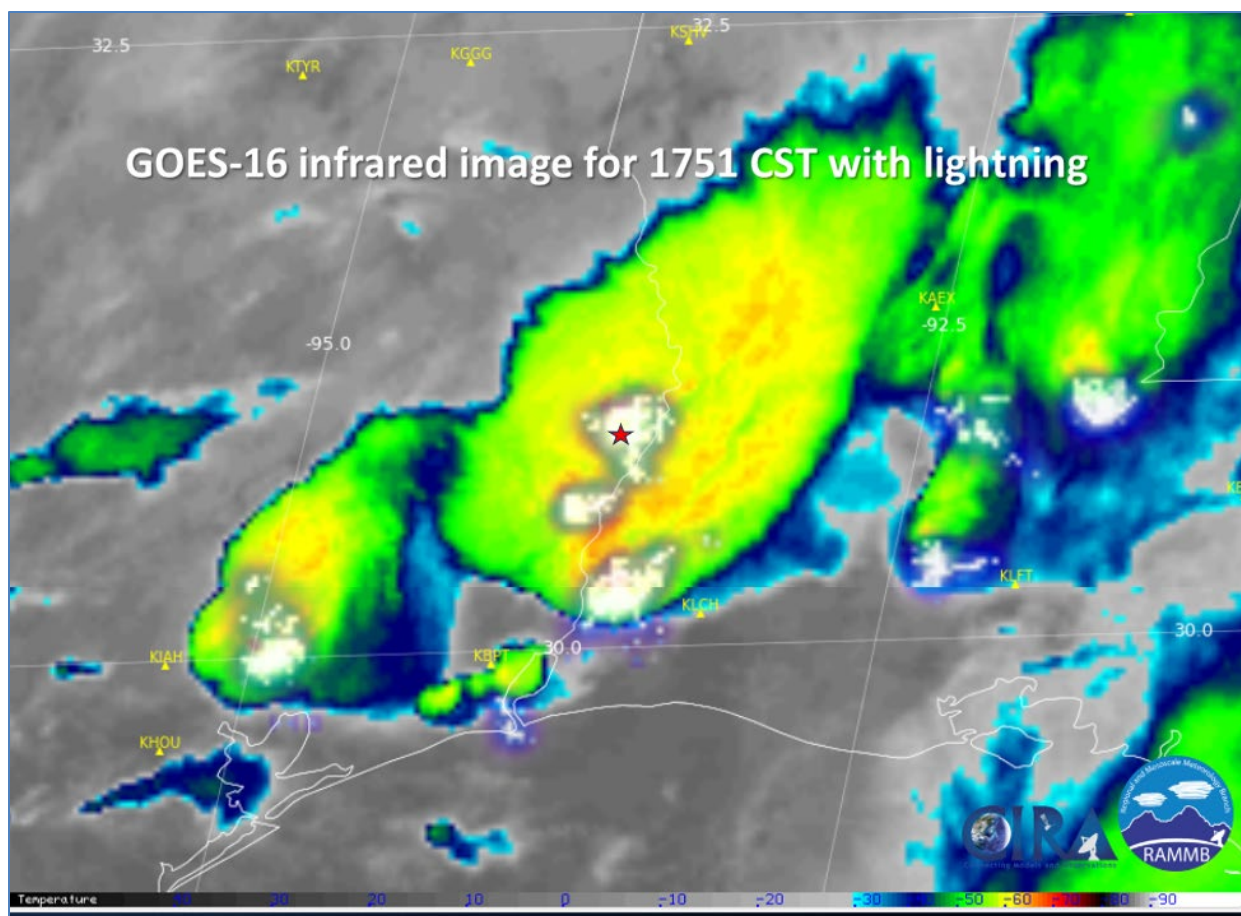


Figure 11 - GOES-16 infrared image with lightning mapper for 1751 CST.

5.0 Weather Surveillance Radar Imagery

The closest NWS Weather Surveillance Radar 1988 Doppler (WSR-88D)²⁷ was from the NWS Lake Charles (KLCH) Weather Forecast Office (WFO), located about 47 miles southwest of the accident site. The Level II and Level III archive radar data were obtained from the NCEI using the Hierarchical Data Storage System and displayed using the NWS NEXRAD Interactive Viewer and Data Exporter software²⁸. The accident aircraft's ADS-B flight track data were obtained and overlaid on the radar imagery. During the period the radar was operating in the precipitation mode volume coverage pattern (VCP-212), where the radar makes 14 different elevation scans in around 4 ½ minutes. This scanning strategy is typically used by the NWS when rapidly developing thunderstorms and for severe weather detection.

²⁷ 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.

²⁸ <https://www.ncdc.noaa.gov/wct/>

Figure 12 is a depiction of this scanning strategy VCP-212 for the various elevation angles and beam height by distance. At 50 miles and the aircraft's altitude of 11,000 ft, the 1.8° elevation scan best defined the echoes²⁹.

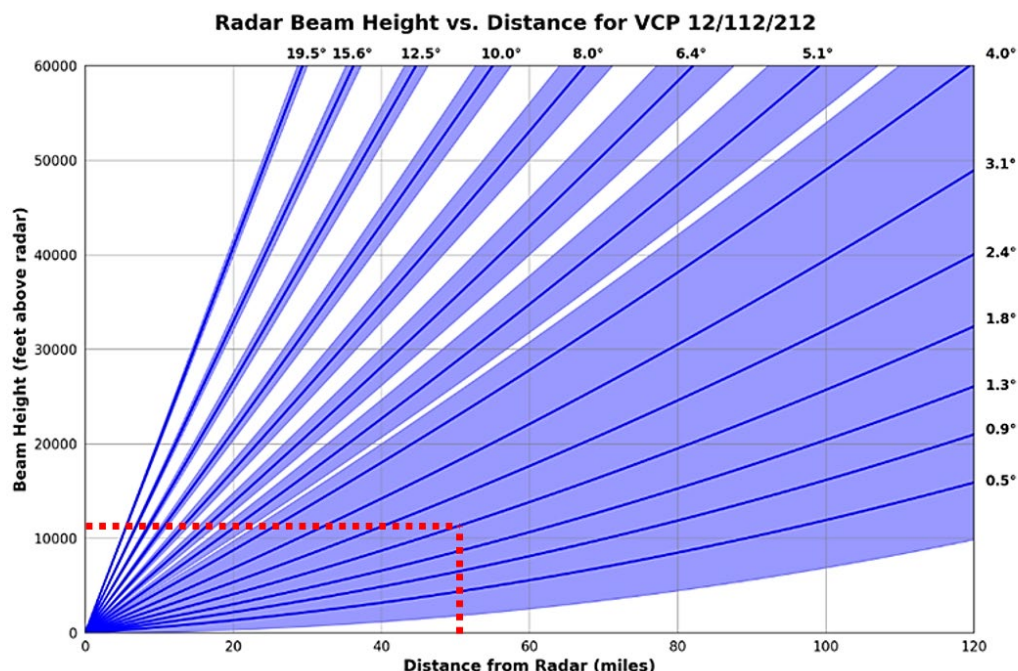


Figure 12 - WSR-88D VCP-212 elevation angles and beam height by distance.

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors³⁰, 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)³¹ and is a general measure of echo intensity. The FAA Aviation Weather Handbook³² defines echoes less than 30 dBZ as "light" in intensity, "moderate" echoes are 30-40 dBZ, "heavy" with echoes of >40-50 dBZ, and "extreme" intensity with echoes above >50 dBZ. These are the new standard radio phraseology terms used by air traffic controllers to describe weather conditions to pilots as shown in the following table. Light rain is typically reported at the surface when reflectivities reach 20 dBZ, while air traffic control weather

²⁹ Based on KLCH WSR-88D antenna height of 137 ft, and at the distance of 50 miles the NTSB calculates the center of the 1.8° elevation beam near 11,070 ft, with the base of the beam at 8,550 ft and the top of the beam at 13,590 ft, assuming standard refraction of the radar beam.

³⁰ Hydrometeors are any product of condensation or sublimation of atmospheric water vapor, whether formed in the free atmosphere or at 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.

³¹ dBZ - Nondimensional "unit" of radar reflectivity which represents a logarithmic power ratio (in decibels, or dB) with respect to radar reflectivity factor, Z.

³² FAA Aviation Weather Handbook - WSR-88D Radar Precipitation Intensity Terminology (Table 24-8).

displays typically do not display echoes less than 30 dBZ or light intensity echoes on their weather displays or disseminate alerts of any such echoes.

Reflectivity (dBZ) Ranges	Weather Radar Echo Intensity Terminology
<30 dBZ	Light
30-40 dBZ	Moderate
>40-50 dBZ	Heavy
>50 dBZ	Extreme

5.1 Composite Reflectivity Imagery

The composite radar imagery depicts the highest reflectivity value from all the elevation scans for the period in dBZ, with a resolution at 1 x 1 km (0.54 x 0.54 nm) and provides a synopsis of the important features in the entire vertical coverage area. Figures 13-17 are the NWS KLCH WSR-88D composite reflectivity images from 1738 through 1759 CST with the corresponding flight track overlaid for the time of the scan. The images depict the accident airplane begin deviating around 1746 CST to the left of course and towards an approximately 5-mile gap between echoes at that time. By 1754 CST, the area of extreme intensity echoes has moved northeastward and filled the previous gap previously depicted in the area. Echoes of greater than 50 dBZ and reaching 73 dBZ³³ extend over the flight track from 1749 through 1759 CST where the hail was encountered.

³³ Reflectivity values greater than 60 dBZ indicate a high probability of hail.

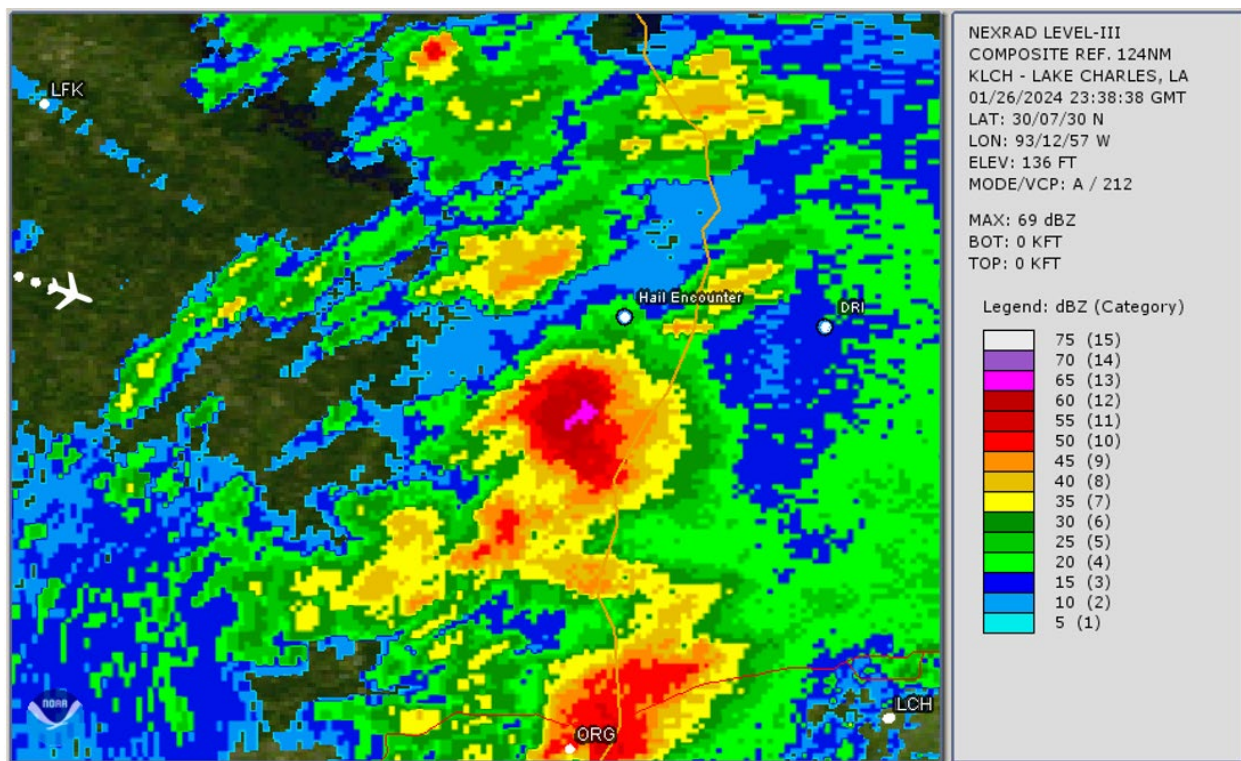


Figure 13 - NWS KLCH WSR-88D composite reflectivity for 1738 CST with flight track.

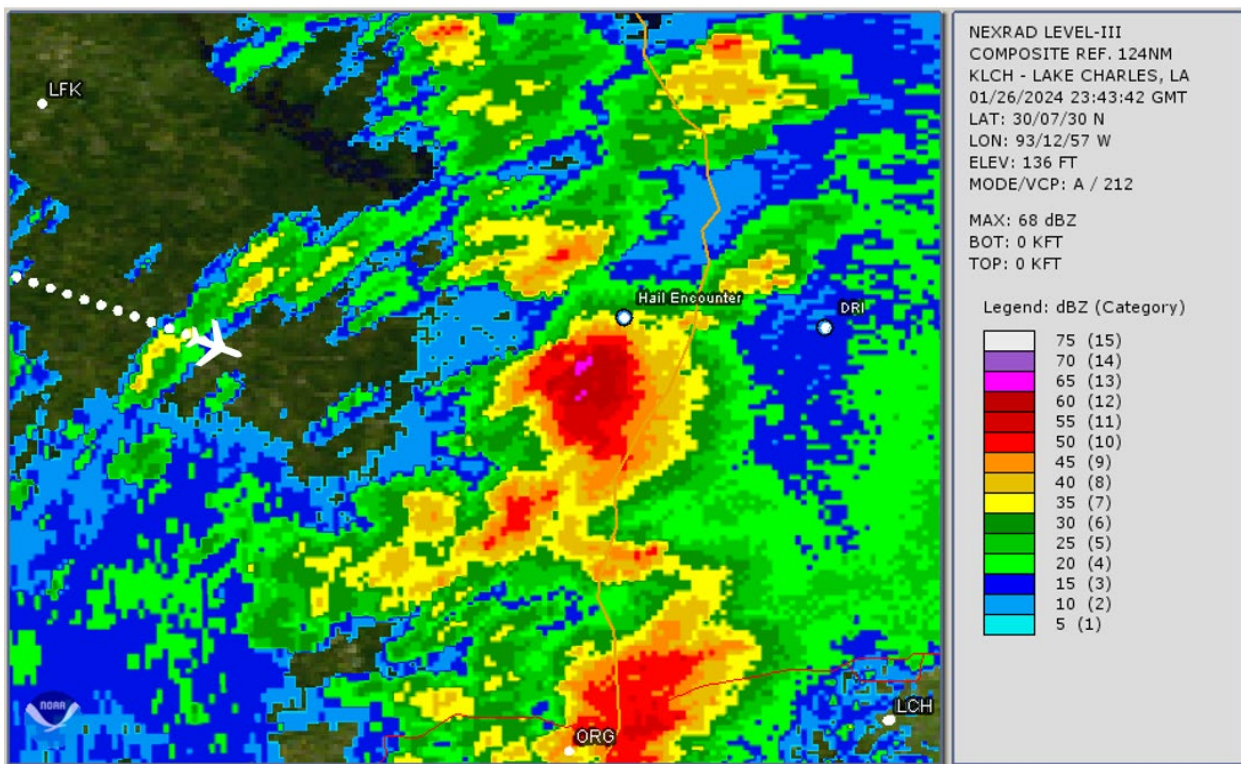


Figure 14 - NWS KLCH WSR-88D composite reflectivity for 1743 CST with flight track.

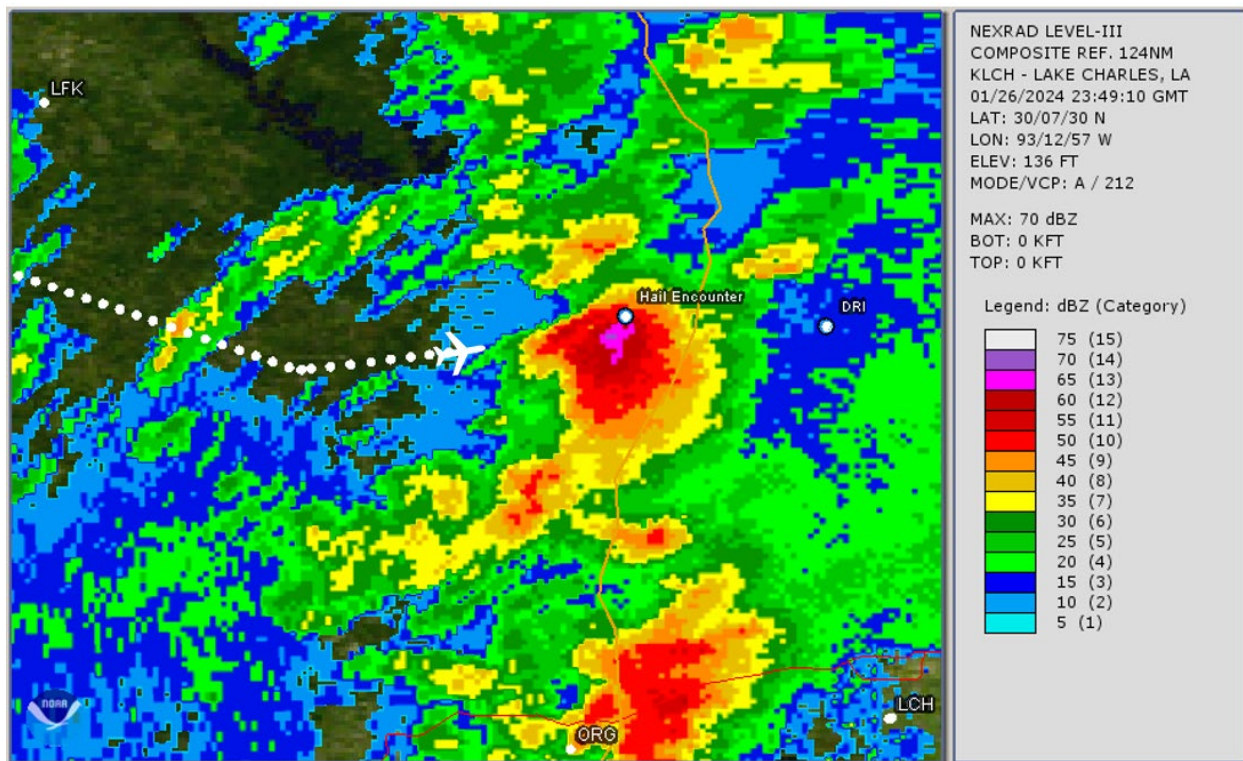


Figure 15 - NWS KLCH WSR-88D composite reflectivity for 1749 CST with flight track.

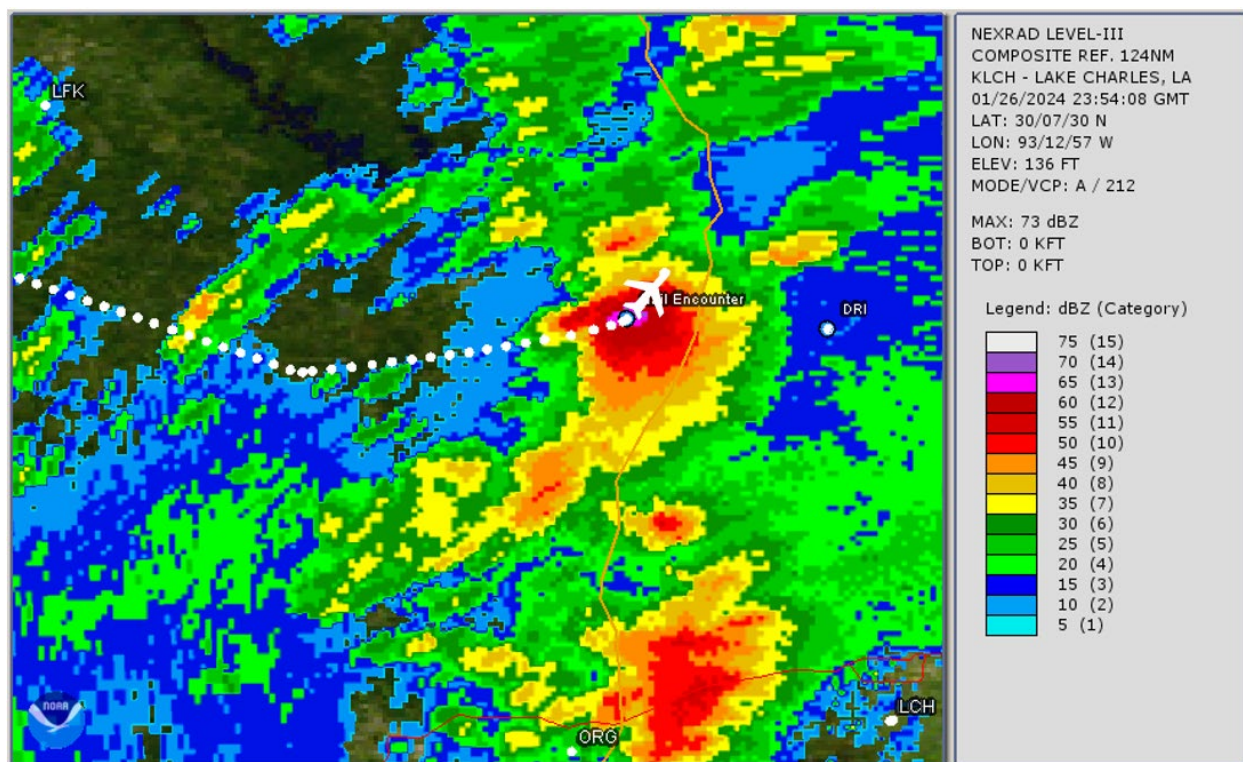


Figure 16 - NWS KLCH WSR-88D composite reflectivity for 1754 CST with flight track.

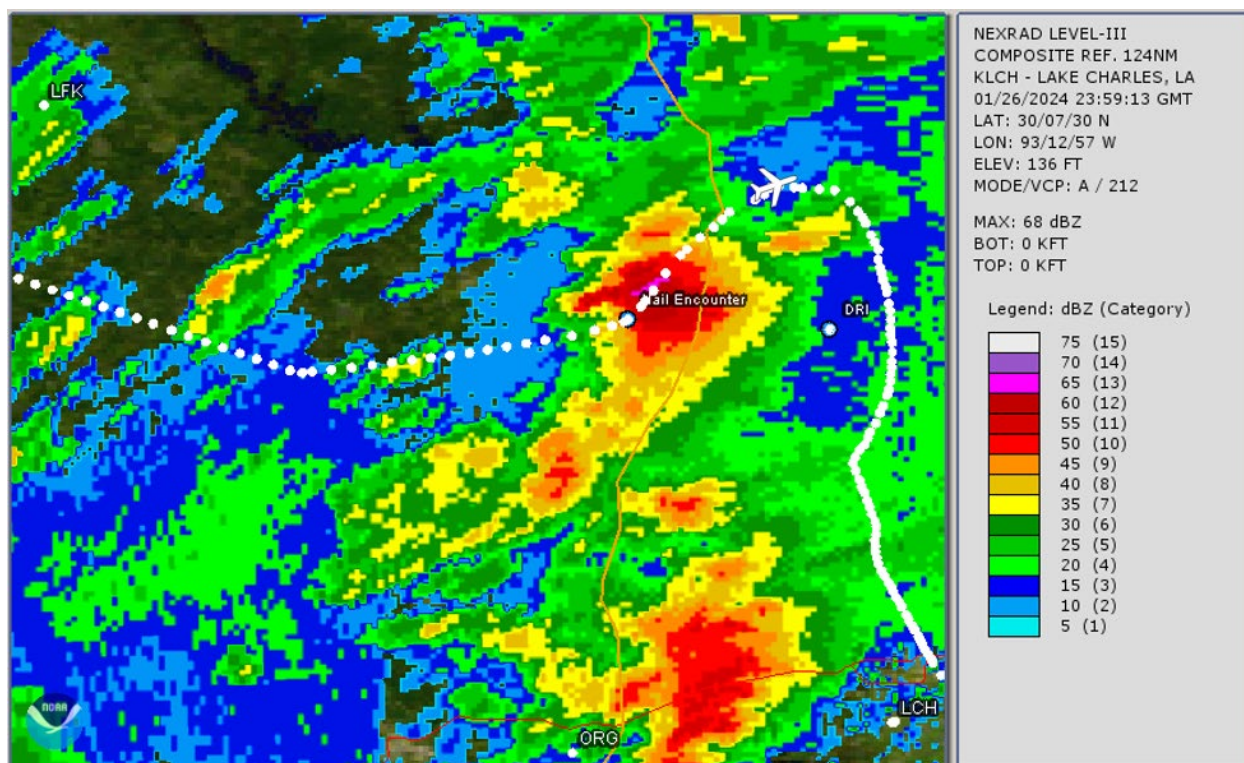


Figure 17 - NWS KLCH WSR-88D composite reflectivity for 1759 CST with flight track.

5.2 Base Reflectivity Imagery

The WSR-88D base reflectivity image provides a higher resolution of 0.25 km (0.13 nm) X 0.5°. The KLCH WSR-88D 1.76° base reflectivity images for 1738, 1743, 1749, 1754, and 1759 CST which depicted the conditions at the accident airplane's cruising altitude of 11,000 ft are included as figures 18-22 with the corresponding flight track overlaid³⁴. The image depicted the accident airplane penetrate an area of extreme intensity echoes with a maximum reflectivity of 75 dBZ. The location of a Three-Body Scatter Spike (TBSS)³⁵ or "hail flare" or "flare echo" signature downrange from the high reflectivity core is depicted on the images, as well as the Weak Echo Region "WER", where there is a sharp reflectivity gradient, that was indicative of the location of the primary updraft.

³⁴ Track position at approximately every 30-seconds is displayed.

³⁵ The TBSS echo spike is strictly an artifact of the electromagnetic radar beam being subject of "Mie scattering" instead of the usual "Rayleigh scattering" process.

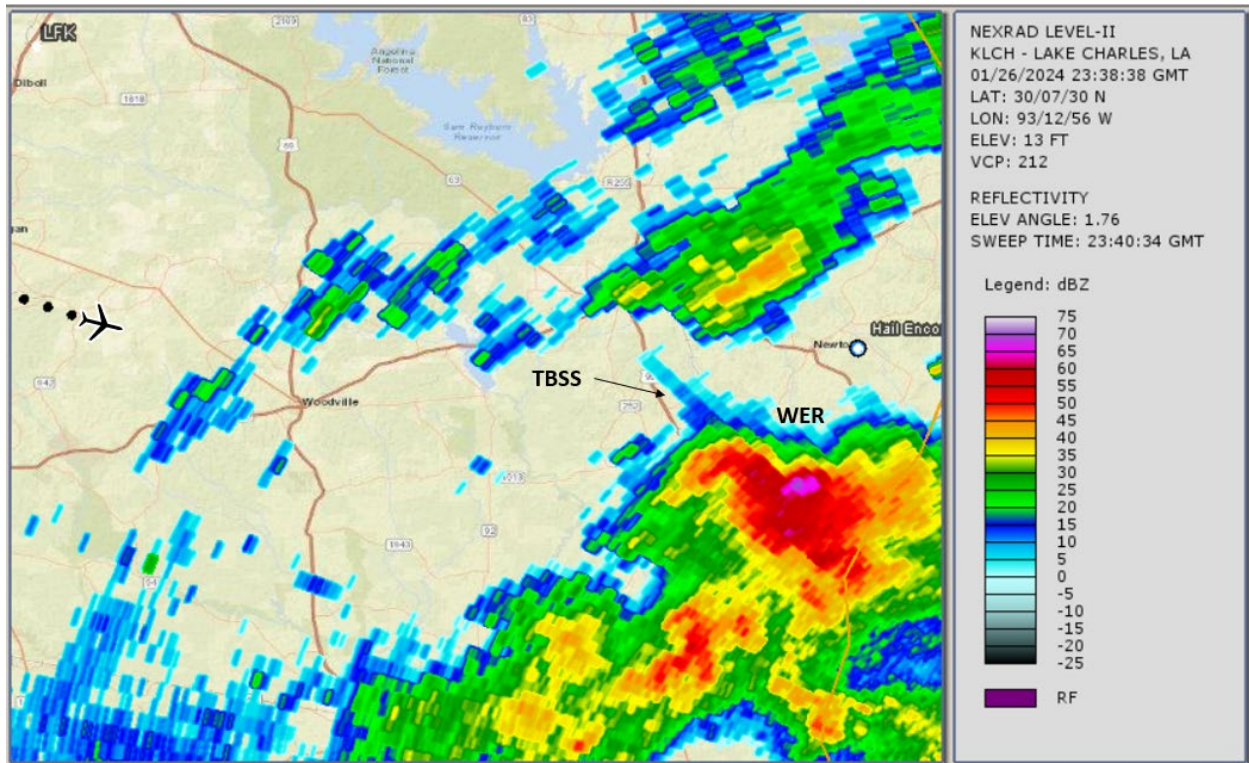


Figure 18 - NWS KLCH WSR-88D 1.76° base reflectivity image for 1740 CST with flight track.

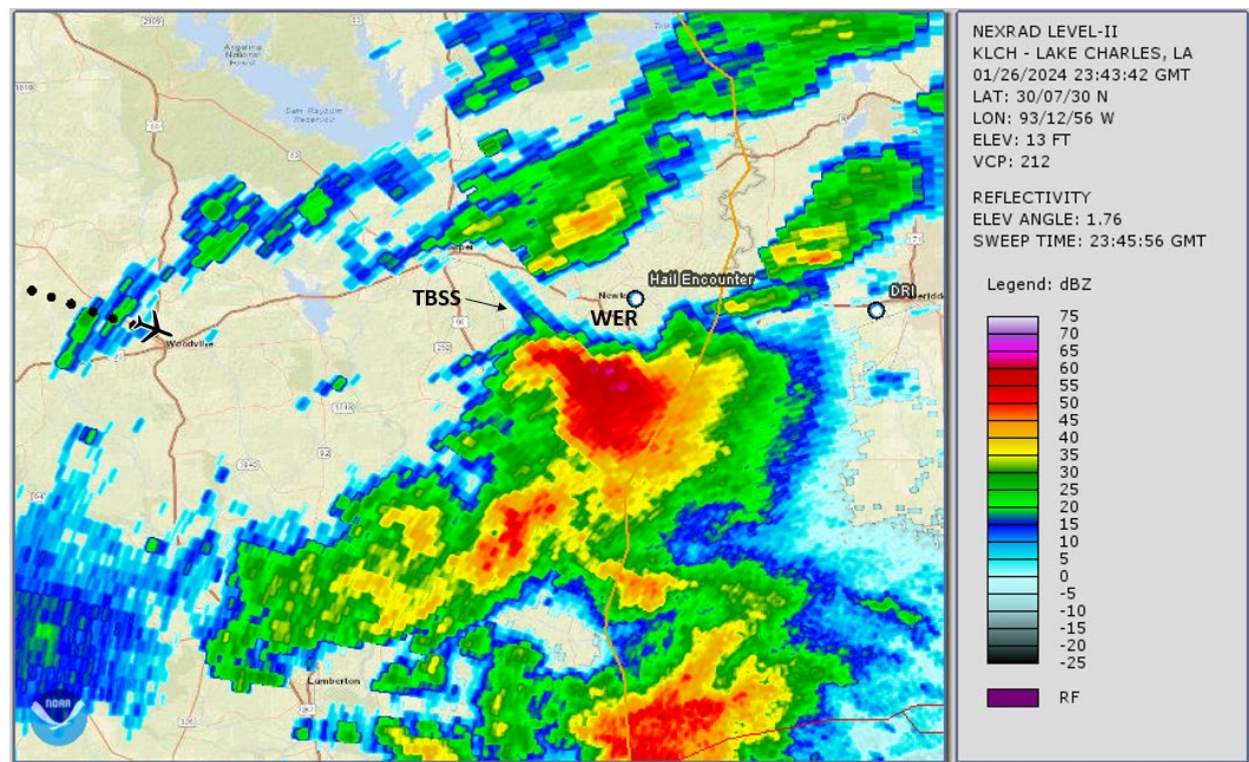


Figure 19 - NWS KLCH WSR-88D 1.76° base reflectivity image for 1745 CST with flight track.

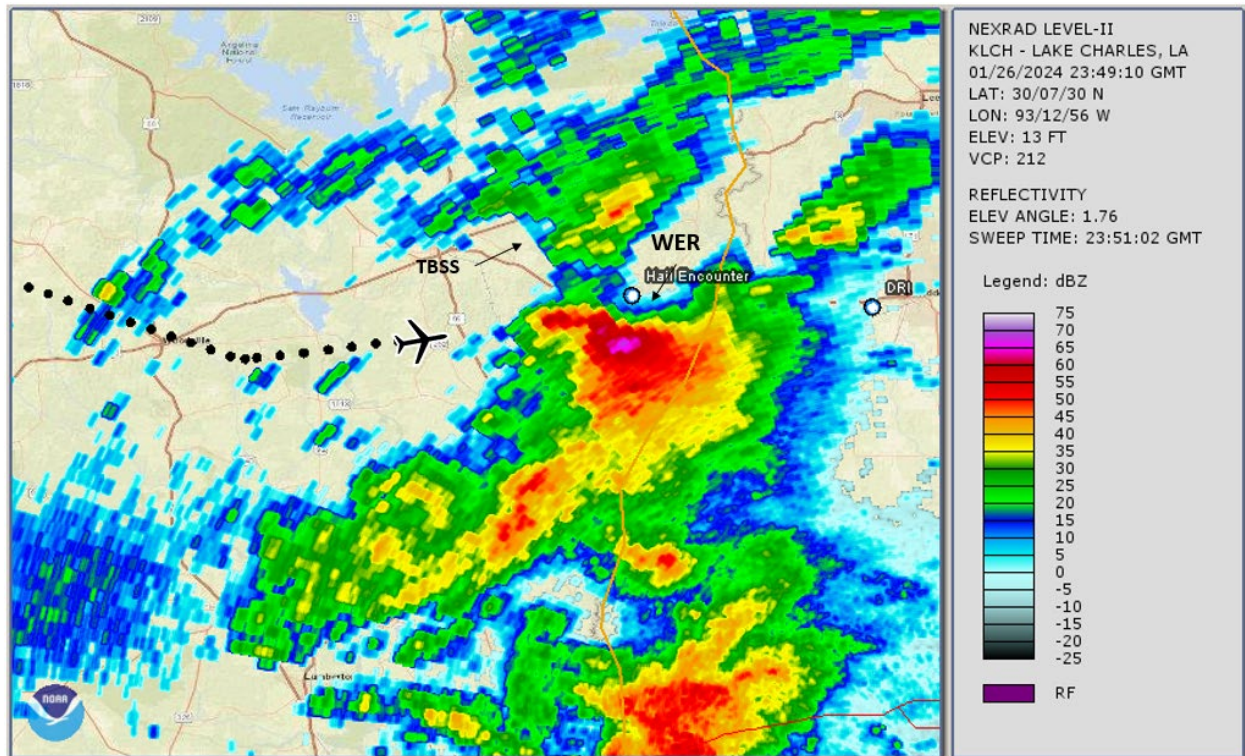


Figure 20 - NWS KLCH WSR-88D 1.76° base reflectivity image for 1751 CST with the flight track.

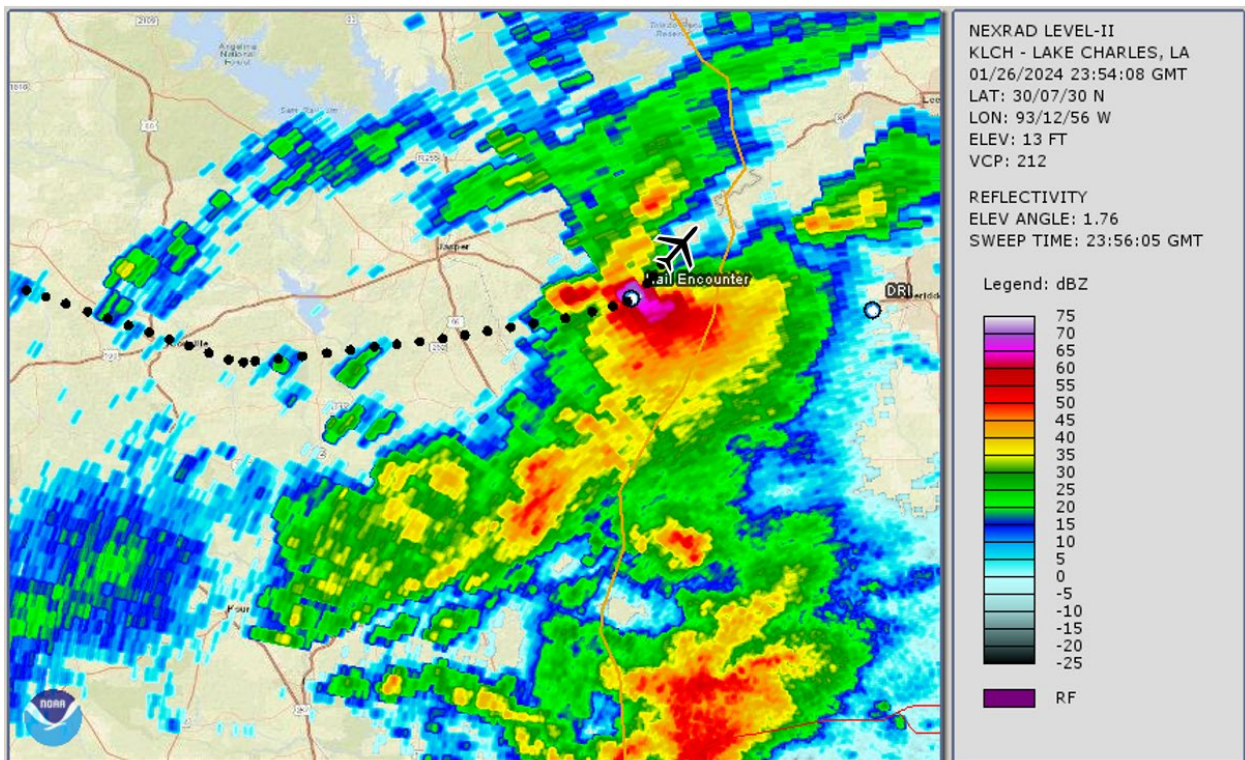


Figure 21 - NWS KLCH WSR-88D 1.76° base reflectivity image for 1756 CST with the flight track.

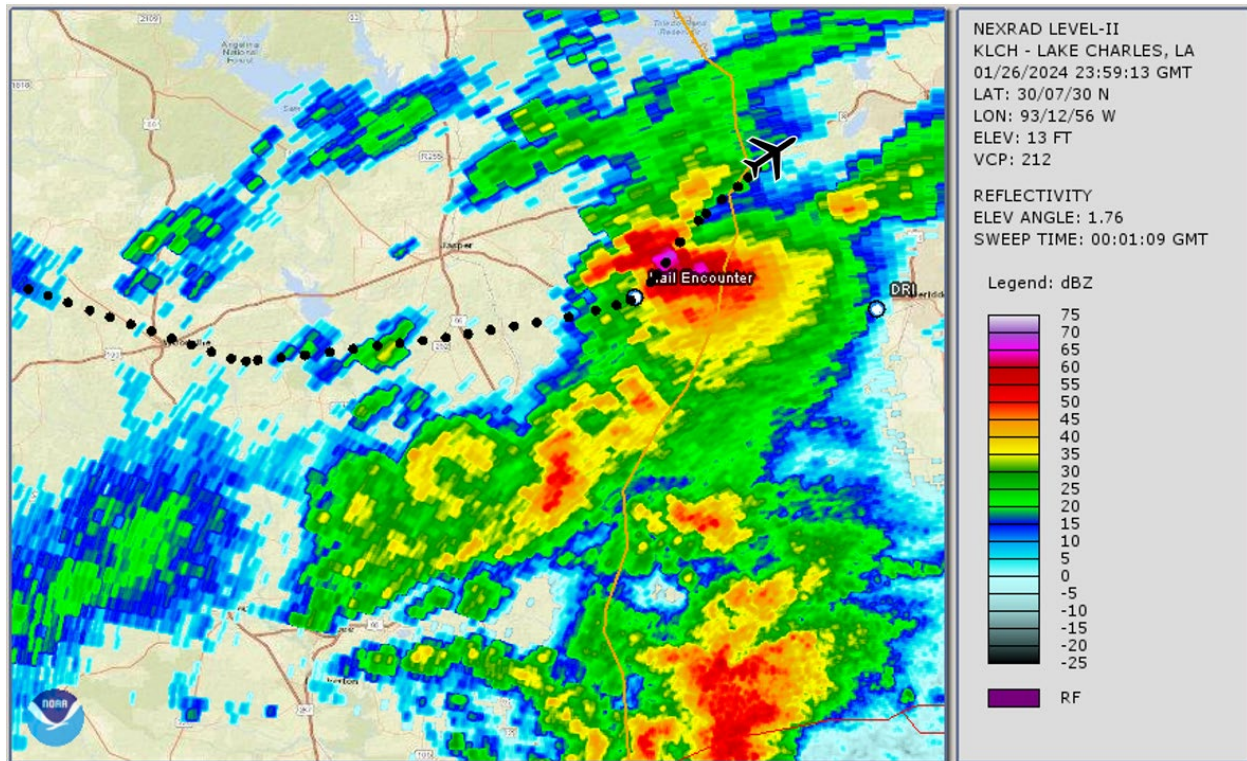


Figure 22 - NWS KLCH WSR-88D 1.76° base reflectivity image for 1801 CST with the flight track.

5.3 Echo Tops Product

The WSR-88D echo tops product provides the estimate height of the 18.5 dBZ return in thousands of ft. The resolution is 1 km (0.54 nm) x 1° at 1,000 ft intervals. The product is typically used to identify those storms with the greatest vertical development and assist in identifying storm structure. Observations of collapsing echo tops can also aid in the timing of the onset of severe weather events at the surface.

The NWS KLCH WSR-88D 1.76° base reflectivity and echo tops product displayed using the GR2 Analyst software³⁶ for 1754 CST is included as figure 23, with the NWS severe thunderstorm watches (section 8.4 below) in yellow and the radar indicated hail³⁷ indicated by the green triangle. At the time of the scan the radar hail algorithm was indicating hail to 2.51 inches in the immediate vicinity of the accident. The echo tops product depicted radar indicated tops³⁸ to 39,000 ft over the accident location with higher tops immediately north-northeast to 44,900 ft. The yellow polygons on the images depict the NWS KLCH severe thunderstorm warnings issued immediately surrounding the period and are documented in section 9.2 of this report.

³⁶ GR2Analyst is a Nexrad Level II analysis application. http://www.grlevelx.com/gr2analyst_2/

³⁷ Hail index provides the user with an estimated probability of hail and estimated size.

³⁸ Radar indicated tops are the highest altitude of 18.5 dBZ are detected, actual cloud tops are higher.

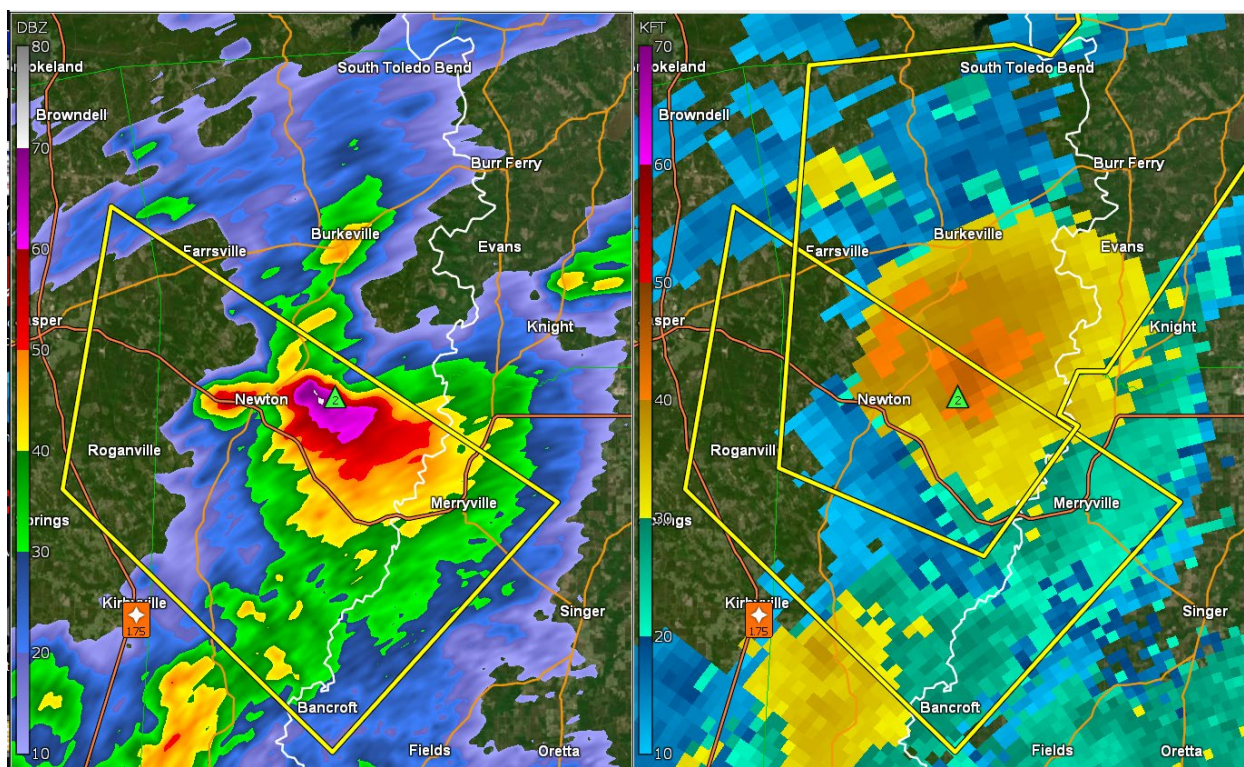


Figure 23 - NWS KLCH WSR-88D 1.76° base reflectivity (left) and echo tops (right) for 1754 CST with severe thunderstorm warnings (yellow polygons), and radar indicated hail (green triangle) and reported hail at the surface (brown rectangle).

5.4 Cross-Section of Echo

The GR2 Analyst software was also utilized to provide cross section of the echoes over the flight path during the period. Figure 24 is the approximate south-to-north cross section along the 320° beam azimuth of from the radar and the hail encounter and figure 25 the approximate west-to-east cross section along the approximate flight path for 1754 CST. The figures show echoes of 63 dBZ at 11,000 ft with the maximum reflectivity of 74 dBZ at about 14,800 ft. A significant reflectivity core above -20°C or above 22,000 ft is noted, which is a common observation with hailstorms.

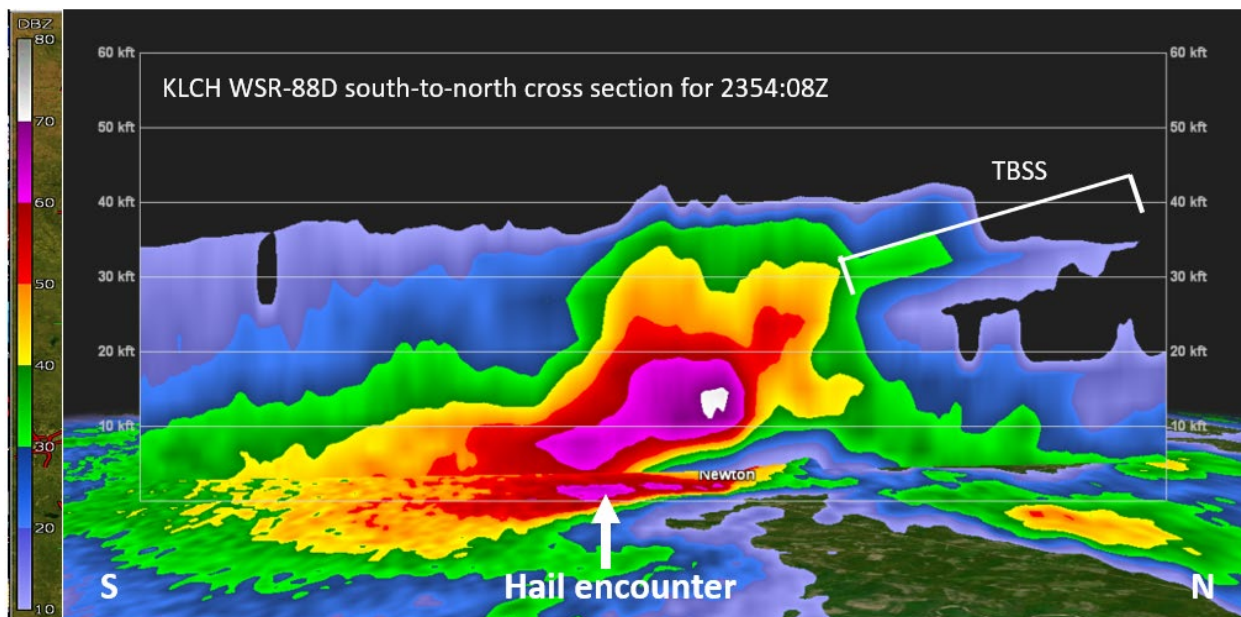


Figure 24 - NWS KLCH WSR-88D approximate south-to-north cross section for 1754 CST.

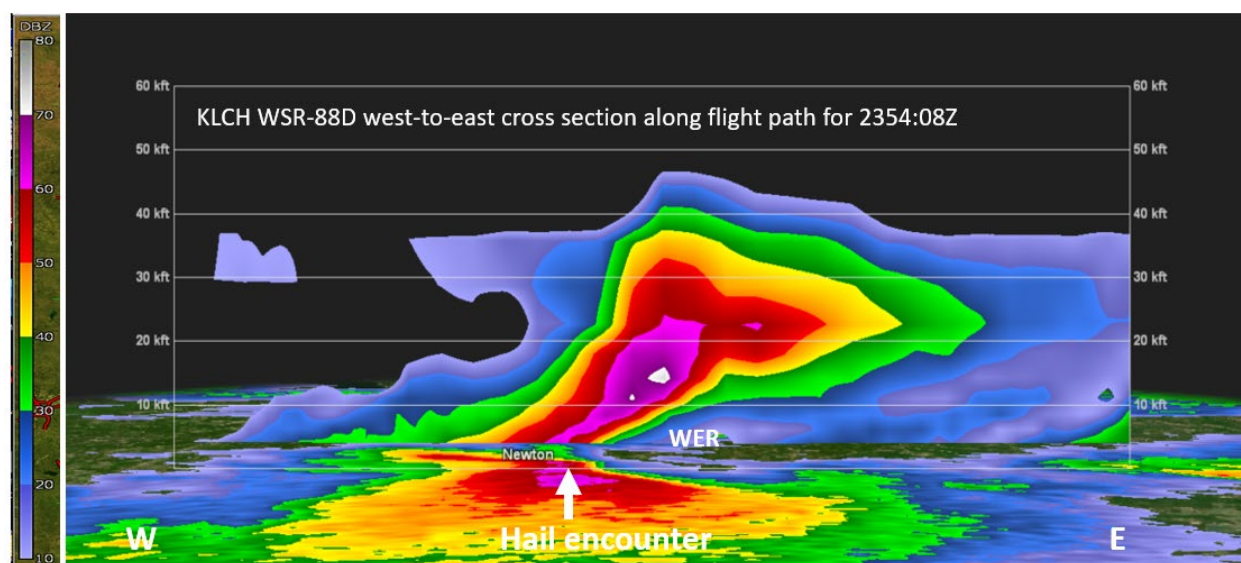


Figure 25 - NWS KLCH WSR-88D west-to-east cross section along approximate flight path for 1754 CST.

5.5 FAA Consolidated Storm Prediction for Aviation Display

The Massachusetts Institute of Technology (MIT) Lincoln Laboratory developed the Consolidated Storm Prediction for Aviation (CoSPA) for the FAA and is presently used in the Houston Air Route Traffic Control Centers (ARTCC) to provide improved situational awareness of weather radar and lightning data. The imagery provides a depiction of vertical integrated liquid (VIL) precipitation levels versus echoes in dBZ,

which is included in figure 26. The product also provides echo tops, cell movement, and lightning data. The program also provides an algorithm growth and decay feature.

VIP or VIL Levels	VIL (digital VIL)	VIL (kg/m ²)	Past and Current VIL	Forecast VIL
1	16	0.15	Level 1	Level 1
2	74	0.76	Level 2	Level 2
3	133	3.47	Level 3	Level 3/4
4	160	6.92	Level 4	Level 3/4
5	181	12.0	Level 5	Level 5/6
6	219	31.6	Level 6	Level 5/6

Figure 26 - CoSPA VIL Levels

VIL is very useful in monitoring the general radar echo pattern for the beginning stages of significant convective development and for helping to distinguish thunderstorms from rain showers. As convective development progresses, relative values of VIL are useful in distinguishing strong, possibly severe, thunderstorms from those not likely to be severe. Persistent high VIL values are often observed with supercell type thunderstorms and can be useful in identifying large hail areas. The limitation with VIL is that is drop size biased and are airmass dependent.

Figures 27 through 30 are the CoSPA VIL intensity displays for 1740 through 1800 CST every 5-minutes with the movement, echo top flags, and cloud-to-ground lightning activity noted by the "+" symbols. The large area of VIL VIP level 6 activity was unchanged and was depicted moving north-northeast at 35 to 40 knots, with tops from 50,000 ft to 46,000 ft.

Figure 31 is the CoSPA echo tops product which depicted the area associated with the hail with tops over 45,000 ft.

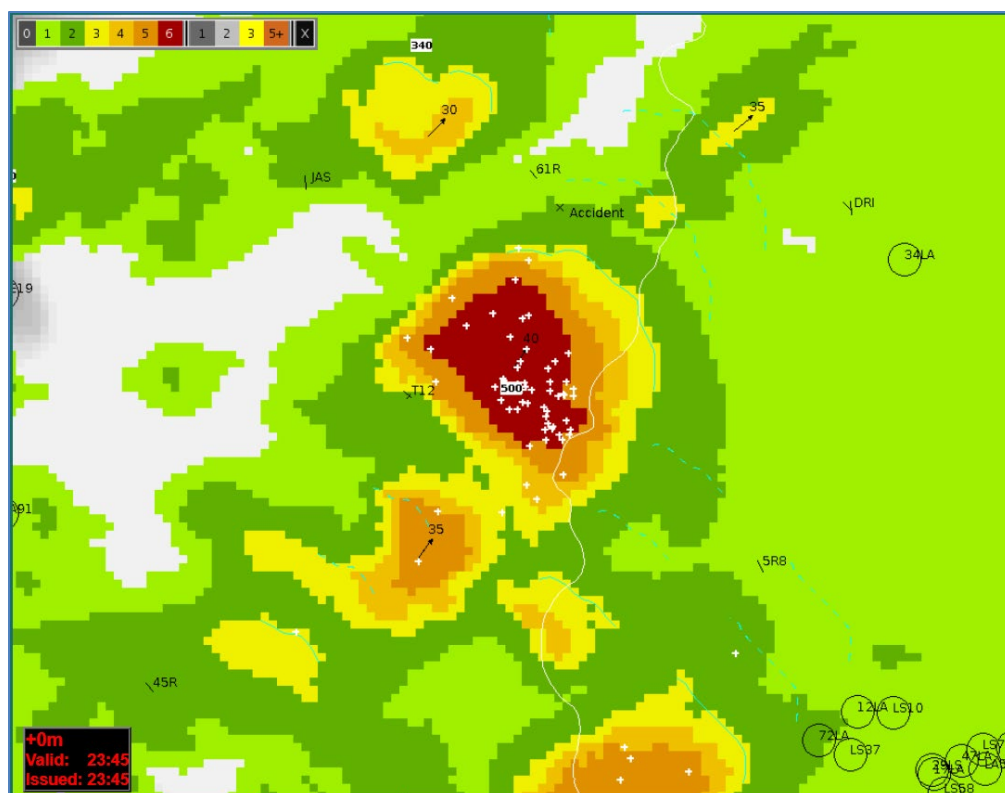


Figure 27 - CoSPA VIL image for 1745 CST with movement, echo tops and lightning.

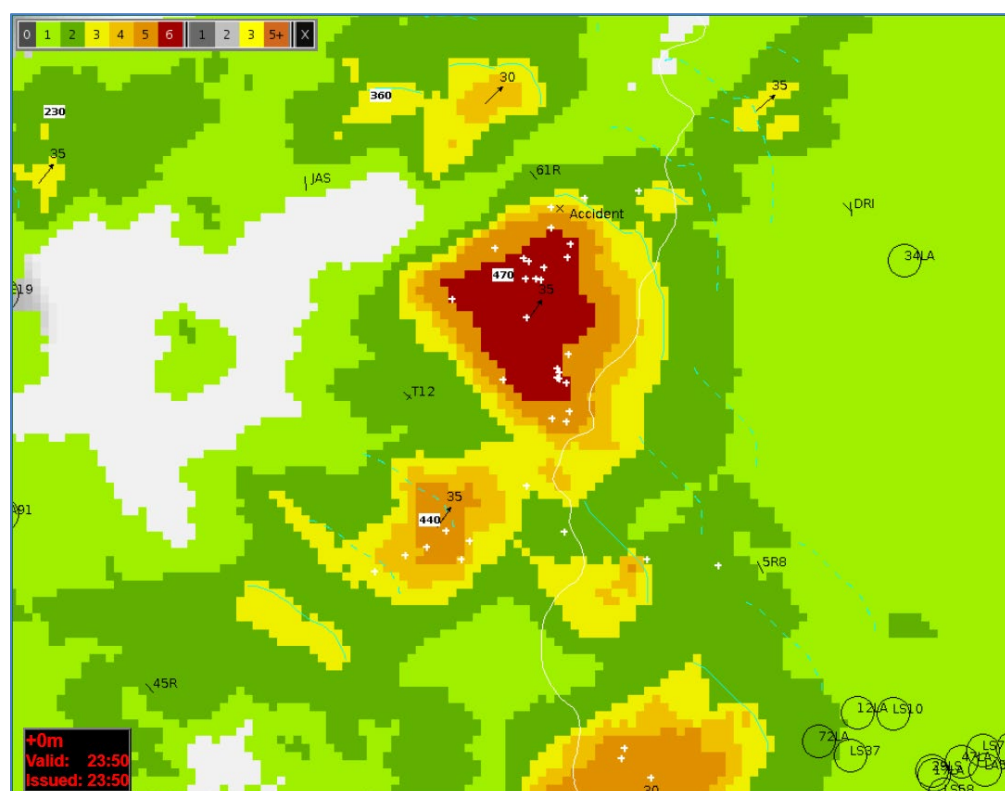


Figure 28 - CoSPA VIL image for 1750 CST with movement, echo tops and lightning.

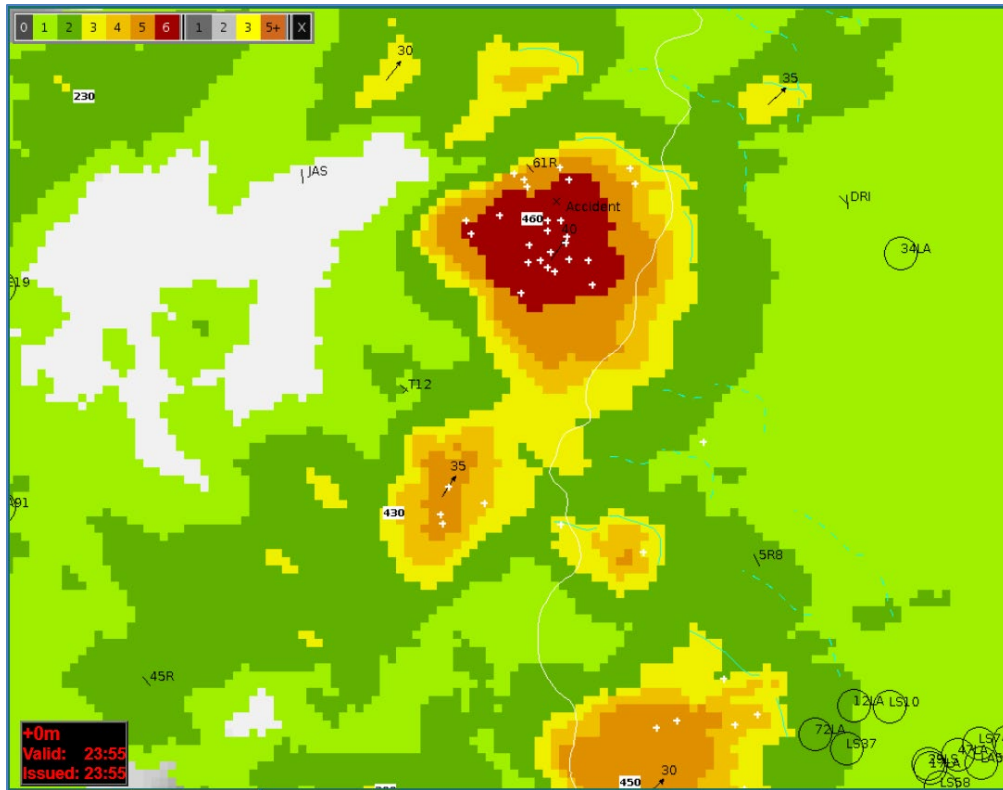


Figure 29 - CoSPA VIL image for 1755 CST with movement, echo tops and lightning.

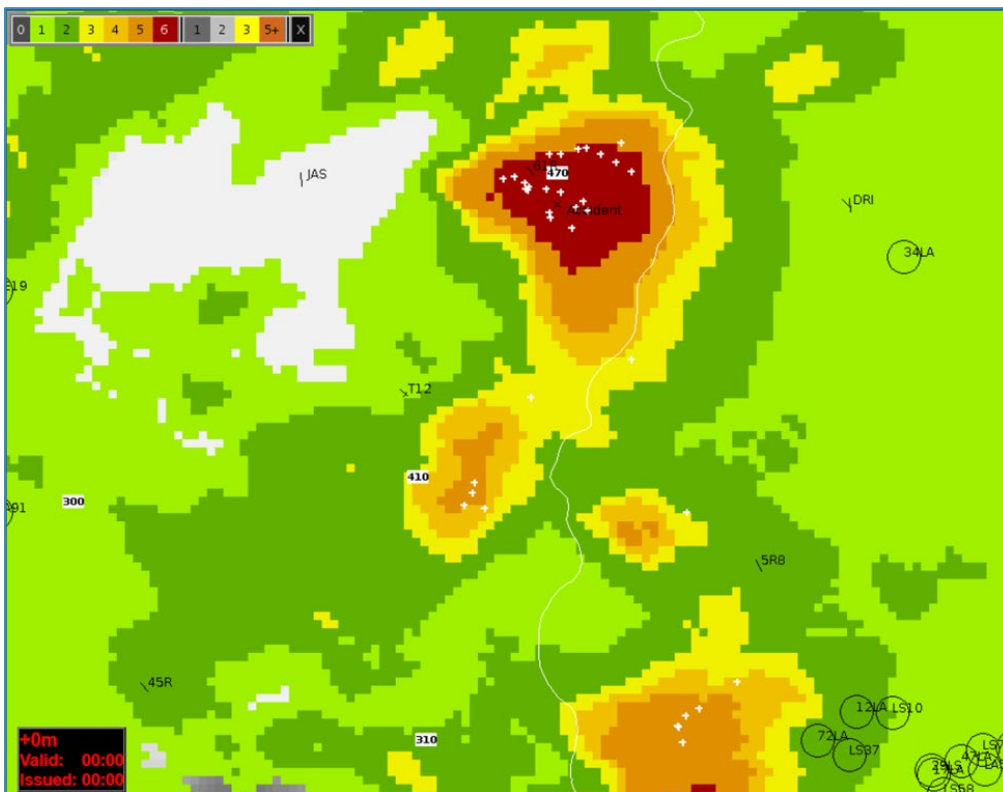
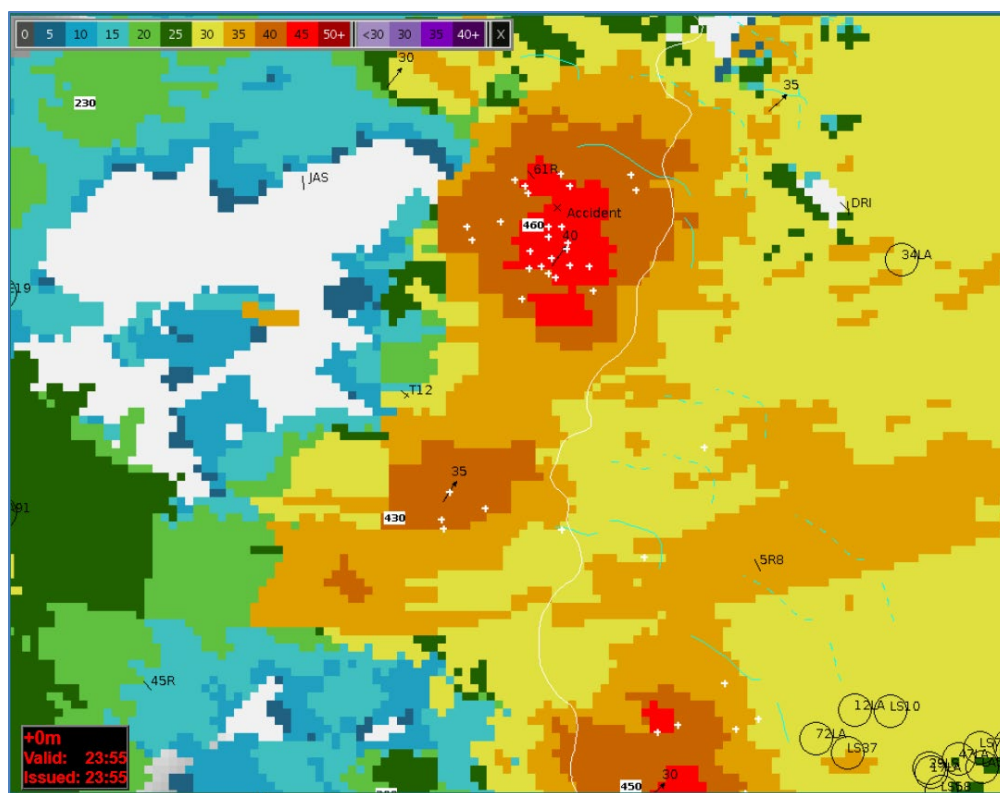


Figure 30 - CoSPA VIL image for 1800 CST with movement, echo tops and lightning.



6.0 Pilot Reports

The following pilot weather reports (PIREPs) were reported³⁹ in the national database within 100nm and below 18,000 ft surrounding the time of the accident.

LCH UA /OV LCH225001/TM 2225/FL003/TP SR22/SK OVC003/WX FV01SM BR

LFK UA /OV LFK/TM 2228/FL035/TP C172/SK OVC035/RM ZHU

BPT UA /OV SBI225020/TM 2251/FL140/TP E145/TB MOD/RM ZHU

HEZ UA /OV HEZ/TM 2300/FL006/TP C172/RM BASES ZHU

MLU UA /OV MLU/TM 2310/FLDURGD/TP HAWK/SK OVC006

BPT UA /OV BPT/TM 2320/FL100/TP E145/SK OVC100/TB MOD

AEX UUA /OV AEX225050/TM 2355/FL110/TP BE58/TB SEV TURB/RM ZHU

JAS UUA /OV JAS090020/TM 0000/FL110/TP BE58/TB SEV /RM ZHU

³⁹ Includes only the reports official recorded and disseminated as a PIREP and may not include “ride reports” broadcasted or other conditions solicited by air traffic controllers and not entered in the formal PIREP format coding. These reports are available to users in near real-time.

The urgent reports in the vicinity of Alexandria (AEX) and Jasper (JES) were likely from the accident flight and entered by air traffic control following the weather encounter, which placed the event slightly east of the actual encounter.

7.0 NWS Forecast Products

The NWS KLCH Weather Forecast Office (WFO) issued the following local forecasts and weather alerts, while the NWS AWC located in Kansas City, Missouri, were responsible for the primary aviation advisories.

7.1 Terminal Aerodrome Forecast

The planned destination and alternate airport the accident airplane diverted to do not routinely issue Terminal Aerodrome Forecasts (TAF). The closest forecast issued to the destination was from Acadiana Regional Airport (KARA), New Iberia, Louisiana, located about 11 miles east of KIYA. While a TAF is valid for a 5 statute mile radius from the airport's center point, they are often used by pilots and flight planning systems to document the closest forecasts along a route of flight and the destination. The forecasts issued by KLCH WFO surrounding the period at 1132 and amended at 1531 CST were as follows.

*TAF KARA 261732Z 2618/2718 06006KT 2SM BR VCSH OVC002
FM262000 11008KT 4SM BR VCTS OVC006CB
FM270000 12010KT 4SM -SHRA BR VCTS OVC003CB
FM270900 20010KT 1 1/2SM -SHRA BR VCTS OVC005CB
FM271500 30011KT 2SM BR OVC003
FM271600 31013G21KT 4SM BR OVC004=*

***AMD TAF KARA 262131Z 2622/2718 11008KT 4SM -RA BR VCTS OVC006CB
FM270000 12010KT 4SM -SHRA BR VCTS OVC003CB
FM270900 20010KT 1 1/2SM -SHRA BR VCTS OVC005CB
FM271500 30011KT 2SM BR OVC003
FM271600 31013G21KT 4SM BR OVC004=***

The amended forecast for KARA after 1400 CST expected IFR conditions to prevail with winds from 110° at 8 knots, visibility 4 miles in light rain and mist, with thunderstorms in the vicinity, with ceiling overcast at 600 ft in cumulonimbus clouds. After 1800 CST, visibility of 4 miles in light rain showers, mist, with thunderstorms in the vicinity were expected to continue with the ceiling expected to lower to 300 ft agl.

7.2 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 an aviation section that includes the general conditions as it relates to the creation of the TAF. These are useful for additional aviation-related issues that cannot be encoded into the TAF and provide some reasoning behind the forecast. These are generated roughly every 6 hours and correspond to the release of the latest TAFs for that office. The AFD issued by the NWS KLCH WFO at 1739 CST or immediately prior to the hail encounter was as follows:

*FXUS64 KLCH 262339
AFDLCH*

*Area Forecast Discussion
National Weather Service Lake Charles LA
539 PM CST Fri Jan 26 2024*

...New AVIATION...

.SHORT TERM...

*(Tonight through Sunday night)
Issued at 347 PM CST Fri Jan 26 2024*

The LCH radar has filled in with showers and thunderstorms this afternoon, as expected with an upper disturbance moving overhead. Expecting this trend to continue through the evening with periods of heavy rain and very low visibility expected to be the primary concern. As a quick addition to this AFD since it just came in...some small hail has been reported from storms in southwest Louisiana. In deeper rain/storm cells this afternoon and evening, there could be some small hail. This is the exception, not the rule.

There is no Dense Fog Advisory issued for areas tonight due to the low confidence in large areas of dense fog. Winds and active weather should keep us from dropping as low as DFY criteria, however one may come later if trends present the need for it.

A low pressure center is expected to lift right over southwest Louisiana after midnight; beneath an upper trof moving across the US and ahead of a cold front. Another round of semi-robust, but elevated, convection is set to come ashore after midnight within a small warm sector. Shear associated with the low will assist in keeping storms organized, with most CAPE available being of the elevated variety. This environment leans into the thought that storms will remain elevated and thus limit severe risk. Where anything can become surface-based, though, there is a low end chance for strong damaging wind gusts or an isolated tornado. This threat will be brief as the cold front sweeps through fairly quickly prior to sunrise.

Once rainfall ends tomorrow morning... that's it for the wet and soggiess. The end is near!! Remaining rain chances clear the Atchafalaya Basin by mid morning. Dry and cool air then floods down into the region, clearing skies from clouds and fog.

Ridging develops quickly and the remainder of the short term period looks cool and dry.

High temperatures tomorrow will top out in the low to mid 60s, while Sunday will see highs in the upper 50s. Overnight lows will drop into the low to mid 40s Sunday morning and mid to upper 30s Monday morning. No freeze expected.

11/Calhoun

.AVIATION...

(00Z TAFS)

Issued at 537 PM CST Fri Jan 26 2024

*Little change in thinking per the last forecast discussion. **Showers and storms continue to move across the area. Some of these have been (and will be) severe, with strong winds impacting a few terminals in the vicinity.** Outside of that, low VIS and CIGs have kept most terminals in the IFR/LIFR categories. Conditions will begin to improve tomorrow morning to afternoon.*

.LCH WATCHES/WARNINGS/ADVISORIES...

LA...None.

TX...None.

GM...Dense Fog Advisory until noon CST Saturday for GMZ430-432-435-436-450-452-455.

The advisory referred to elevated convection⁴⁰ or thunderstorms over the region associated with an upper level disturbance and the frontal wave moving across the region. The aviation section mentioned that some of the some of those thunderstorms have been identified as being severe.

7.3 Graphic Forecast for Aviation

The NWS Graphic Forecast for Aviation (GFA) is a graphical depiction of surface wind, thunderstorms, precipitation, color-coded general flight categories, and cloud cover bases and tops reported in msl heights, from graphical output from the NWS National Digital Forecast Database (NDFD) with the Graphical-Airmen's Meteorological Information (G-AIRMET) for IFR conditions, mountain obscuration, icing conditions, and strong surface wind overlaid. The GFA provides a forecast for the enroute phase of flight and for locations without a TAF. The GFA is available at the NWS AWC website and through other weather briefing services. The 9-hour GFA forecasts current for the period are included as figures 32 and 33 and represent the enroute forecast valid for the period.

⁴⁰ Elevated Convection - Convection occurring within an elevated layer, i.e., a layer in which the lowest portion is based above the earth's surface. Elevated convection often occurs when air near the ground is relatively cool and stable, e.g., during periods of isentropic lift, when an unstable layer of air is present aloft. In cases of elevated convection, stability indices based on near-surface measurements (such as the lifted index) typically will underestimate the amount of instability present. Severe weather is possible from elevated convection but is less likely than it is with surface-based convection.

The 9-hour GFA surface forecast (figure 30) depicted an extensive area of visibility below 3 miles along the Texas coast and across most of Louisiana with another area over the Texas Panhandle, Oklahoma, and northwestern Texas. Scattered thunderstorms and rain showers were expected over eastern Texas and most of Louisiana, with an area of numerous (probability 60% -100%) thunderstorms expected near the Texas and Louisiana border, into Louisiana. Graphic-AIRMETs for IFR conditions extended over eastern Texas and Louisiana. The GFA 9-hour cloud forecast (figure 31) depicted an extensive area of overcast clouds over the route with bases between 300 and 600 ft with tops near 11,000 ft.

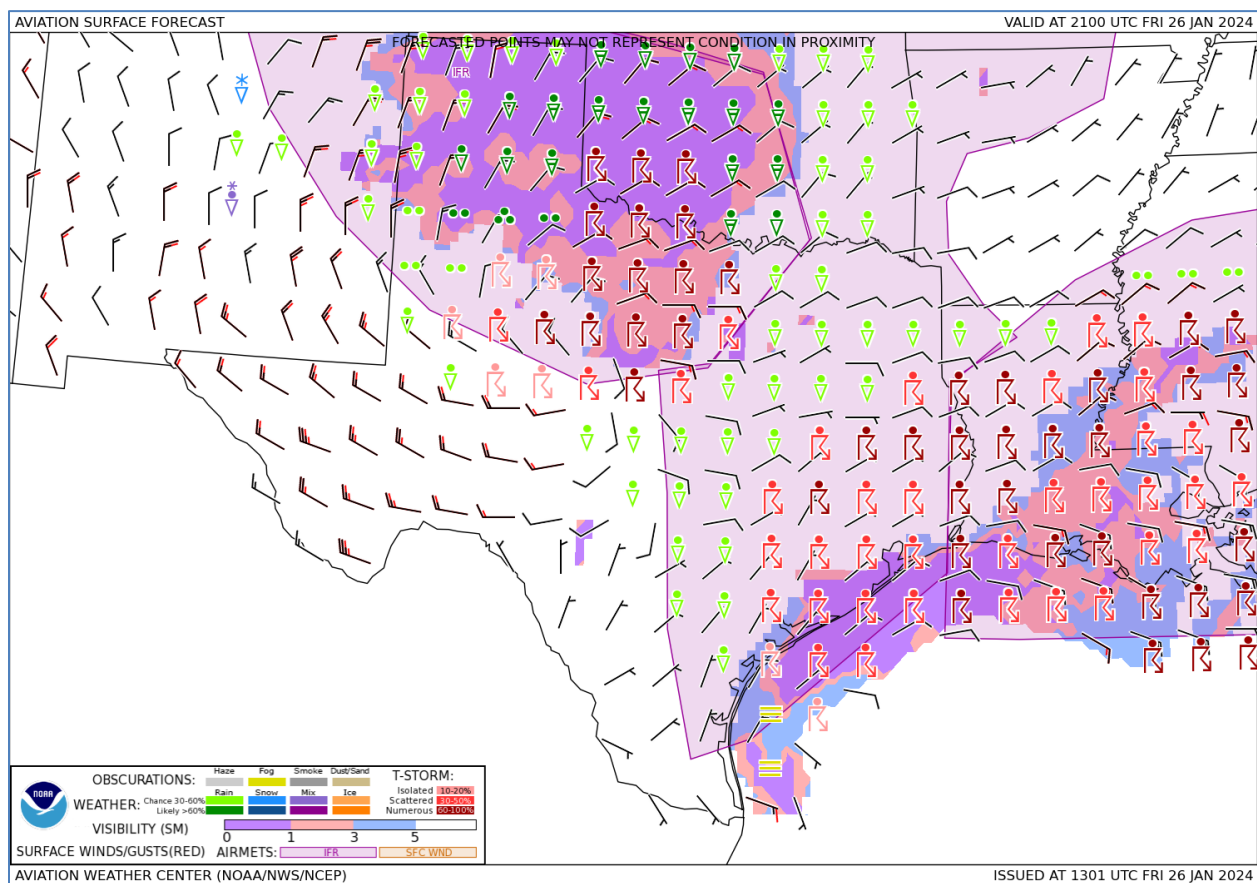


Figure 32 - Graphic Forecast for Aviation (GFA) 9-hour surface forecast valid for the period between 1500 and 1800 CST.

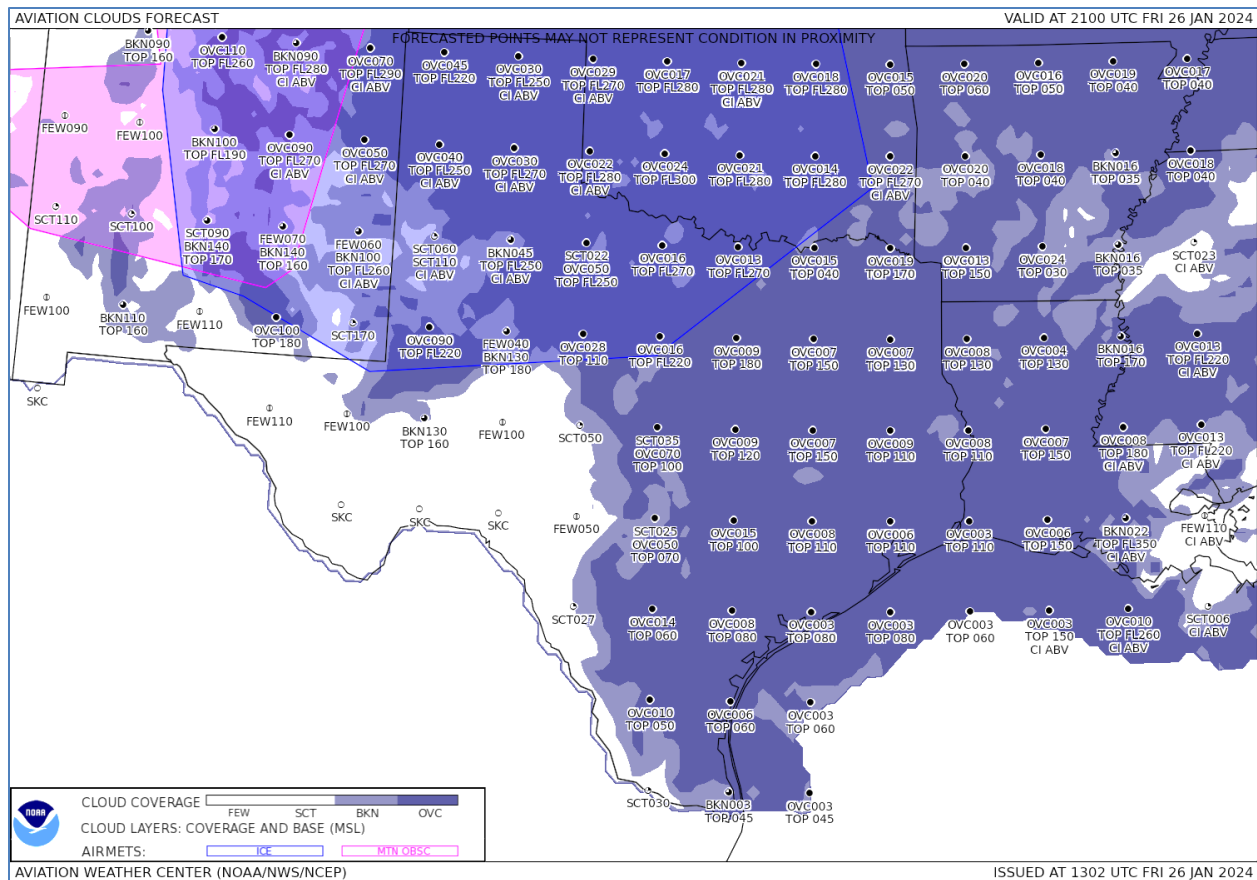


Figure 33 - Graphic Forecast for Aviation (GFA) 9-hour cloud forecast valid for the period between 1500 and 1800 CST.

7.4 Traffic Flow Management Convective Forecast

The Traffic Flow Management (TFM) Convective Forecast (TCF) is used by air traffic management decision makers in support of convective weather mitigation strategies within the national airspace system (NAS). It is designed to meet the needs of Traffic Flow Manager (TFM) decisionmakers at the FAA's Air Traffic Control System Command Center (ATCSCC), the FAA's Air Route Traffic Control Center's (ARTCC) Traffic Management Units (TMUs), and airline and corporate flight operations centers (FOC). The TCF is a high-confidence graphical representation of forecasted convection meeting specific criteria⁴¹ of coverage, intensity, and echo top height provided in 100's ft. The TCF graphics are produced every 2 hours and are valid at 4, 6, and 8 hours after issuance time.

Figures 34 and 35 are the TCF 4-hour and 6-hour forecasts valid for the period surrounding the time of the accident. The 4-hour forecast depicted an area of echoes

⁴¹ TCF criteria is for composite reflectivity of at least 40 dBZ, echo tops at or above 25,000 ft, with a coverage of at least 25% of the polygon, and forecaster confidence of at least 50%.

off the southeast Louisiana, Mississippi, Alabama, and Florida panhandle gulf coast with tops to FL340, with no organized thunderstorms depicted along the accident aircraft's route of flight. The TCF 6-hour forecast depicted scattered echoes over the area with tops to FL340.

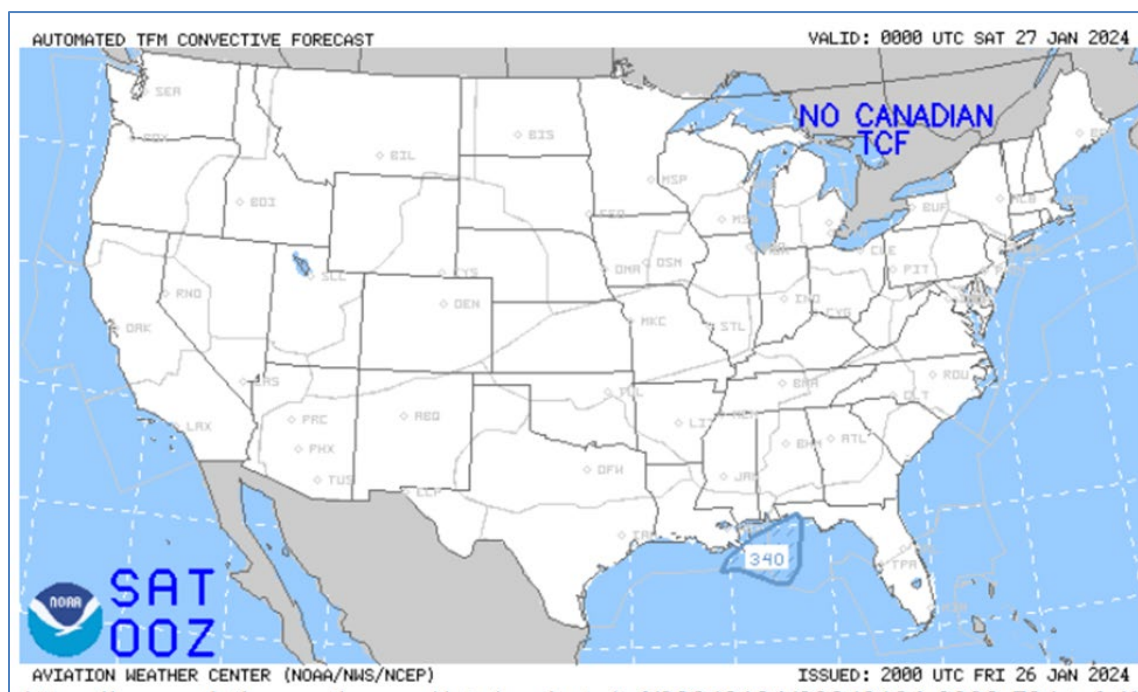


Figure 34 - TCF 4-hour Convective Forecast valid for 1800 CST with the accident site marked.



Figure 35 - TCF 6-hour Convective Forecast valid for 1900 CST with the accident site marked.

8.0 Inflight Weather Advisories

In-flight Aviation Weather Advisories are forecasts that advise en route aircraft of the development of potentially hazardous weather. Inflight aviation weather advisories in the conterminous U.S. are issued by the NWS AWC, as well as from the Center Weather Service Units (CWSU) at the various Air Route Traffic Control Centers (ARTCCs). There are four basic types of inflight aviation weather advisories: the Significant Meteorological Information (SIGMET), the Convective SIGMET, the G-AIRMET, and the Center Weather Advisory (CWA). Inflight advisories serve to notify en-route pilots of the possibility of encountering hazardous flying conditions that may not have been forecast at the time of the preflight briefing. Whether or not the condition described is potentially hazardous to a particular flight is for the pilot to evaluate based on experience and the operational limits of the aircraft. Once issued they are broadcast by FAA air traffic controllers upon issuance and available on inflight weather broadcasts.

The following advisories were applicable surrounding the time of the accident.

8.1 Convective SIGMETs

Convective SIGMETs are issued hourly at 55 minutes past the hour when any of the following conditions are occurring or, in the judgement of the forecaster, are expected to occur; a line of thunderstorms at least 60 miles long, an area of thunderstorms expected to have a significant impact on aviation covering at least 40% of the area concerned and with very strong radar reflectivity intensity or a significant satellite or lightning signature, embedded thunderstorms, or severe thunderstorms. Convective SIGMETs are current for a 2 hour period or until superseded by the next hourly issuance. Any Convective SIGMET implies the potential for severe or greater turbulence, severe icing, and low-level wind shear (LLWS).

At 1655 CST the NWS AWC issued Convective SIGMET 38C which extended over the route of flight and the accident site. The advisory warned of an area of thunderstorms moving from 250° at 30 knots, with tops to FL450⁴². A depiction of the Convective SIGMETs current at 1700 CST is included as figure 36, followed by the text version of the advisory.

⁴² Flight level (FL) reference to height in 100's of ft above msl.

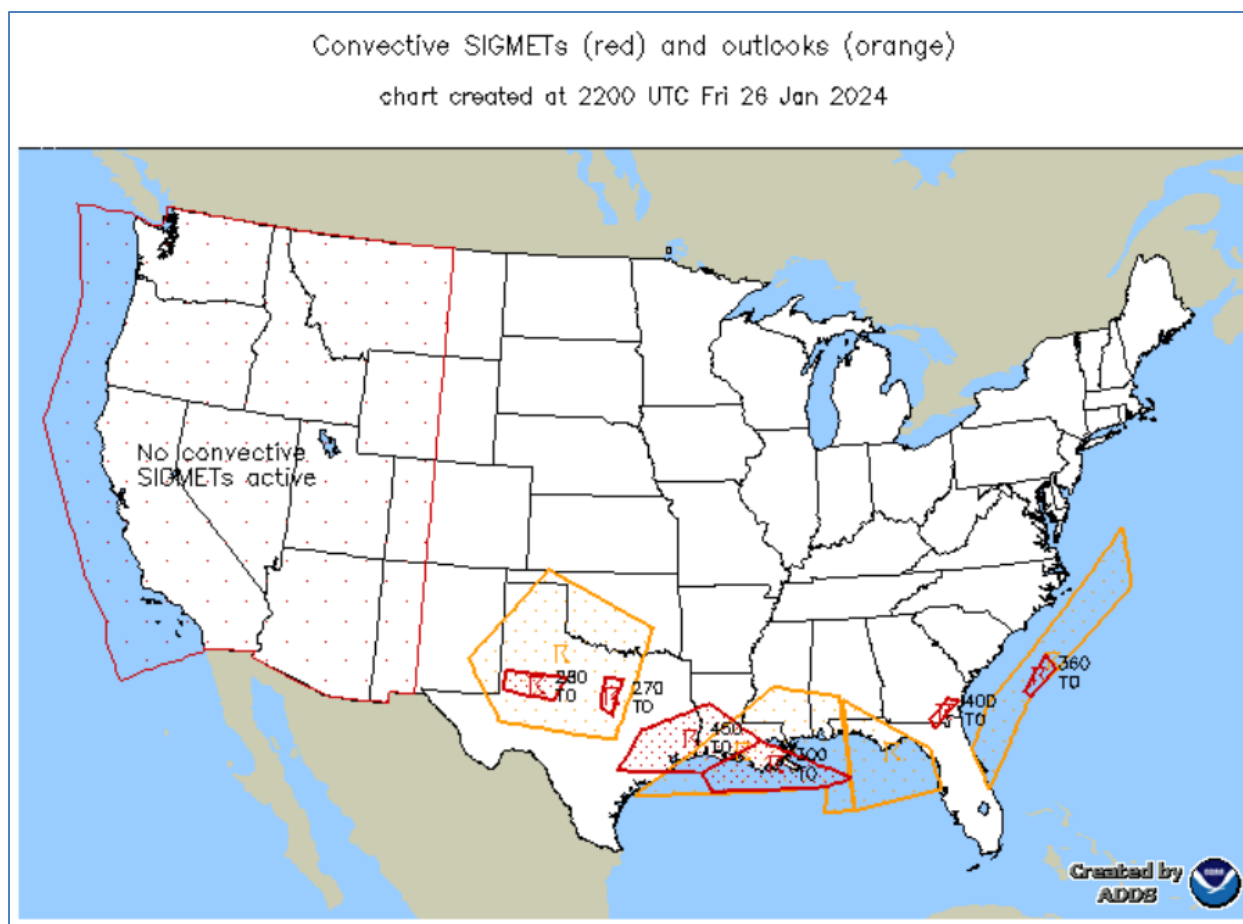


Figure 36 - Convective SIGMETs current at 1700 CST.

The text version of the Convective SIGMET issued at 1655 CST was as follows.

WSUS32 KPCI 262155

SIGC

CONVECTIVE SIGMET 38C

VALID UNTIL 2355Z

LA TX AND CSTL WTRS

FROM 50NW AEX-30ESE LSU-70SSW LCH-60WNW PSX-70NW IAH-50NW AEX

AREA TS MOV FROM 25030KT. TOPS TO FL450.

At 1755 CST the Convective SIGMET was updated by advisory 46C for an area of severe embedded thunderstorms moving from 250° at 30 knots, with tops above FL450, and hail to 1 inch was possible. Figure 37 is the depiction of the Convective SIGMETs for 1800 CST followed by the text version of the advisories.

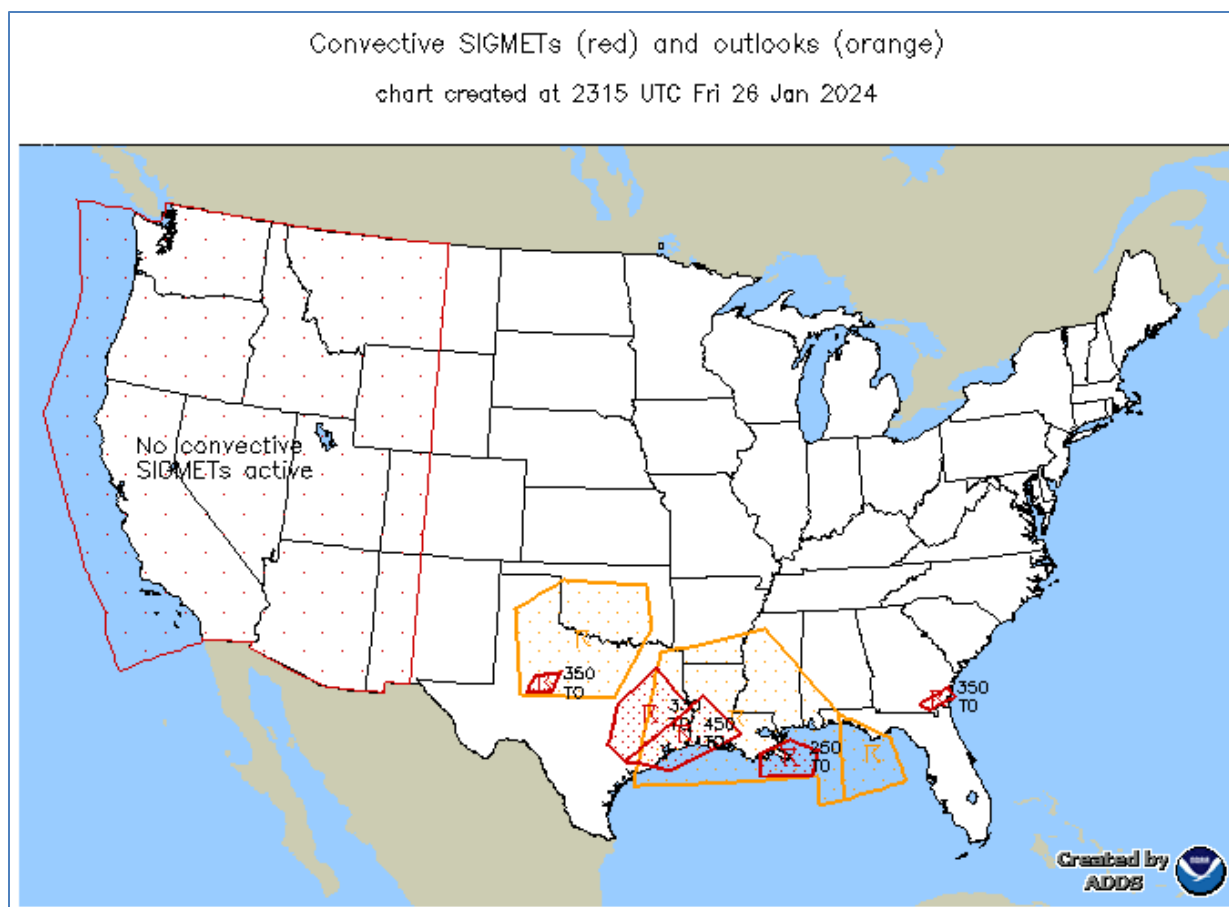


Figure 37 - Convective SIGMETs issued at 1800 CST.

The text version of the Convective SIGMETs issued at 1755 CST were as follows.

WSUS32 KPCI 262355

SIGC

CONVECTIVE SIGMET 46C

VALID UNTIL 0155Z

MS LA TX AND LA TX CSTL WTRS

FROM 10NW MLU-40W MHZ-20E LSU-100SSE IAH-30NW PSX-10NW MLU

AREA SEV EMBD TS MOV FROM 25030KT. TOPS ABV FL450. HAIL TO 1 IN POSS.

WSUS32 KPCI 262355

SIGC

CONVECTIVE SIGMET 45C

VALID UNTIL 0155Z

LA TX

FROM 60ESE TTT-50NW AEX-30NW PSX-30SSE CWK-10WNW ACT-60ESE TTT

AREA EMBD TS MOV FROM 25030KT. TOPS TO FL310.

8.2 Center Weather Advisories

The Houston ARTCC CWSU issued no CWA's surrounding the period of the accident on January 26th, 2024.

8.3 Graphic-AIRMETs

The NWS AWC issued a Graphic - AIRMET for IFR conditions that was active for the accident site at 1800 CST and is depicted in figure 38.

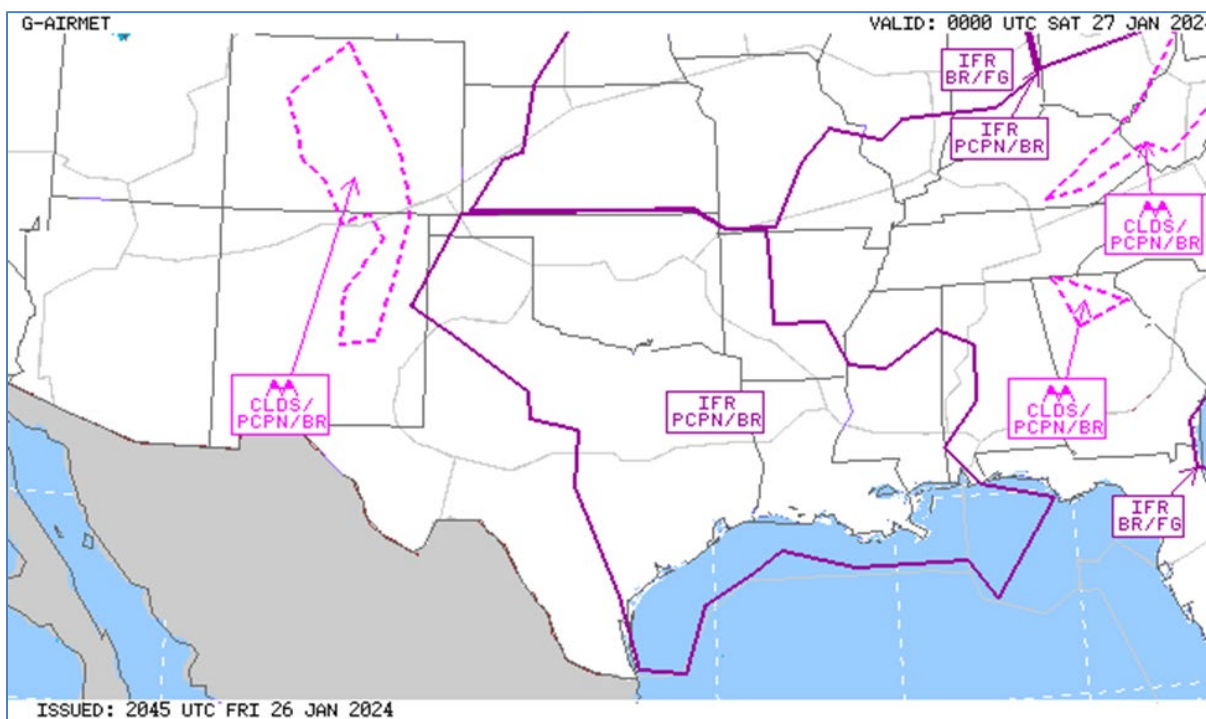


Figure 38 - Graphic AIRMET valid for 1800 CST for IFR conditions.

9.0 NWS Local Weather Warnings

The following weather advisories and warnings were issued by the NWS KLCH WFO surrounding the period and not disseminated to aviation interests but are broadcasted on local emergency alert networks to the public.

9.1 Severe Weather Statements

The NWS KLCH WFO issued the following severe weather statement to the immediately prior to the accident at 1724 CST as a strong thunderstorm capable of

producing large hail was identified in the immediate area. The image related to the advisory is included as figure 39.

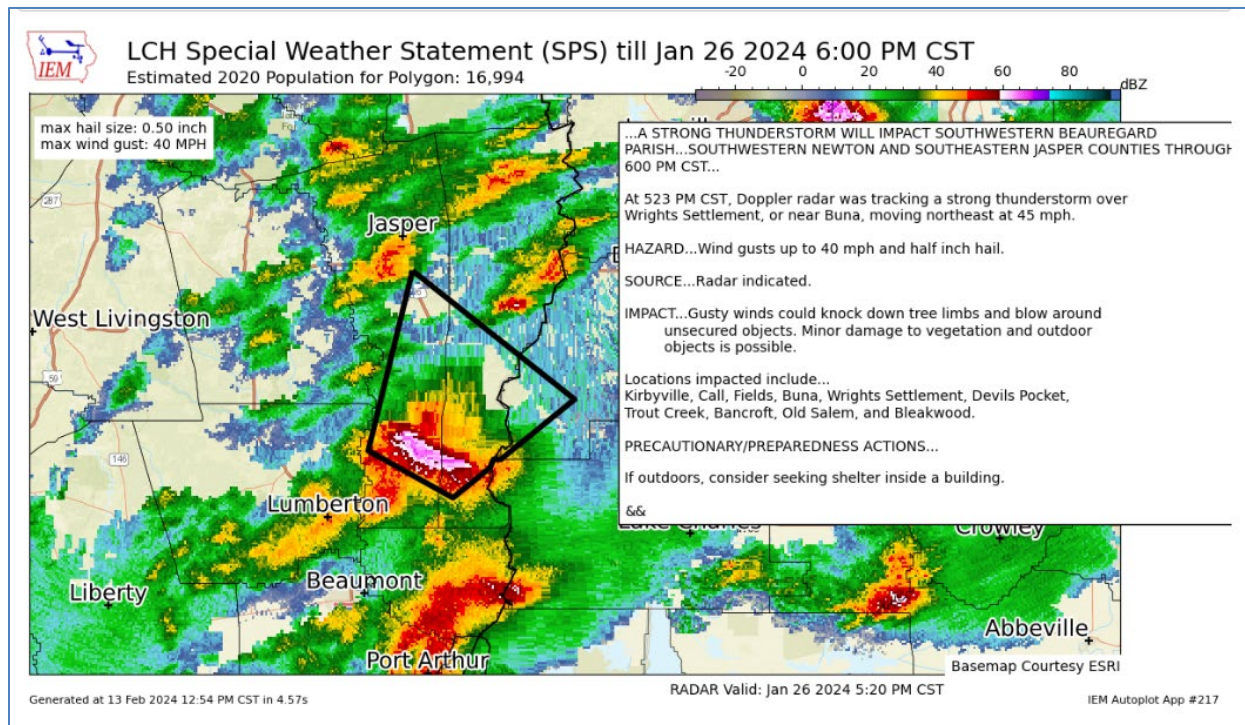


Figure 39 - NWS KLCH WFO Special Weather Statement for strong thunderstorms and hail.

The text version of the special weather statement was as follows:

WWUS84 KLCH 262324
SPSLCH

Special Weather Statement
National Weather Service Lake Charles LA
524 PM CST Fri Jan 26 2024

LAZ030-TXZ259>262-270000-
Beauregard LA-**Southern Newton TX**-Northern Newton TX-Northern Jasper TX-
Southern Jasper TX-
524 PM CST Fri Jan 26 2024

...A STRONG THUNDERSTORM WILL IMPACT SOUTHWESTERN BEAUREGARD PARISH
....SOUTHWESTERN NEWTON AND SOUTHEASTERN JASPER COUNTIES THROUGH
600 PM CST...

At 523 PM CST, Doppler radar was tracking a strong thunderstorm over Wrights
Settlement, or near Buna, moving northeast at 45 mph.

HAZARD...Wind gusts up to 40 mph and half inch hail.

SOURCE...Radar indicated.

IMPACT...Gusty winds could knock down tree limbs and blow around unsecured objects. Minor damage to vegetation and outdoor objects is possible.

Locations impacted include...

Kirbyville, Call, Fields, Buna, Wrights Settlement, Devils Pocket, Trout Creek, Bancroft, Old Salem, and Bleakwood.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

If outdoors, consider seeking shelter inside a building.

LAT...LON 3084 9397 3054 9353 3040 9373 3040 9375
 3038 9376 3031 9386 3042 9409
TIME...MOT...LOC 2323Z 216DEG 39KT 3046 9389

MAX HAIL SIZE... 0.50 IN
MAX WIND GUST... 40 MPH

9.2 Severe Thunderstorm Warning

Immediately before the accident at 1733 CST the NWS KLCH WFO issued a severe thunderstorm warning valid through 1800 CST, which included the accident site. The advisory was as follows:

*WUUS54 KLCH 262333
SVRLCH
LAC011-TXC241-351-270000-
/O.NEW.KLCH.SV.W.0014.240126T2333Z-240127T0000Z/*

*BULLETIN - IMMEDIATE BROADCAST REQUESTED
Severe Thunderstorm Warning
National Weather Service Lake Charles LA
533 PM CST Fri Jan 26 2024*

The National Weather Service in Lake Charles has issued a

** Severe Thunderstorm Warning for...*

*Northwestern Beauregard Parish in southwestern Louisiana... **Southern Newton County in southeastern Texas...** East central Jasper County in southeastern Texas...*

*** Until 600 PM CST.**

*** At 533 PM CST, a severe thunderstorm was located over Call, moving north at 50 mph.**

HAZARD...Quarter size hail.

SOURCE...Radar indicated.

IMPACT...Damage to vehicles is expected.

** Locations impacted include...*

Newton, Kirbyville, Merryville, Call, Bon Weir, Trout Creek, Bivens, Old Salem, Jamestown, Roganville, Bancroft, Harrisburg, and Bleakwood.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

For your protection move to an interior room on the lowest floor of a building.

LAT...LON 3044 9378 3055 9401 3103 9392 3076 9344
TIME...MOT...LOC 2333Z 198DEG 45KT 3061 9388

HAIL THREAT... RADAR INDICATED
MAX HAIL SIZE... 1.00 IN
WIND THREAT... RADAR INDICATED
MAX WIND GUST... <50 MPH

A second advisory was issued at 1758 CST or immediately after the hail encounter and valid through 1930 CST warning of a severe thunderstorm with possible considerable damage. The accident site was located within the boundary of this advisory and in the immediate vicinity of Newton, Texas.

WUUS54 KLCH 262358
SVRLCH
LAC115-TXC351-270030-
/O.NEW.KLCH.SV.W.0015.240126T2358Z-240127T0030Z/

BULLETIN - IMMEDIATE BROADCAST REQUESTED

Severe Thunderstorm Warning

National Weather Service Lake Charles LA
558 PM CST Fri Jan 26 2024

The National Weather Service in Lake Charles has issued a

* Severe Thunderstorm Warning for...
Western Vernon Parish in west central Louisiana...
Northern Newton County in southeastern Texas...

*** Until 630 PM CST.**

*** At 558 PM CST, a severe thunderstorm was located near Newton, moving northeast at 50 mph.**

HAZARD...60 mph wind gusts and ping pong ball size hail.

SOURCE...Radar indicated.

IMPACT...People and animals outdoors will be injured. Expect hail damage to roofs, siding, windows, and vehicles. Expect considerable tree damage. Wind damage is also likely to mobile homes, roofs, and outbuildings.

* Locations impacted include...

Newton, Anacoco, Toledo Bend Dam, Bon Weir, Burkeville, Jamestown, Farrsville, Burr Ferry, Mayflower, Stringtown, Evans, and Wiergate.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

For your protection move to an interior room on the lowest floor of a building.

Large hail, damaging wind, and continuous cloud to ground lightning are occurring with this storm. Move indoors immediately. Lightning is one of nature's leading killers. Remember, if you can hear thunder, you are close enough to be struck by lightning.

LAT...LON 3126 9322 3088 9352 3088 9355 3084 9357
3083 9355 3071 9365 3079 9387 3116 9384
3118 9362 3117 9358 3120 9355 3124 9356
3128 9353 3128 9344
TIME...MOT...LOC 2358Z 204DEG 45KT 3087 9369

THUNDERSTORM DAMAGE THREAT...CONSIDERABLE

HAIL THREAT... RADAR INDICATED
MAX HAIL SIZE... 1.50 IN
WIND THREAT... RADAR INDICATED
MAX WIND GUST... 70 MPH

Stigger/87

9.3 Storm Reports

The following Storm reports were received by the NWS KLCH WFO on January 26, 2024.

Time	Event	City/County	Coordinates	Remarks
1735	Hail 1.75"	1 SE Kirbyville, Jasper, TX	30.65N 93.89W	Jasper Co Sheriff Dept received reports of hail in Kirbyville. (LCH)
1759	Hail 4.00"	1 E Newton, Newton, TX	30.85N 93.74W	Picture from Newton shows large hail at least 4 inch diameter. Reported as 5 inches but needs additional investigation. (LCH)
1805	Hail 1.34"	Newton, Newton, TX	30.85N 93.75W	Newton County Sheriff Dept reports golf ball size hail, which broke the windshield of a deputy's vehicle. (LCH)

10.0 Weather Briefing and Statement

The pilot had filed an instrument flight plan for the flights and obtained a standard ForeFlight weather briefing prior to departing on the first leg of the flight from Abbeville (KAYI), LA to Abaline (KABI), TX, and for the return leg. He was aware of the

general forecast conditions and for a chance of convection on his return leg. The pilot interview is included in the docket.

11.0 Weather in the Cockpit Display

The accident airplane did not have an airborne weather radar installed or a StormScope for lightning detection. The aircraft did have a Garmin 750 weather display in the cockpit, which provided the pilot with the XM Weather Nexrad composite imagery to increase their situational awareness of the weather conditions. Attachment 4 contains the WX Weather composite radar images which were provided by Baron Services, Inc. for the period from 1730 through 1830 CST. As noted in Aviation Weather Handbook FAA-H-8083-28, the composite reflectivity product is created at the end of all the elevation scans, and as a result the image has an inherent latency. Unlike airborne weather avoidance radar, weather data linked from ground based weather surveillance radar system is not real-time information. The radar data displays recent weather rather than current weather conditions. The current location of a thunderstorm cell may be different than the broadcast weather product.

12.0 Astronomical Conditions

The United States Naval Observatory's website⁴³ provided the following astronomical data for the location of the hail encounter.

<u>Sun</u>	<u>Time (CST)</u>
Beginning civil twilight	0644
Sunrise	0710
Upper transit	1227
Sunset	1745
Accident	1755
End civil twilight	1811

F. ATTACHMENTS

- 1 - GOES-16 infrared satellite imagery animation over the regions for the period from 1700 through 1756 CST.
- 2 - GOES-16 infrared imagery animation with the GLM over the region for the period from 1700 through 1756 CST.

⁴³ https://aa.usno.navy.mil/data/RS_OneDay

3 - KLCH WSR-88D 1.8° base reflectivity animation.

4 - XM Weather Nexrad composite imagery over the region during the period from 1730 through 1830 CST.

Submitted by:

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