



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

February 26, 2020

Weather Study

METEOROLOGY

DCA19CA208

Table Of Contents

A.	ACCIDENT	3
B.	METEOROLOGY GROUP	3
C.	DETAILS OF THE INVESTIGATION	3
D.	FACTUAL INFORMATION	3
1.0	Weather Radar	3
2.0	Upper Air Data.....	6
3.0	Satellite Imagery	7
4.0	Pilot Reports.....	8
5.0	SIGMETs	8
6.0	CWSU Products	10
7.0	AIRMETs for Turbulence.....	10
8.0	CIWS.....	10
9.0	GTG	17
10.0	Astronomical Data	22

A. ACCIDENT

Location: Chicago, Illinois¹

Date: August 26, 2019

Time: about 2021 central daylight time (0121 UTC² on August 27, 2019)

Aircraft: Type - MD-88: Registration - N911DL

B. METEOROLOGIST

Mike Richards

Senior Meteorologist

Operational Factors Division (AS-30)

National Transportation Safety Board

C. DETAILS OF THE INVESTIGATION

The Meteorology Group did not travel in support of this investigation and gathered all data for this accident investigation remotely. Unless otherwise noted, all times are in central daylight time (CDT) for August 26, 2019 (based upon the 24-hour clock), directions are referenced to true north, distances are in nautical miles and heights are above mean sea level (msl).

Coordinates used for the accident location³ in this report: 41.691806° north latitude, 86.730924° west longitude at an altitude of 14,000 feet.

D. FACTUAL INFORMATION

1.0 Weather Radar

WSR-88D Level-II weather radar imagery from near Fort Wayne, Indiana (KIWX), are presented in Figures 1-3. KIWX was located approximately 52 miles east-southeast of the accident location an antenna height of about 1,055 feet. Assuming standard refraction and considering the 0.95°

¹ This location is often recorded as the nearest community with a US Post Office within the state where the accident/incident occurred. However, this location may not directly correlate to the coordinates of the accident site. Such situations include when the accident/incident occurred in a remote area, in international territories or aloft (where the aircraft landed safely at another location).

² UTC – abbreviation for Coordinated Universal Time

³ Exact location of the accident is unknown, however it is known that the accident occurred nears the HULLS waypoint at about 14,000 feet. The coordinates used to estimate the accident location in this report refer to the accident aircraft's position while at 14,000 feet near the HULLS waypoint, according to the aircraft's automatic dependent surveillance—broadcast track.

beam width for the WSR-88D radar beam, the KIWX 0.48° and 2.42° tilts would have “seen” altitudes above the accident location of between about 2,900 and 8,100 feet msl and between about 13,600 and 18,800 feet msl, respectively.

A vertical cross-section of the Level-II weather radar imagery around this time along and in front of the accident aircraft’s trajectory at the accident time is presented in Figure 3.

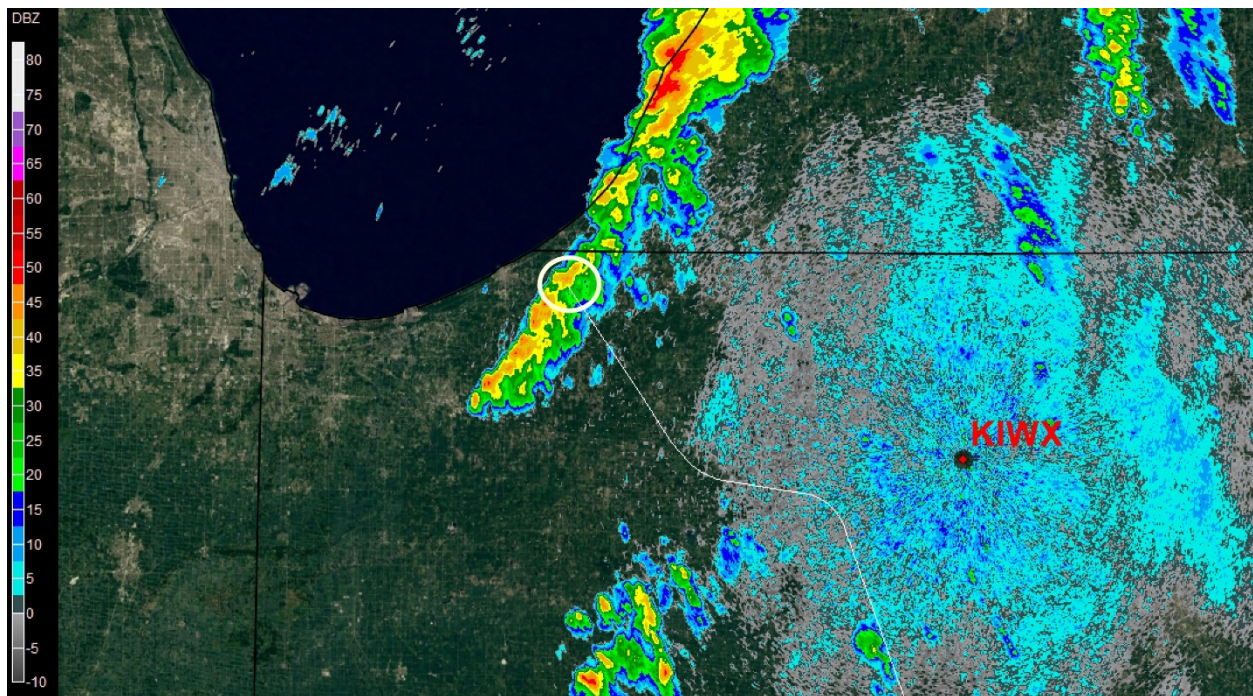


Figure 1 – KIWX 0.48° Level-II base reflectivity product from a sweep initiated at 2020:55 CDT. The accident aircraft’s flight path through 2021:00 CST is depicted by the white line. The accident location is within the white circle.

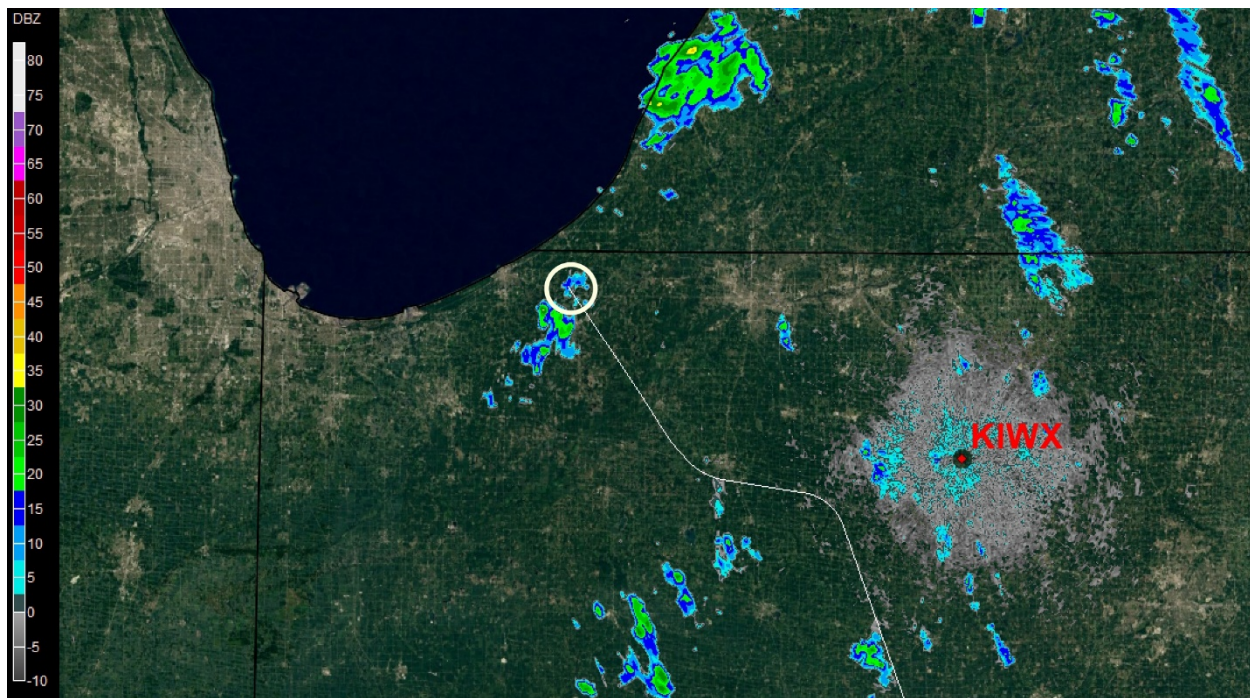


Figure 2 – KIWX 2.42° Level-II base reflectivity product from a sweep initiated at 2019:16 CDT. The accident aircraft’s flight path through 2021:00 CST is depicted by the white line. The accident location is within the white circle.

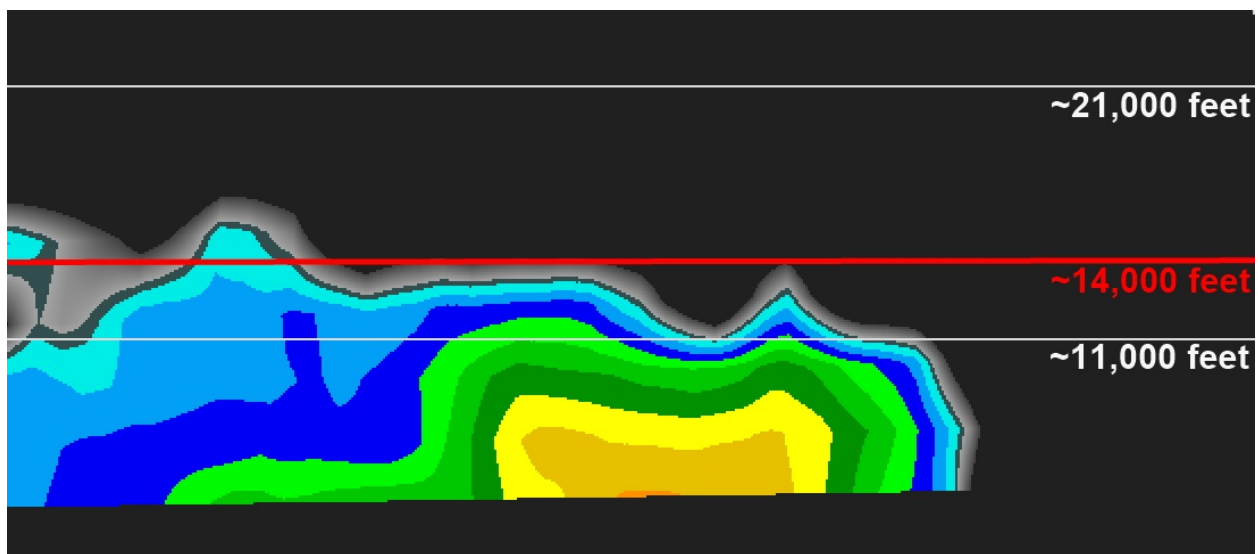


Figure 3 – Vertical cross-section of the KIWX Level-II weather radar imagery for the volume scan initiated at 2021:00 CDT along and in front of the accident aircraft’s trajectory at the accident time (mostly within the white circle in Figure 1). Color table is as presented in Figures 1 and 2.

A WSR-88D regional radar composite reflectivity mosaic obtained from the National Centers for Environmental Information (NCEI) for 2020 PST is presented in Figure 4.

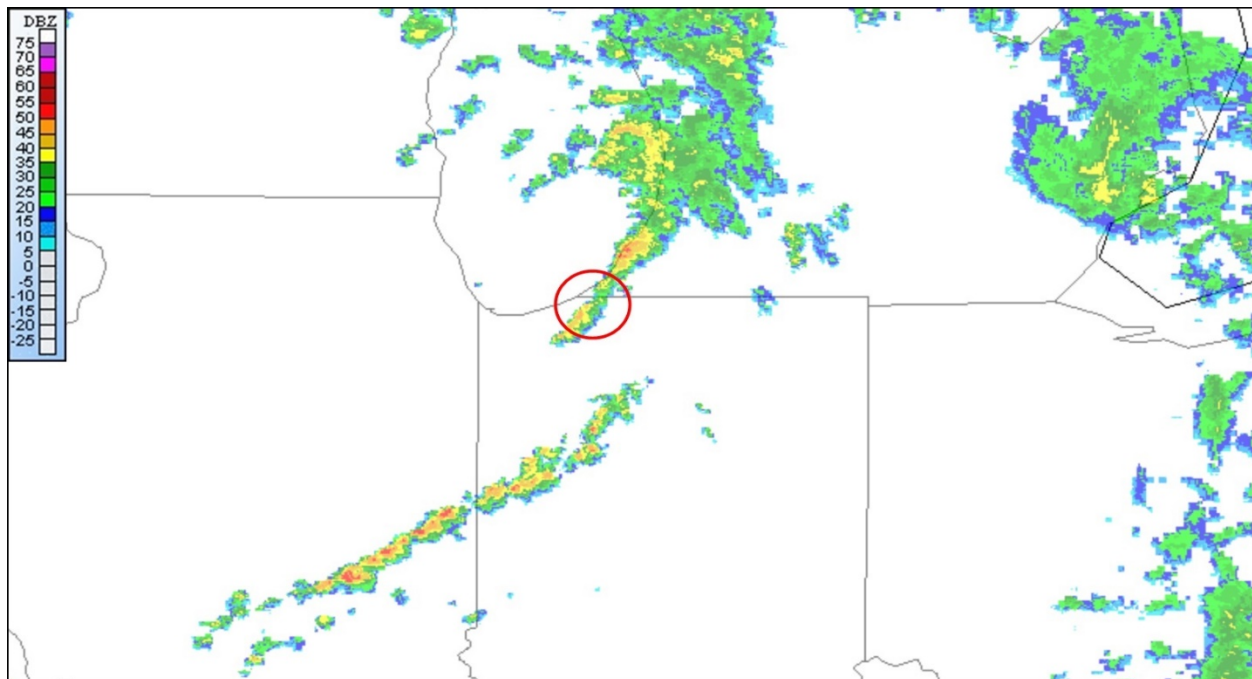


Figure 4 – NCEI WSR-88D mosaic from 2020 CDT. Accident location is within the red circle.

2.0 Upper Air Data

A High-Resolution Rapid Refresh (HRRR) model⁴ sounding (Figure 5) for the accident site at 2000 CDT was retrieved from the National Oceanic and Atmospheric Administration's Air Resources Laboratory. Near 14,000 feet the wind was from the west at about 30 knots. Calculations made by the Rawinsonde OBservation Program indicated the potential for moderate turbulence conditions between about 12,000 feet and 14,500 feet. The most-unstable Convective Available Potential Energy (CAPE) parameter was 383 Joules/kilogram (from 863 hectopascals [hPa]). The Lifting Condensation Level (LCL) was calculated to 1,122 feet and Level of Free Convection (LFC) for this scenario was calculated to be 7,728 feet. Maximum vertical velocity for the most-unstable atmosphere was calculated as 20 meters/second (about 4,000 feet per minute).

⁴ The HRRR is a NOAA real-time three-kilometer resolution, hourly-updated, cloud-resolving, convection-allowing atmospheric model, initialized by three-kilometer grids with three-kilometer radar assimilation. Radar data is assimilated in the HRRR every 15 minutes over a one-hour period.

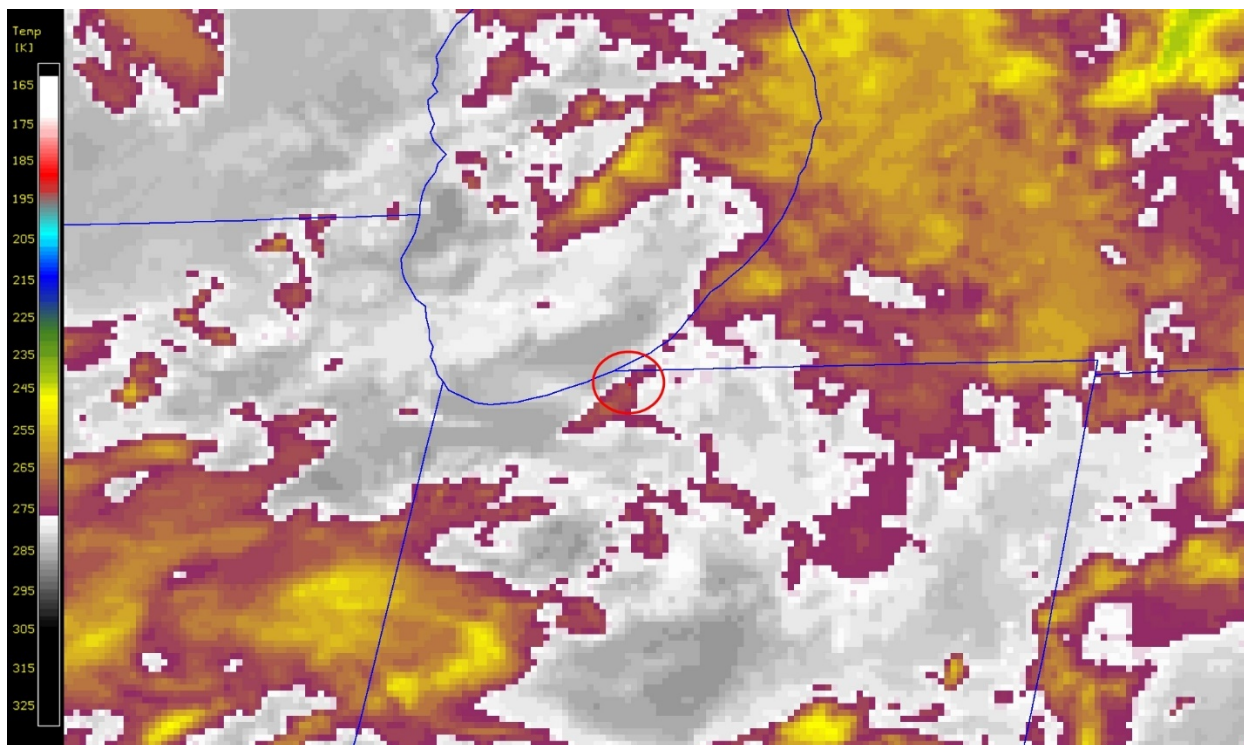


Figure 6 – GOES-17 infrared imagery from 2021 CDT. Accident location denoted by red circle. This image has not been corrected for parallax error.

4.0 Pilot Reports

The following pilot reports (PIREPs) were made within one hour and 20 miles of the accident site and disseminated to the Federal Aviation Administration's (FAA) public database.

SBN UA /OV GIJ270025/TM 0033/FL150/TP CRJ2/TB MOD

SBN UA /OV GIJ270020/TM 0042/FL200/TP B737/TA M08/IC MOD RIME

5.0 SIGMETs

There were no non-convective Significant Meteorological Information (SIGMET) advisories active in the region at the accident time.

At 1955 CDT, a Convective SIGMET was issued near to and applicable for the accident location (Figure 7) that advised of a line of thunderstorms 20 miles wide moving from 250° at 20 knots with cloud tops to FL280⁵.

WSUS31 KKCI 270055

SIGE

MKCE WST 270055

CONVECTIVE SIGMET 4E

VALID UNTIL 0255Z

MI IN IL LM

FROM 20NW PMM-40N BVT

LINE TS 20 NM WIDE MOV FROM 25020KT. TOPS TO FL280.

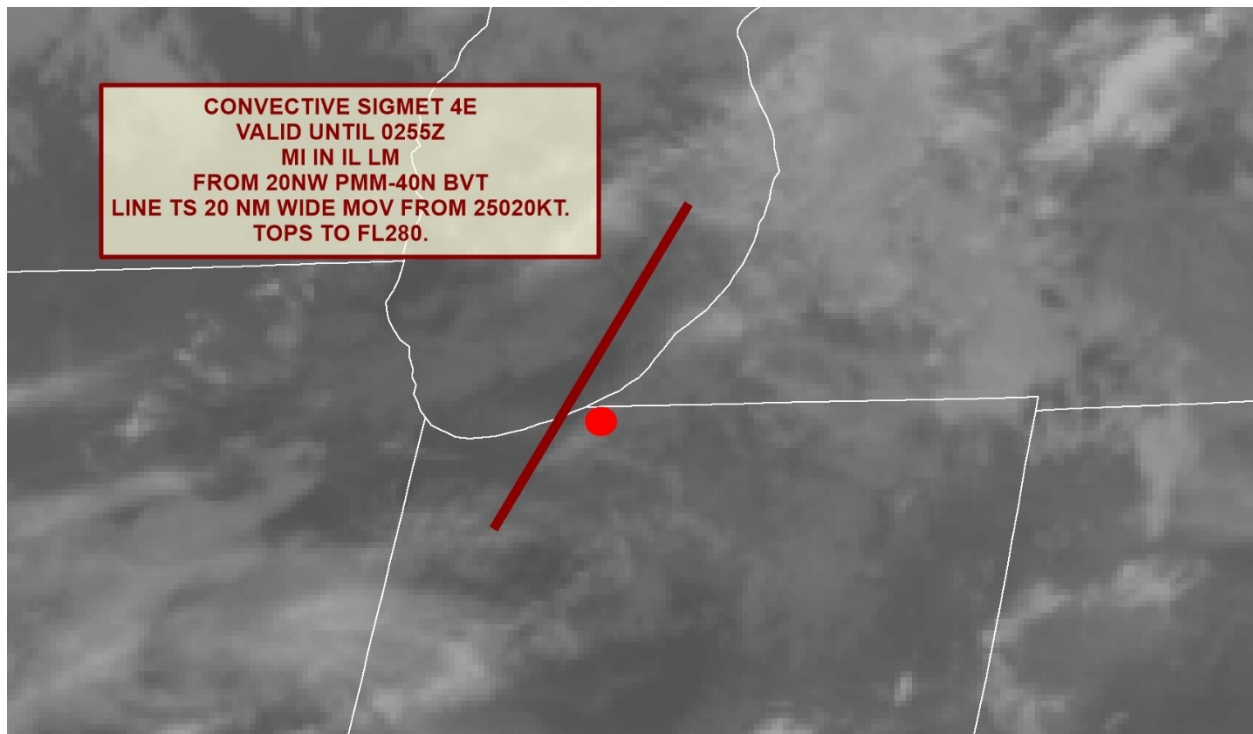


Figure 7 – Depiction of Convective SIGMET 4E. Accident location denoted by the red circle.

⁵ Flight Level (FL) - 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 inches of mercury), the average sea-level pressure, and therefore is not necessarily the same as the aircraft's true altitude either above msl or agl.

6.0 CWSU Products

There were no Center Weather Advisories or Meteorological Impact Statements active for the accident site at the accident time.

7.0 AIRMETs for Turbulence

There were no AIRMETs for turbulence active for the accident location below FL180.

8.0 CIWS

Archive data from the FAA's Corridor Integrated Weather System (CIWS) for the accident region between 2005 and 2025 CDT are presented in Figures 8-13. These images present growth and decay or echo top information and cloud-to-ground lightning flash detections from the National Lightning Detection Network, however no lightning was detected in the selected regions.

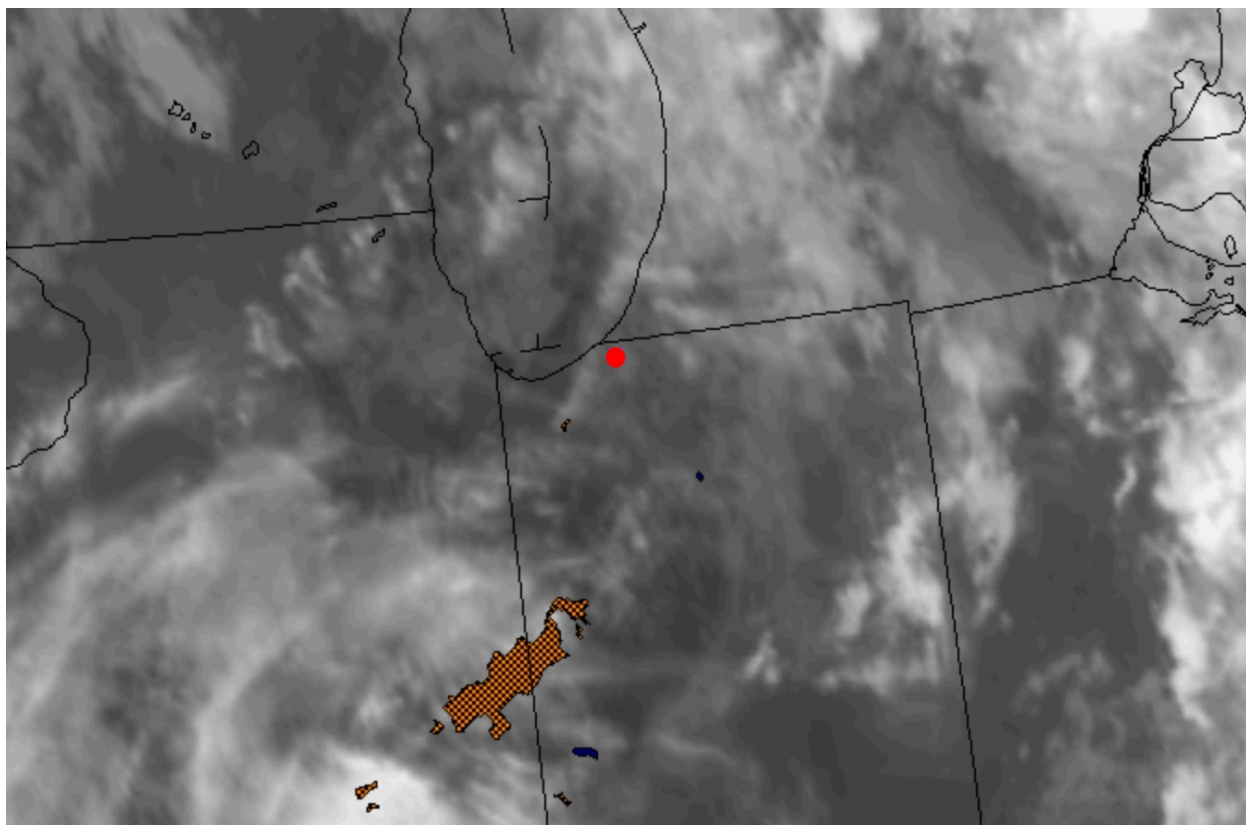


Figure 8 – Archive CIWS display from 2005 CDT. Areas of convective growth are identified by the orange hatched areas. The accident location is denoted by the red circle.

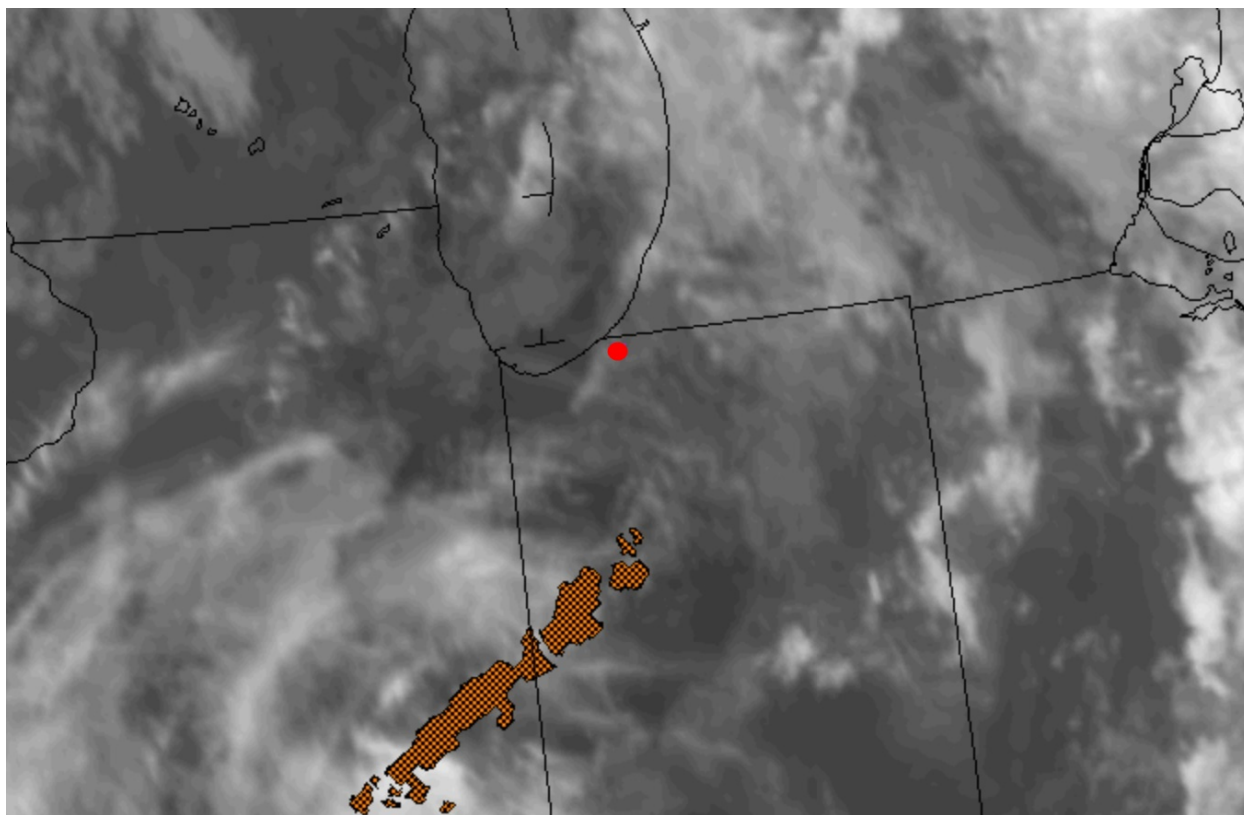


Figure 9 – Archive CIWS display from 2010 CDT. Areas of convective growth are identified by the orange hatched areas. The accident location is denoted by the red circle.

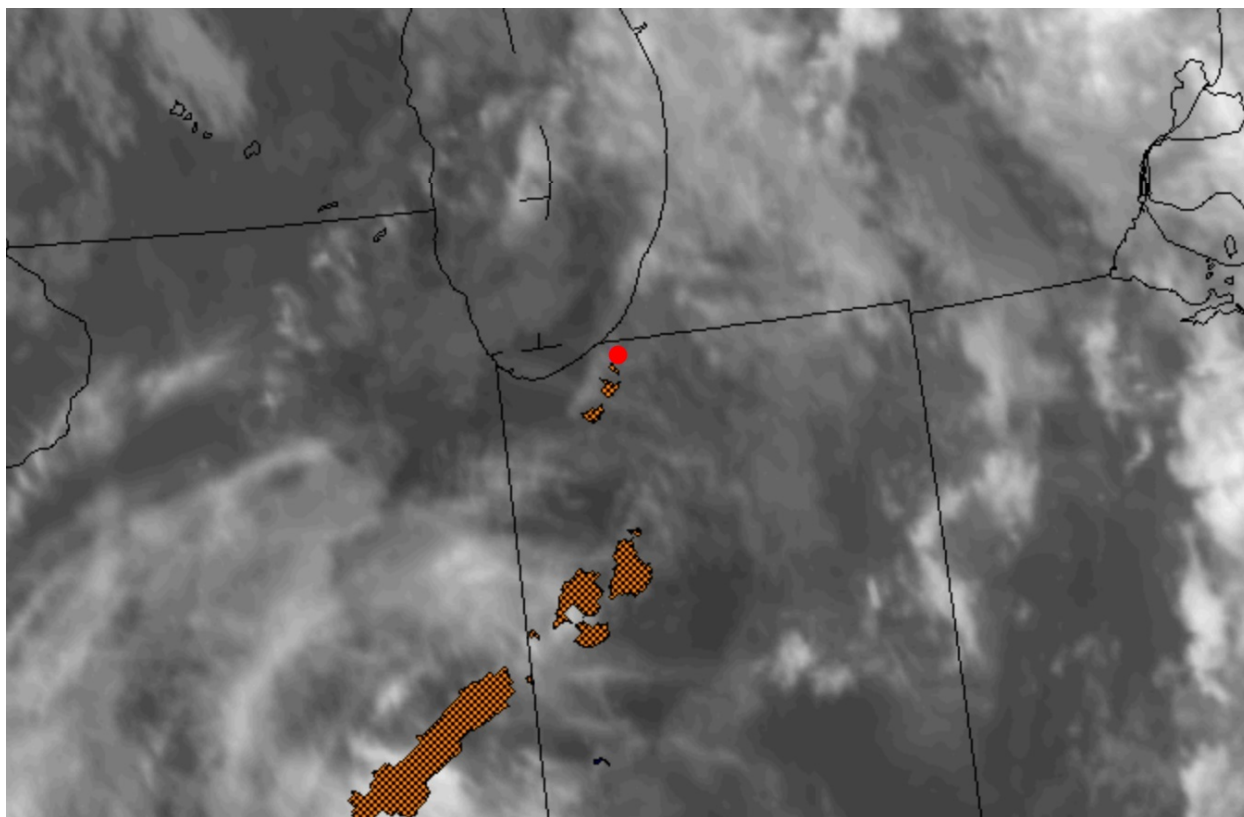


Figure 10 – Archive CIWS display from 2015 CDT. Areas of convective growth are identified by the orange hatched areas. The accident location is denoted by the red circle.

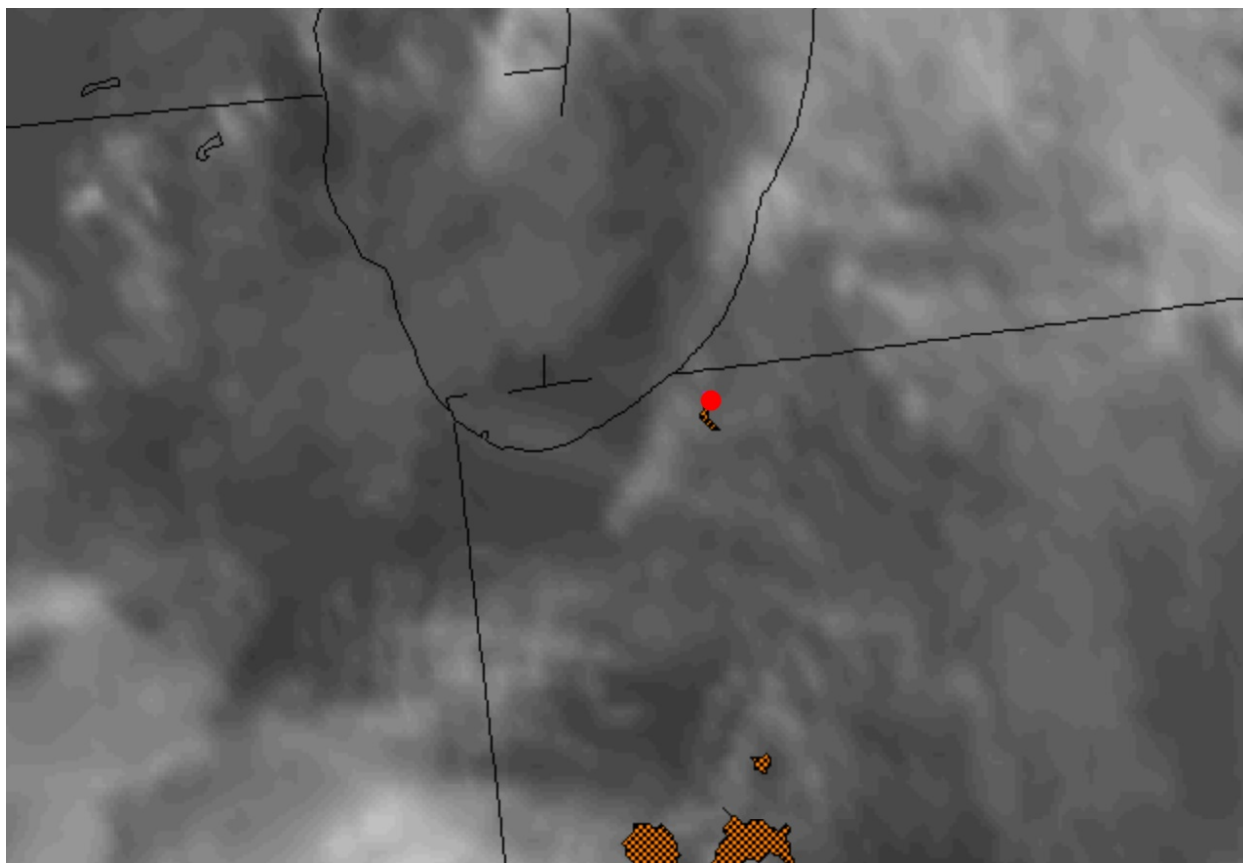


Figure 11 – Archive CIWS display from 2020 CDT. Areas of convective growth are identified by the orange hatched areas. The accident location is denoted by the red circle.

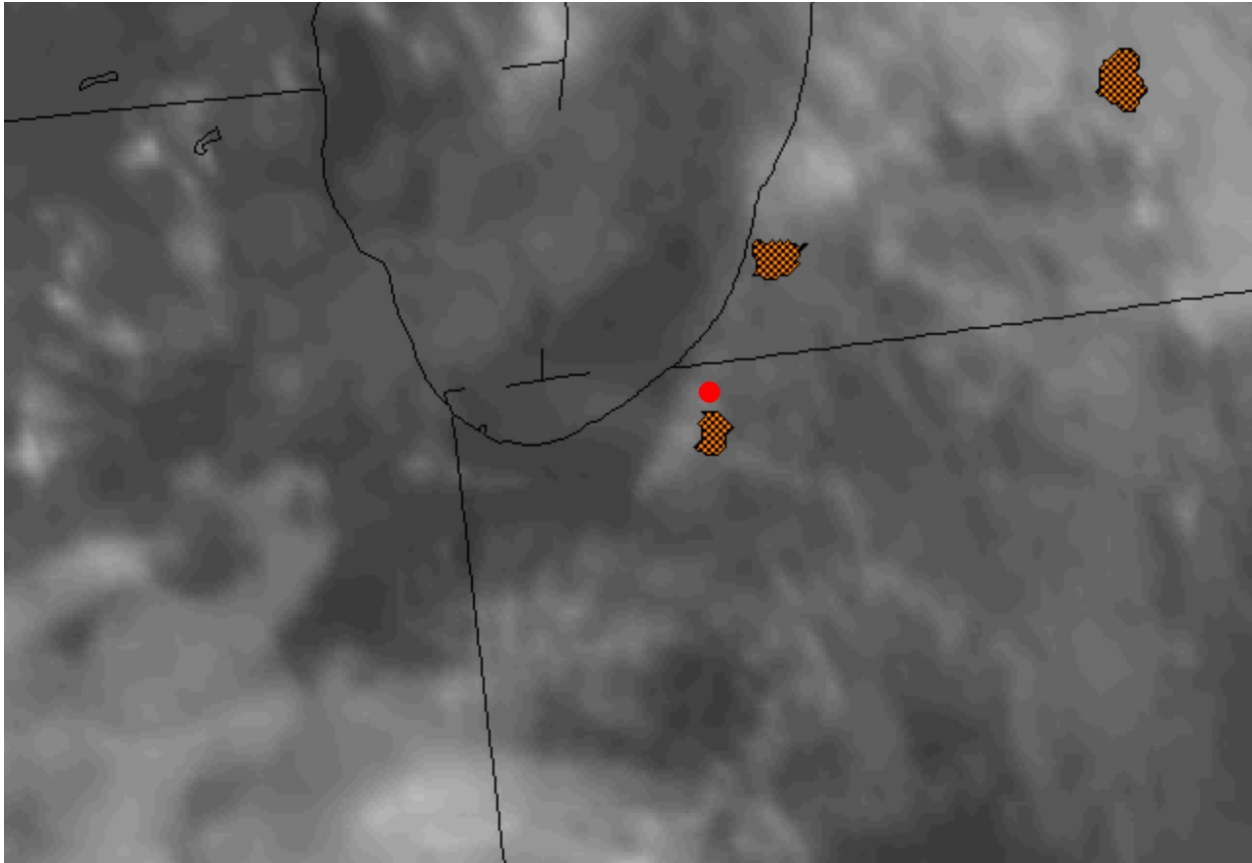


Figure 12 – Archive CIWS display from 2025 CDT. Areas of convective growth are identified by the orange hatched areas. The accident location is denoted by the red circle.

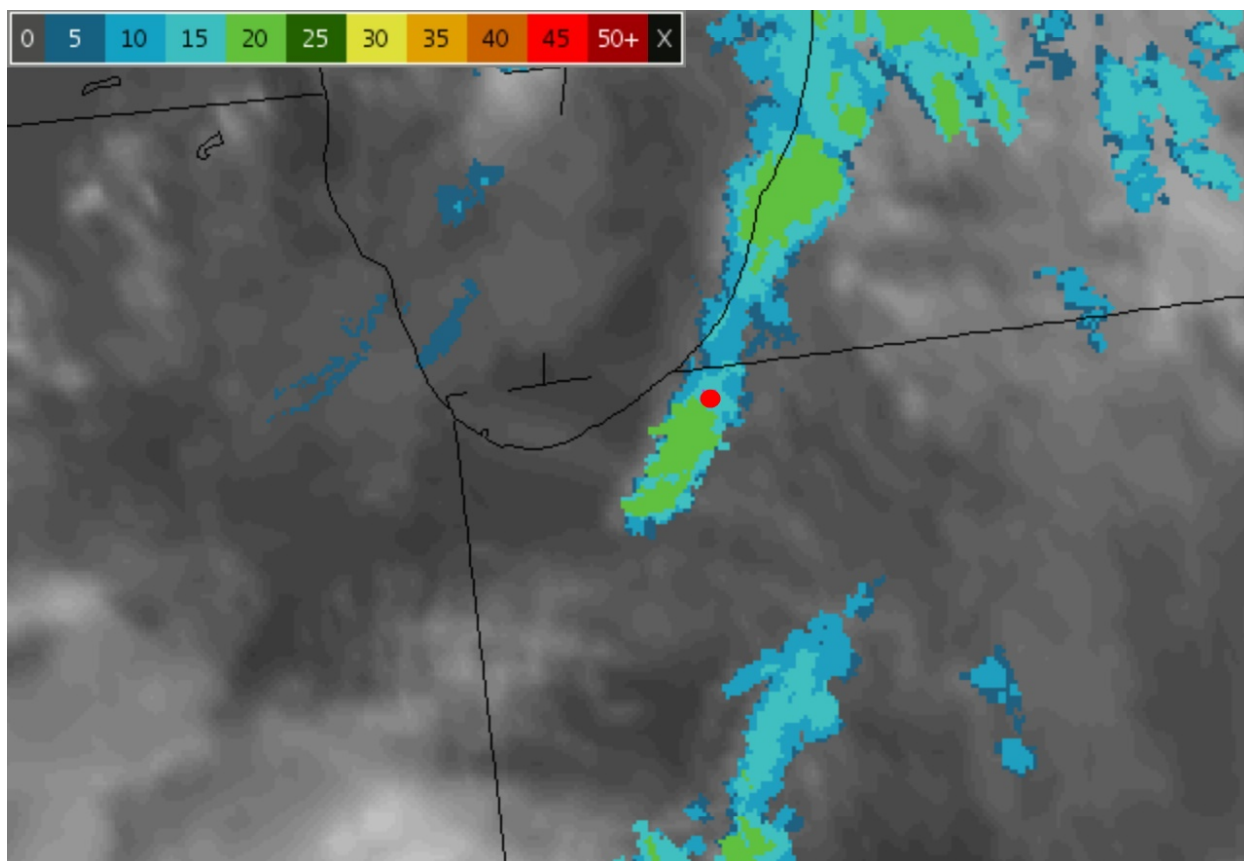
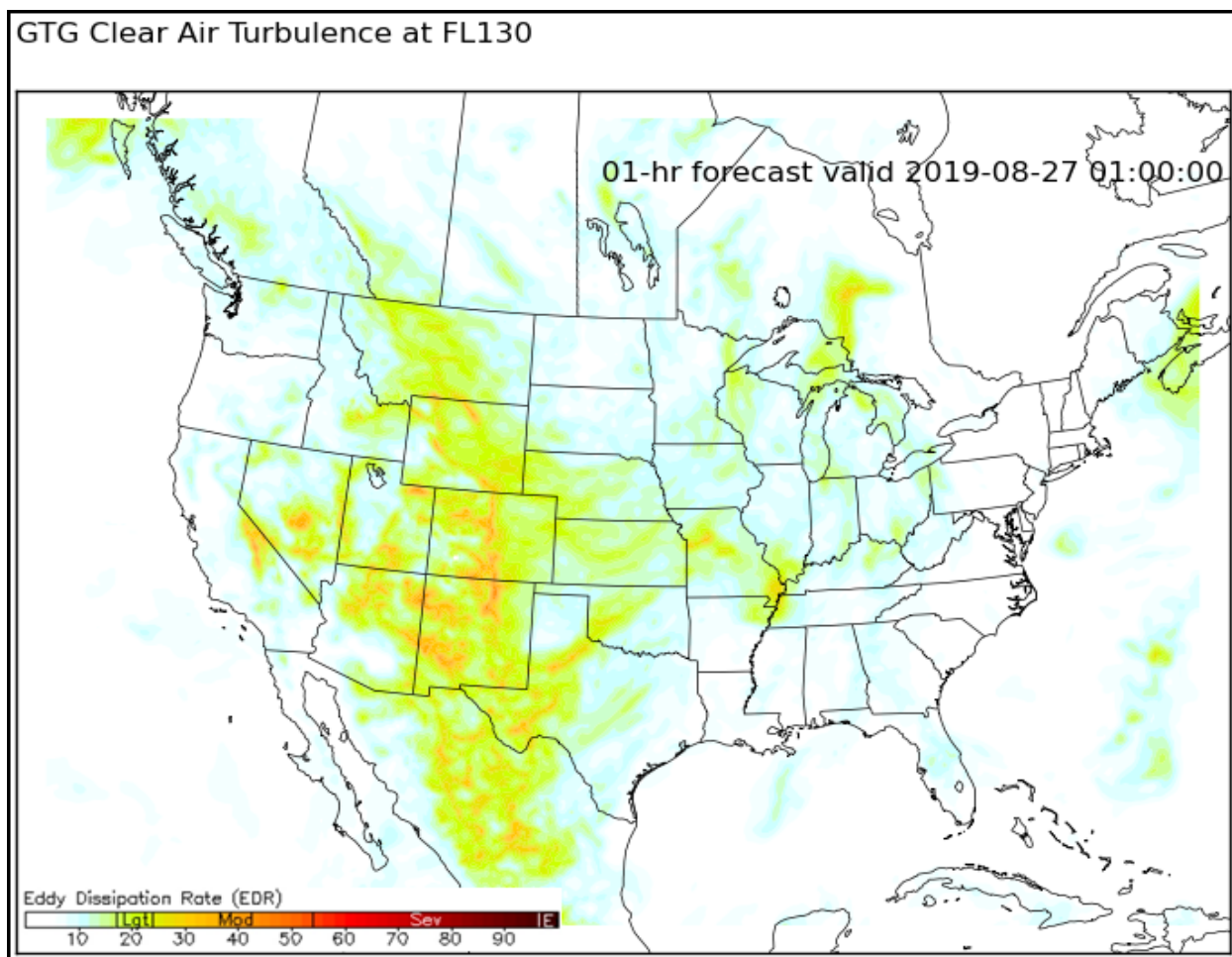


Figure 13 – Archive CIWS echo top (feet x 1,000) display from 2020 CDT. The accident location is denoted by the red circle.

9.0 GTG

The Graphical Turbulence Guidance (GTG) turbulence product is generated operationally at the National Centers for Environmental Prediction and published for public use on the Aviation Weather Center's (AWC) website.⁶ The GTG yields computer-generated four-dimensional forecasts of information related to the expected intensity of clear-air or mountain wave turbulence. It is not intended to predict turbulence associated with convection and thunderstorm clouds, but may provide some guidance in areas of properly predicted thunderstorms when the convection is widespread. Figures 14-19 present GTG clear-air turbulence forecast and analysis imagery for 2000 CDT for 13,000, 14,000 and 15,000 feet using the eddy dissipation rate scale applicable to “heavy” aircraft.



⁶ <https://www.aviationweather.gov/adds/>
MET WEATHER STUDY

Figure 14 – GTG clear air turbulence 1-hour forecast imagery valid for 13,000 feet at 2000 CDT.

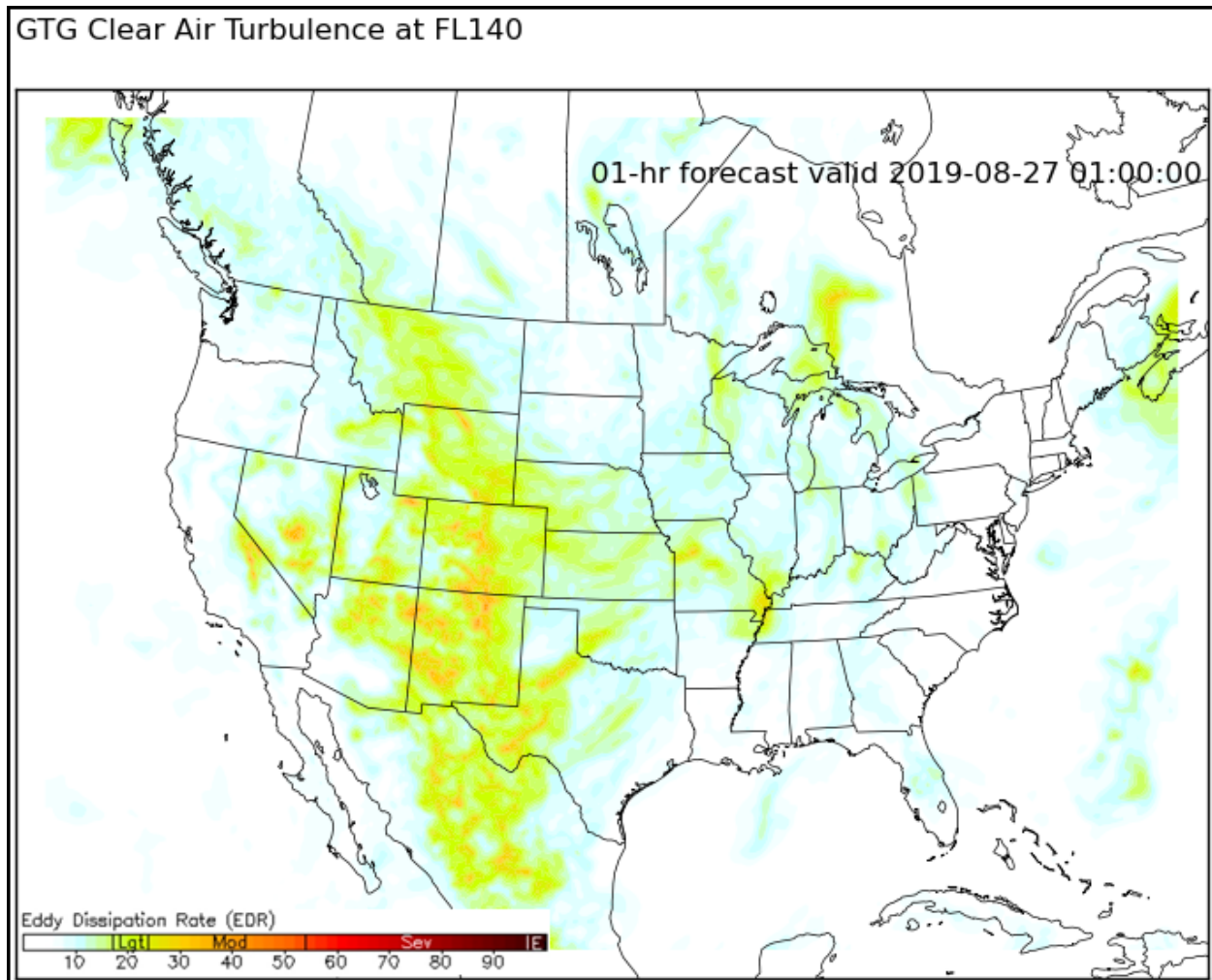


Figure 15 – GTG clear air turbulence 1-hour forecast imagery valid for 14,000 feet at 2000 CDT.

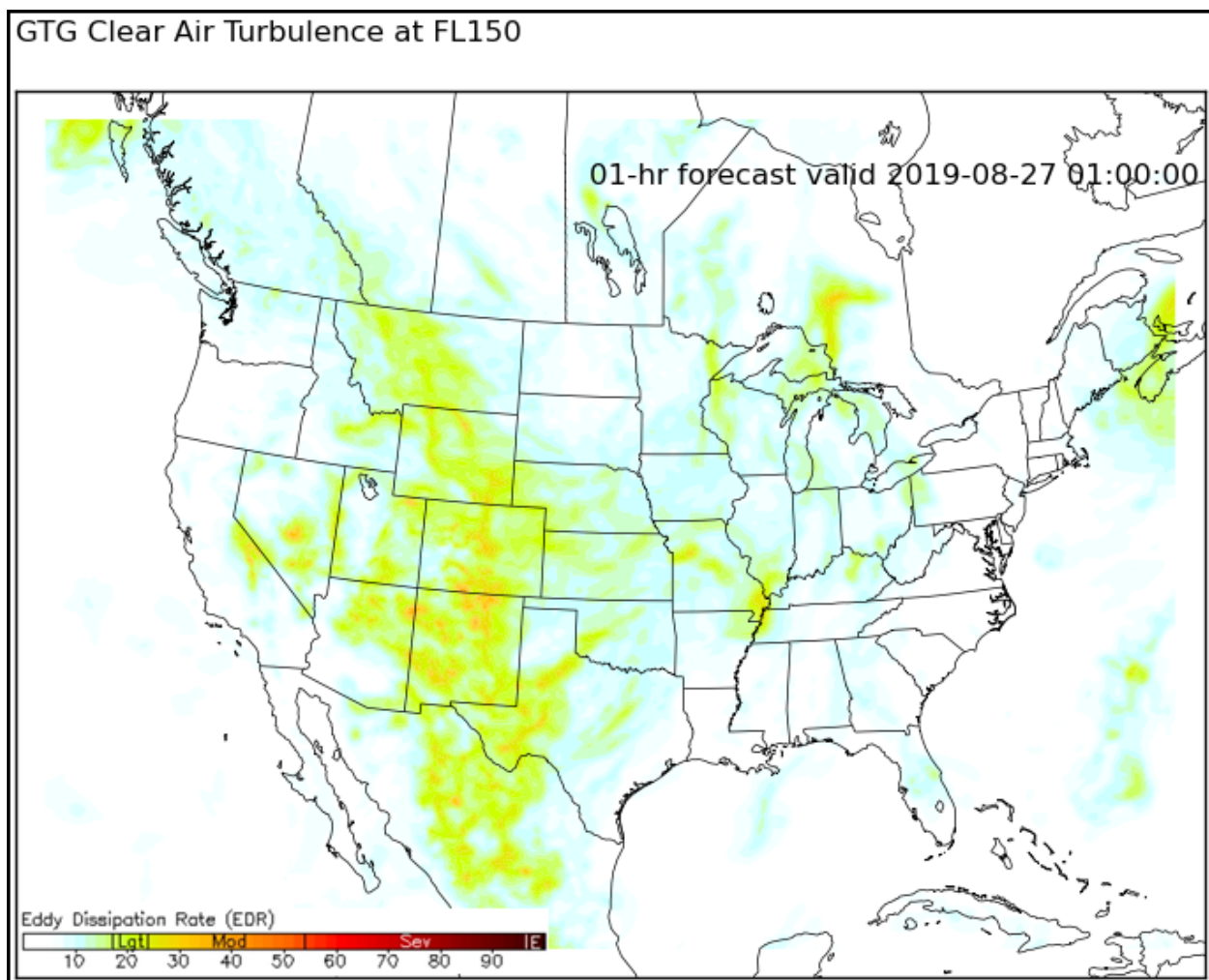


Figure 16 – GTG clear air turbulence 1-hour forecast imagery valid for 15,000 feet at 2000 CDT.

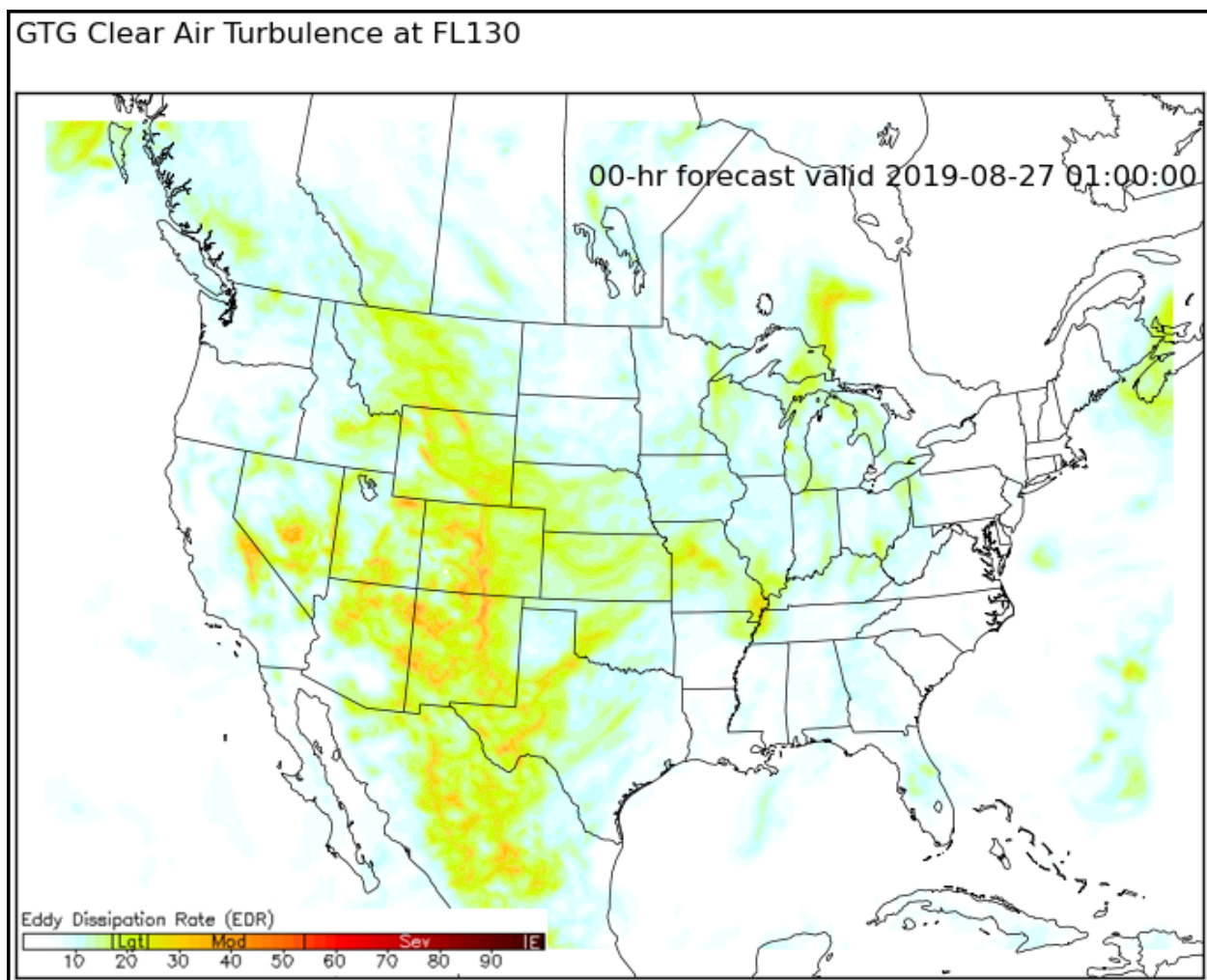


Figure 17 – GTG clear air turbulence analysis imagery valid for 13,000 feet at 2000 CDT.

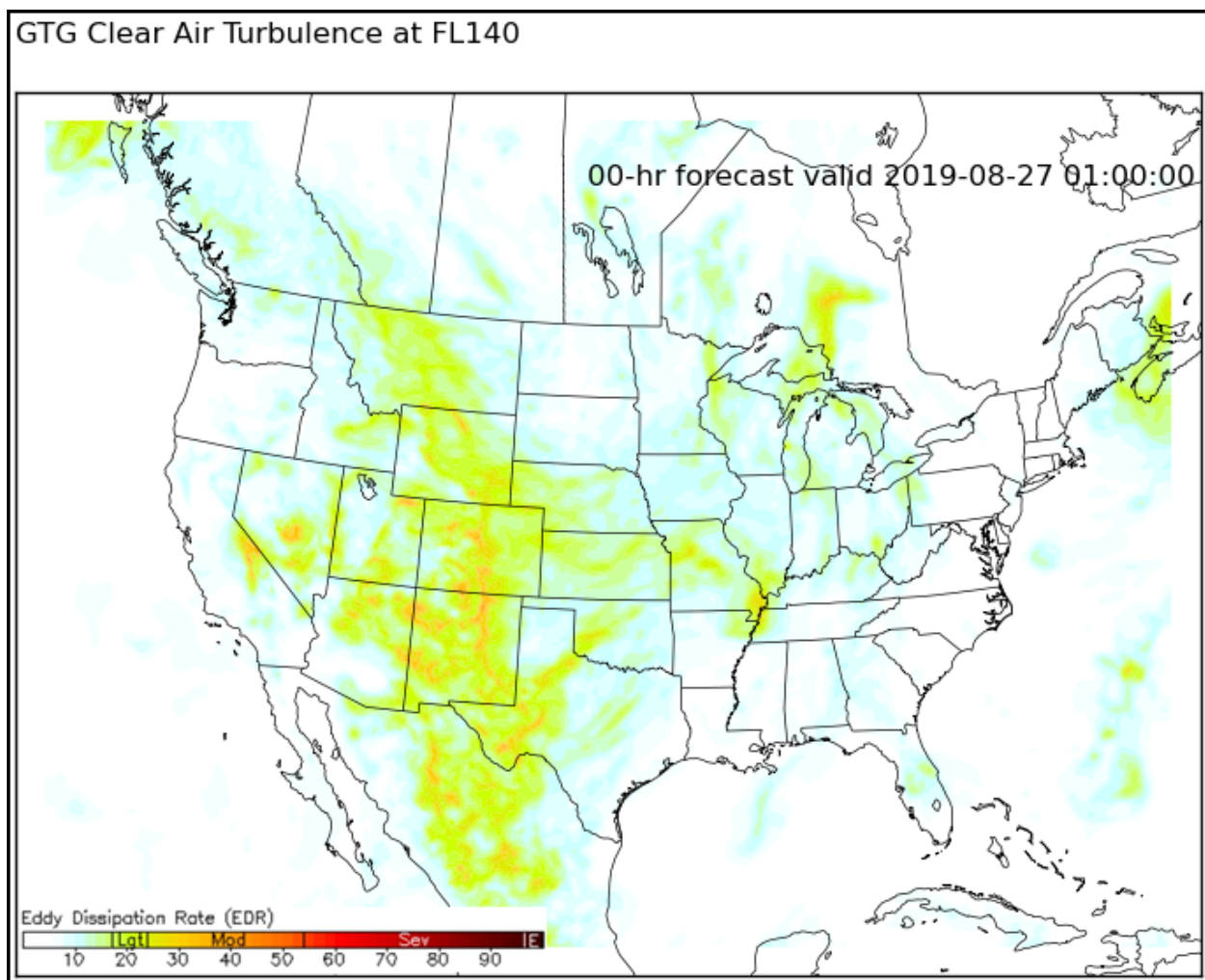


Figure 18 – GTG clear air turbulence analysis imagery valid for 14,000 feet at 2000 CDT.

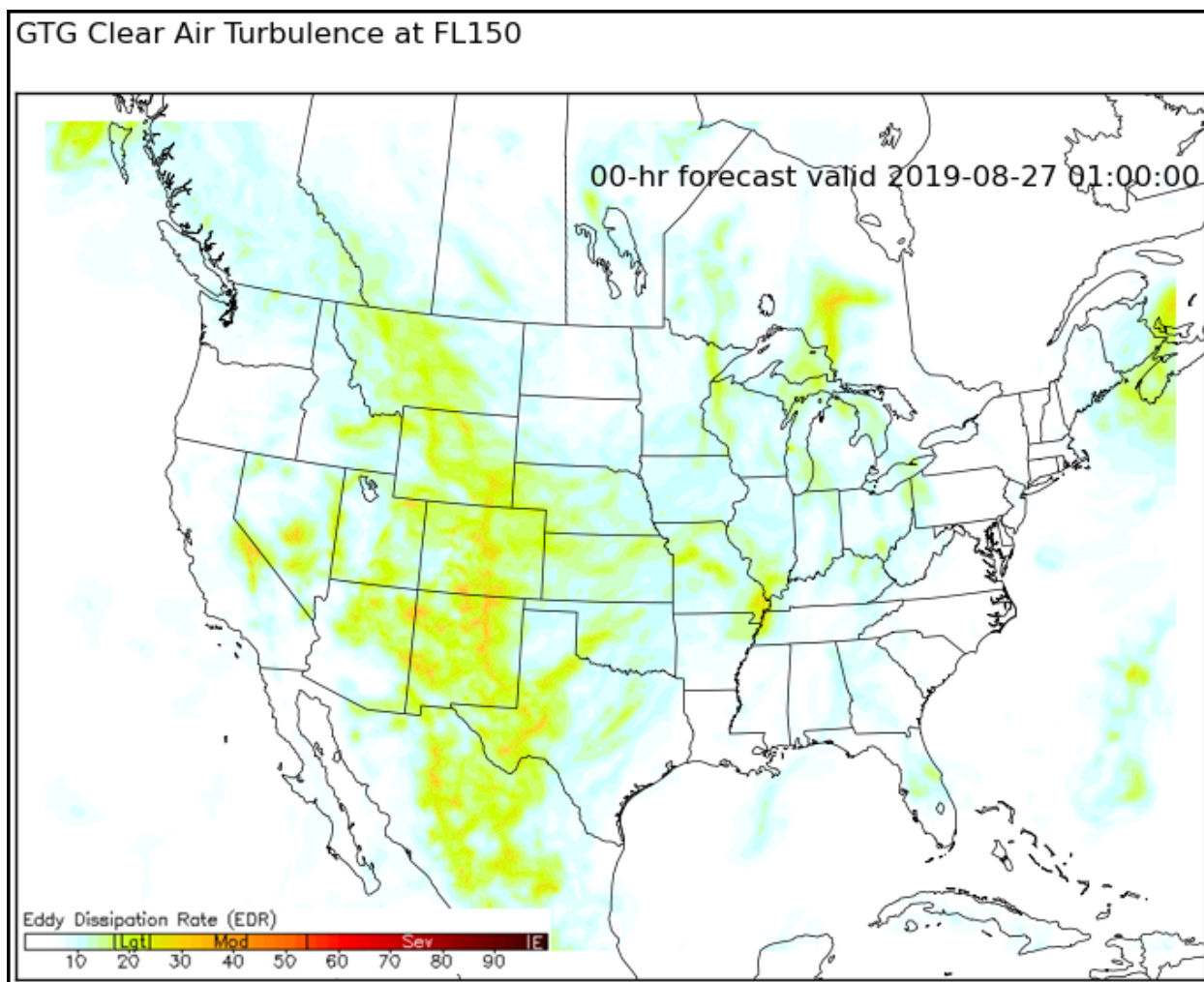


Figure 19 – GTG clear air turbulence analysis imagery valid for 15,000 feet at 2000 CDT.

10.0 Astronomical Data

The astronomical data obtained from the National Oceanic and Atmospheric Administration for the accident location indicated apparent sunset occurred at 1930 CDT.

Submitted by:

Mike Richards
Senior Meteorologist

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