



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

March 12, 2021

Specialist's Factual Report

METEOROLOGY

ERA21LA035

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A. ACCIDENT

Location: Ellicott, New York
Date: November 1, 2020
Time: 1748 eastern standard time
2248 Coordinated Universal Time (UTC)
Airplane: Grumman GA7; Registration: N791GA

B. METEOROLOGIST

Paul Suffern
Senior Meteorologist
Operational Factors Division (AS-30)
National Transportation Safety Board

C. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's (NTSB) Meteorologist did not travel for this investigation and gathered the weather data for this investigation from official National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) sources including the National Centers for Environmental Information (NCEI). This specialist factual contains the meteorological factors pertinent to the weather surrounding the accident time. All times are eastern standard time (EST) on November 1, 2020, and are based upon the 24-hour clock, where local time is -5 hours from UTC, and UTC=Z (unless otherwise noted). 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. NWS airport and 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.

The accident site was located at latitude 42.1606° N, Longitude 79.2400° W, with an approximate elevation of 1,380 feet (ft).

D. FACTUAL INFORMATION

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 and the Weather Prediction Center, located in College Park, 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 00-45H.¹

1.1 Surface Analysis Chart

A northeast section of the NWS Surface Analysis Chart for 1900 EST is provided as figure 1 with the approximate location of the accident site marked within the red circle. The chart identified a high pressure system near the accident site over western New York with a pressure of 1013-hectopascals (hPa). Several low pressure centers were located along the East Coast with their associated frontal boundaries in southern Vermont, Long Island, New York, and northeastern Virginia with pressures of 1002-, 1003, and 1009-hPa, respectively. A cold front (west of the accident site) stretched from southern Michigan northward into southern Ontario.

The station models around the accident site depicted air temperatures in the mid 20’s to mid 30’s degrees Fahrenheit (°F), dew point temperatures in the mid to upper 20’s °F with temperature-dew point spreads of 2°F or less, a west wind of 10 to 20 knots, overcast sky cover, and light to moderate snow.

¹

https://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/1030235

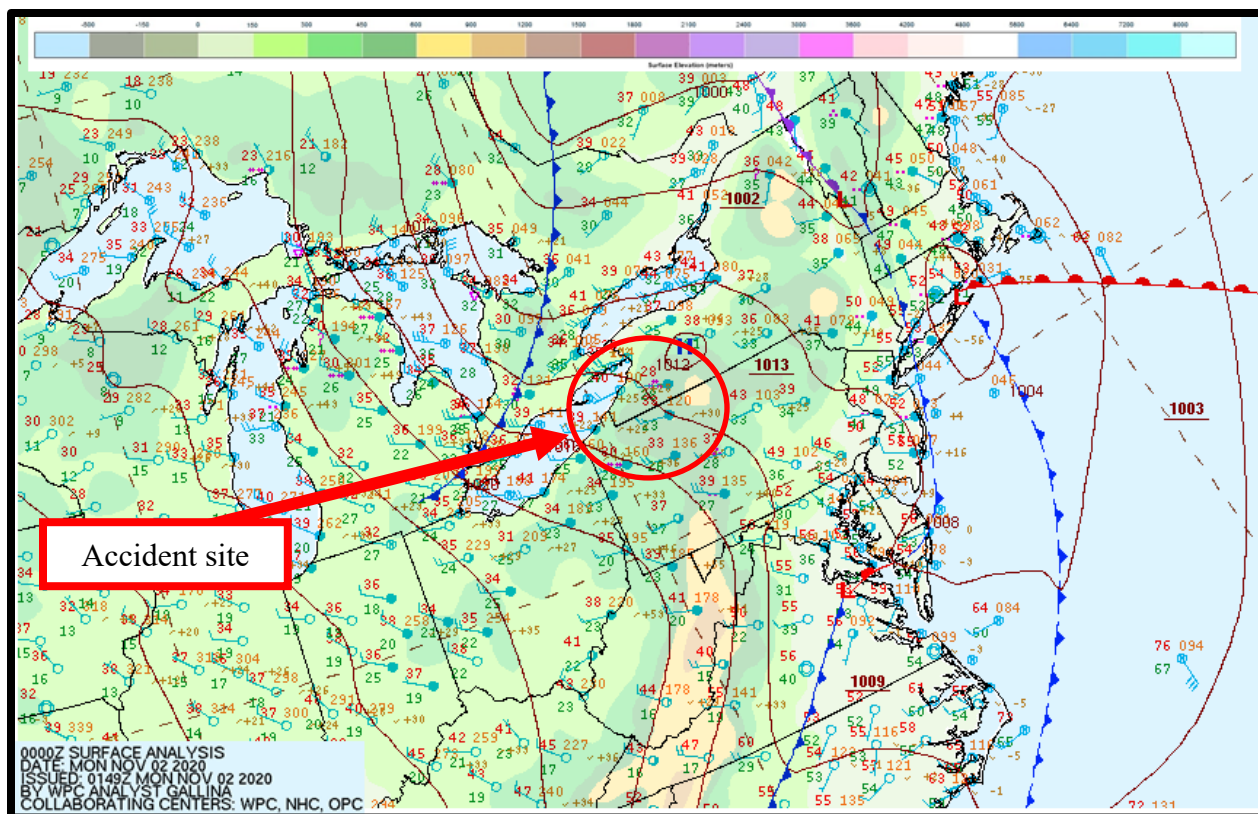


Figure 1 – NWS Surface Analysis Chart for 1900 EST.

1.2 Upper Air Charts

The NWS Storm Prediction Center (SPC) Constant Pressure Charts for 1900 EST at 925-, 850- and 700-hPa are presented in figures 2 through 4. The accident site was located in between two troughs² at 1900 EST at both 925- and 850-hPa (figures 2 and 3). A trough at 700-hPa was located directly above the accident site. Troughs can act as lifting mechanisms to help produce clouds and precipitation if sufficient moisture is present. There was a west wind at 30 knots at 925-hPa with the wind becoming southwesterly between 40 and 45 knots by 700-hPa.

² Trough – An elongated area of relatively low atmospheric pressure or heights.

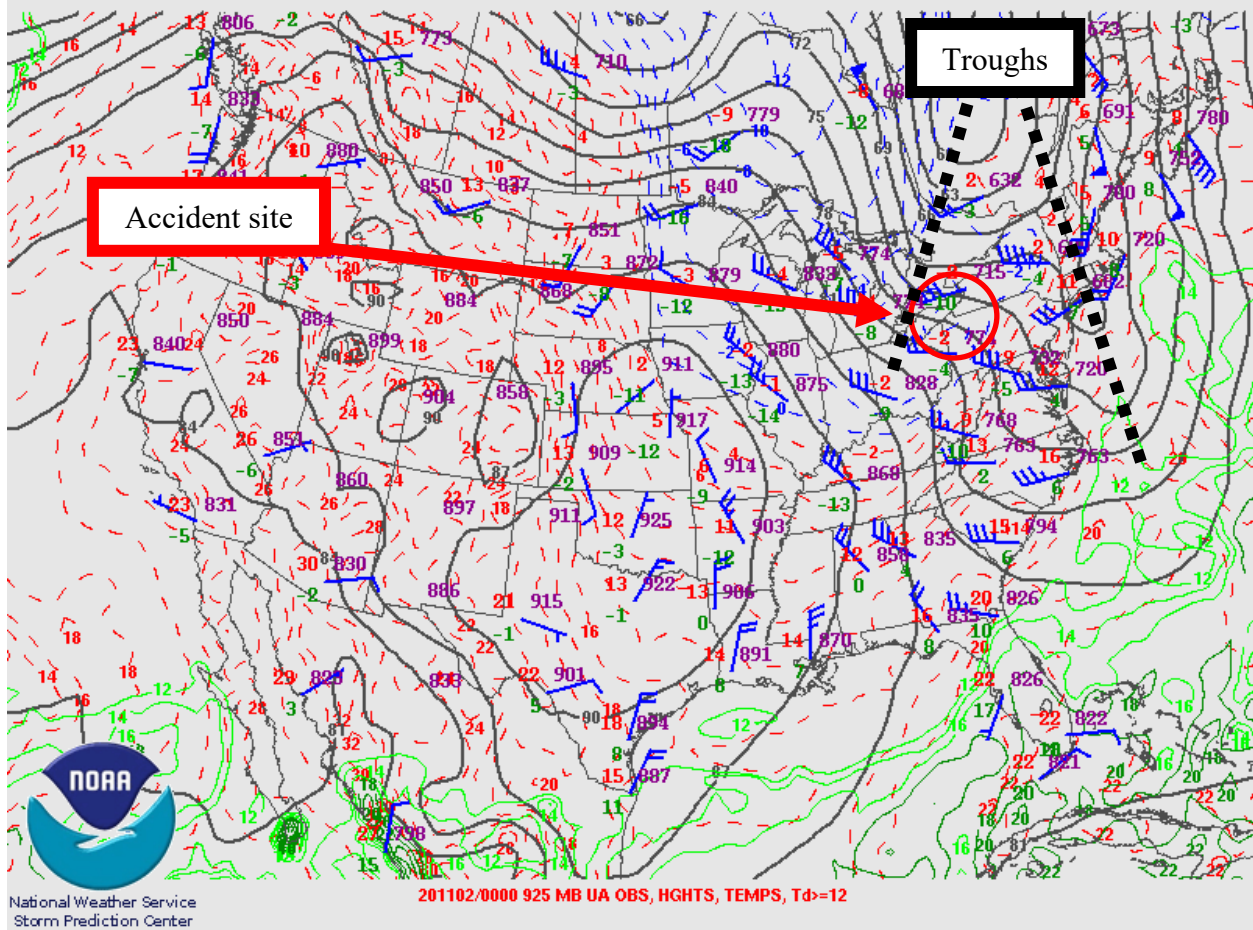


Figure 2 – 925-hPa Constant Pressure Chart for 1900 EST.

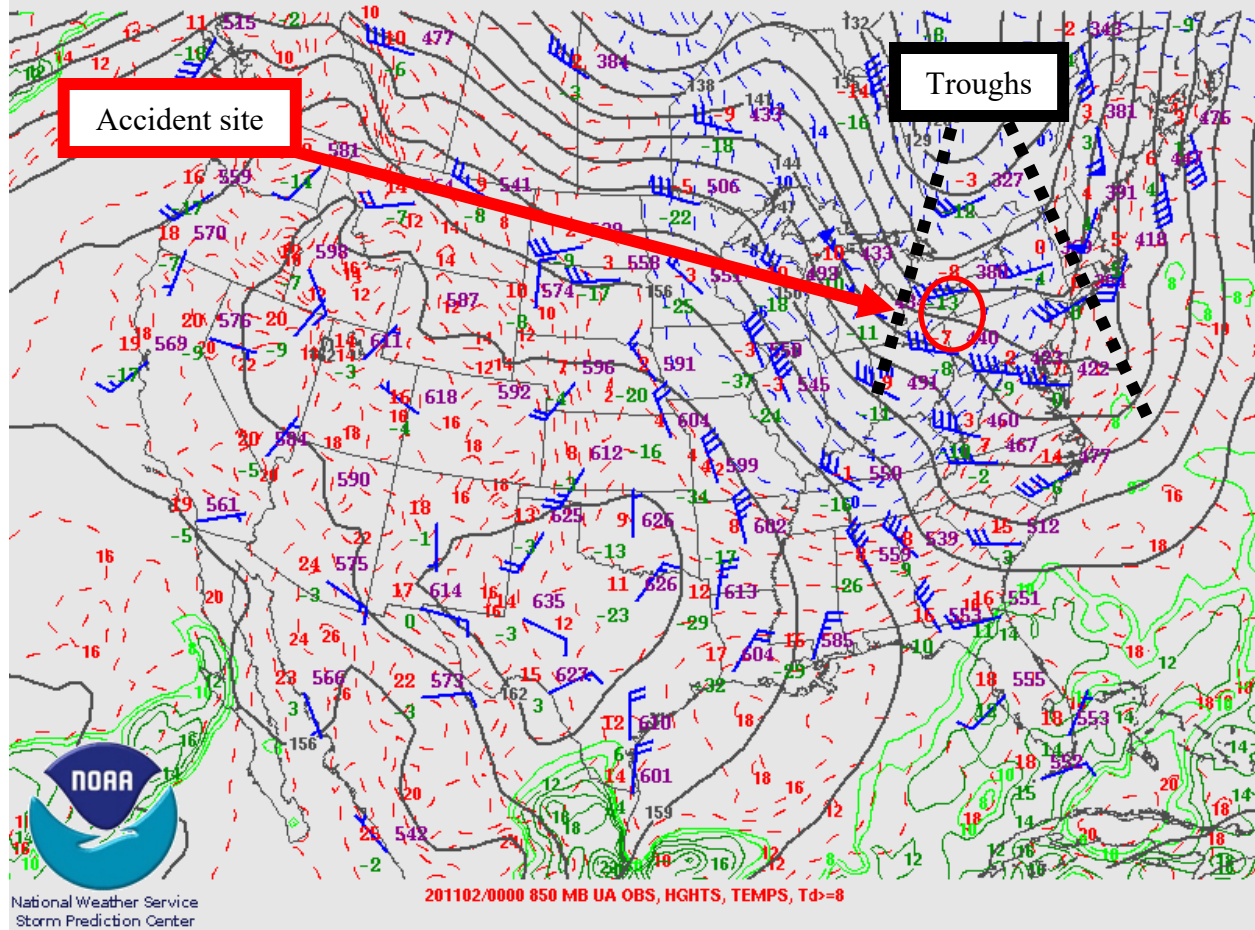


Figure 3 – 850-hPa Constant Pressure Chart for 1900 EST.

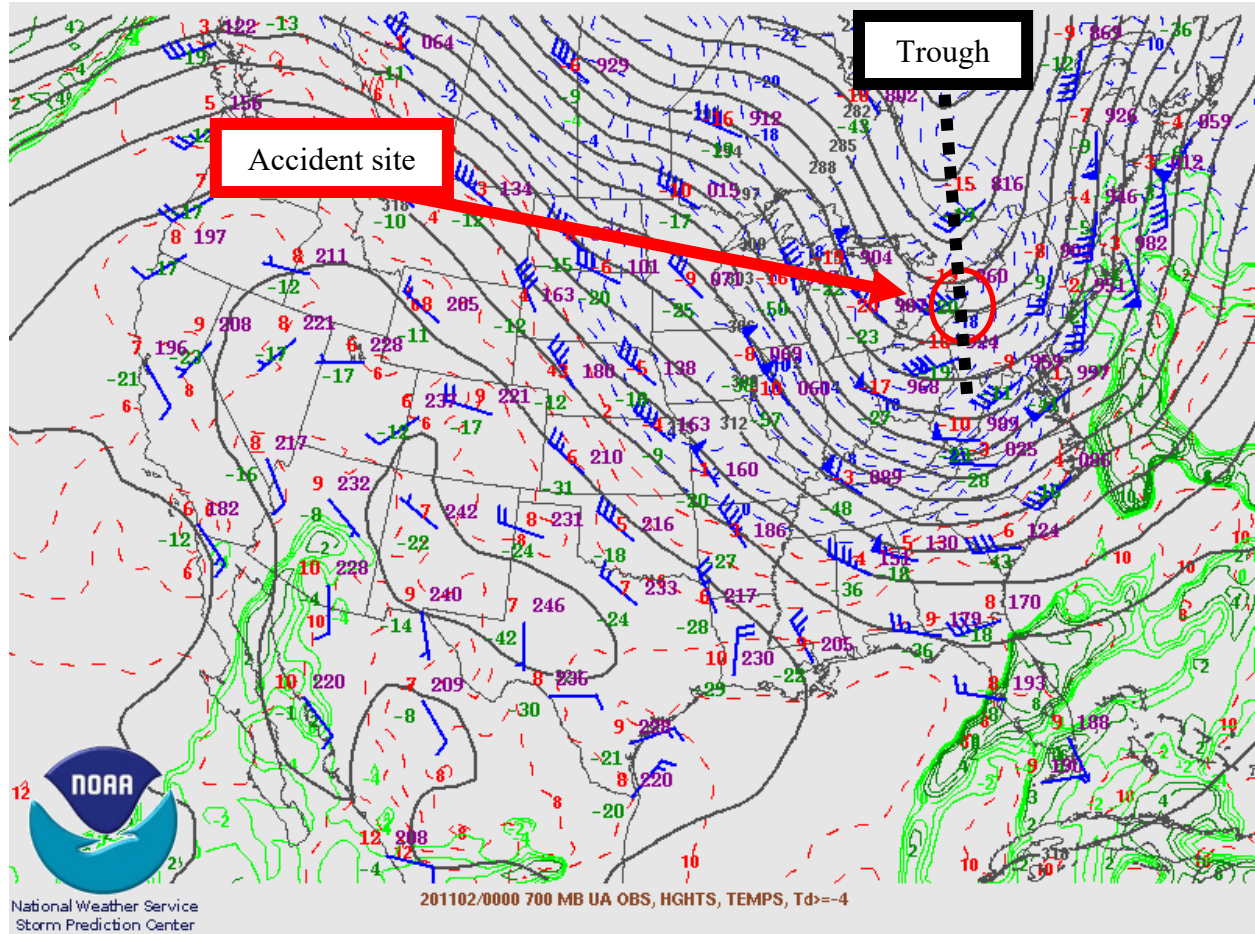


Figure 4 – 700-hPa Constant Pressure Chart for 1900 EST.

2.0 Surface Observations

The area surrounding the accident site was documented using official Aviation Routine Weather Reports (METARs) and Specials (SPECIs). The following observations were taken from standard code and are provided in plain language. Figure 5 is a local sectional chart with the accident site and the closest weather reporting location marked.



Figure 5 – Sectional map of the accident area with the location of the accident site and surface observation site.

Chautauque County/Jamestown Airport (KJHW) had the closest official weather station to the accident site. KJHW had an Automated Weather Observing System (AWOS³) whose reports were not supplemented. KJHW was located 1 mile west-southwest of the accident site, at an elevation of 1,723 ft, and had a 10° westerly magnetic variation⁴. The following automated longline⁵ observations were taken and disseminated during the times surrounding the accident:⁶

[1717 EST] SPECI KJHW 012217Z AUTO 27019G24KT 1SM -SN BR SCT007 BKN013
OVC018 00/M01 A2983 RMK AO2 P0000 FZRANO RVRNO=

[1720 EST] SPECI KJHW 012220Z AUTO 27017G24KT 2 1/2SM -SN BR SCT007
OVC013 00/M01 A2983 RMK AO2 P0000 FZRANO=

³ AWOS – Automated Weather Observing System is equipped with meteorological instruments to observe and report temperature, dewpoint, wind speed and direction, visibility, cloud coverage and ceiling up to 12,000 feet, and altimeter setting. AWOS are maintained by the FAA.

⁴ Magnetic variation – The angle (at a particular location) between magnetic north and true north. Latest measurement taken from <https://adip.faa.gov/agis/public/#/airportData/JHW>

⁵ “Longline” refers to the dissemination of weather observations with the intent that they are available in near-real time to national databases (effectively, the whole world) and accessible to the general global public from a large number of vendors. This does not include public accessibility to observations from a reporting station’s Very High Frequency (VHF; line-of-site) or telephone broadcast, where applicable. Longline-dissemination of weather observations is the primary vehicle through which the general global public has access to surface weather observations, particularly outside of the aviation community.

⁶ The bold sections in this NWS product and the rest of the products in this report are intended to highlight the sections that directly reference the weather conditions that affected the accident location around the accident time. The local times in this section next to the METARs are provided for quick reference between UTC and local times around the accident time.

[1722 EST] SPECI KJHW 012222Z AUTO 27017G24KT 6SM -SN BR SCT007 OVC015
00/M01 A2983 RMK AO2 P0001 FZRANO=

[1736 EST] SPECI KJHW 012236Z AUTO 28014G18KT 8SM -SN FEW007 BKN014
OVC018 00/M01 A2984 RMK AO2 P0001 FZRANO=

**[1745 EST] SPECI KJHW 012245Z AUTO 28016G21KT 1 3/4SM -SN BR FEW005
OVC012 00/M01 A2985 RMK AO2 P0001 FZRANO=**

ACCIDENT TIME 1748 EST

**[1750 EST] SPECI KJHW 012250Z AUTO 28020G30KT 3/4SM -SN BR SCT005 BKN010
OVC017 M01/M02 A2985 RMK AO2 PK WND 27030/2247 CIG 008V013
P0001 FZRANO RVRNO=**

[1756 EST] METAR KJHW 012256Z AUTO 27019G30KT 1SM -SN BR SCT005 BKN008
OVC013 M01/M02 A2985 RMK AO2 PK WND 27030/2247 SLP127
P0001 T10061017 FZRANO RVRNO=

KJHW weather at 1745 EST, automated, wind from 280° at 16 knots with gusts to 21 knots, visibility 1 and 3/4 miles, light snow, mist, few clouds at 500 ft above ground level (agl), overcast ceiling at 1,200 ft agl, temperature of 0°Celsius (C), dew point temperature of -1°C, and an altimeter setting of 29.85 inches of mercury (inHg). Remarks: automated station with a precipitation discriminator, 0.01 inches of precipitation since 1656 EST, freezing rain sensor is not operating.

KJHW weather at 1750 EST, automated, wind from 280° at 20 knots with gusts to 30 knots, visibility 3/4 miles, light snow, mist, scattered clouds at 500 ft agl, broken ceiling at 1,000 ft agl, overcast skies at 1,700 ft agl, temperature of -1°C, dew point temperature of -2°C, and an altimeter setting of 29.85 inHg. Remarks: automated station with a precipitation discriminator, peak wind from 270° at 30 knots at 1747 EST, ceiling varying between 800 and 1,300 ft agl, 0.01 inches of precipitation since 1656 EST, freezing rain sensor is not operating, runway visual range sensor is not operating.

The observations from KJHW surrounding the accident time indicated LIFR⁷ conditions with light snow and wind gusts reported to 30 knots.

⁷ As defined by the NWS and the FAA Aeronautical Information Manual (AIM) section 7-1-7 defines the following general flight categories:

- Low Instrument Flight Rules (LIFR*) – ceiling below 500 ft above ground level (agl) and/or visibility less than 1 statute mile.
- Instrument Flight Rules (IFR) – ceiling between 500 to below 1,000 feet agl and/or visibility 1 to less than 3 miles.
- Marginal Visual Flight Rules (MVFR**) – ceiling from 1,000 to 3,000 ft agl and/or visibility 3 to 5 miles.
- Visual Flight Rules (VFR) – ceiling greater 3,000 ft agl and visibility greater than 5 miles.

* 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.

3.0 Upper Air Data

A High-Resolution Rapid Refresh (HRRR)⁸ model sounding was created for the accident site for 1800 EST using a surface elevation of 1,463 ft.⁹ The 1800 EST HRRR sounding was plotted on a standard Skew-T Log P diagram¹⁰ with the derived stability parameters included in figure 6 with data from the surface to 600-hPa (or approximately 14,000 ft msl). These data were analyzed using the RAOB¹¹ software package. The sounding depicted the lifted condensation level (LCL)¹² at 1,471 ft agl, the level of free convection (LFC)¹³ at 2,665 ft agl, and the convective condensation level (CCL)¹⁴ at 3,057 ft agl. It was freezing at the surface and remained below freezing through 14,000 ft above msl. The precipitable water value was 0.25 inches.

⁸ 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.

⁹ HRRR sounding was created using NOAA Air Resource Laboratory: <https://ready.arl.noaa.gov/READYamet.php>

¹⁰ 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.

¹¹ RAOB – (The complete Rawinsonde Observation program) is an interactive sounding analysis program developed by Environmental Research Services, Matamoras, Pennsylvania.

¹² LCL - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.

¹³ 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.

¹⁴ 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.

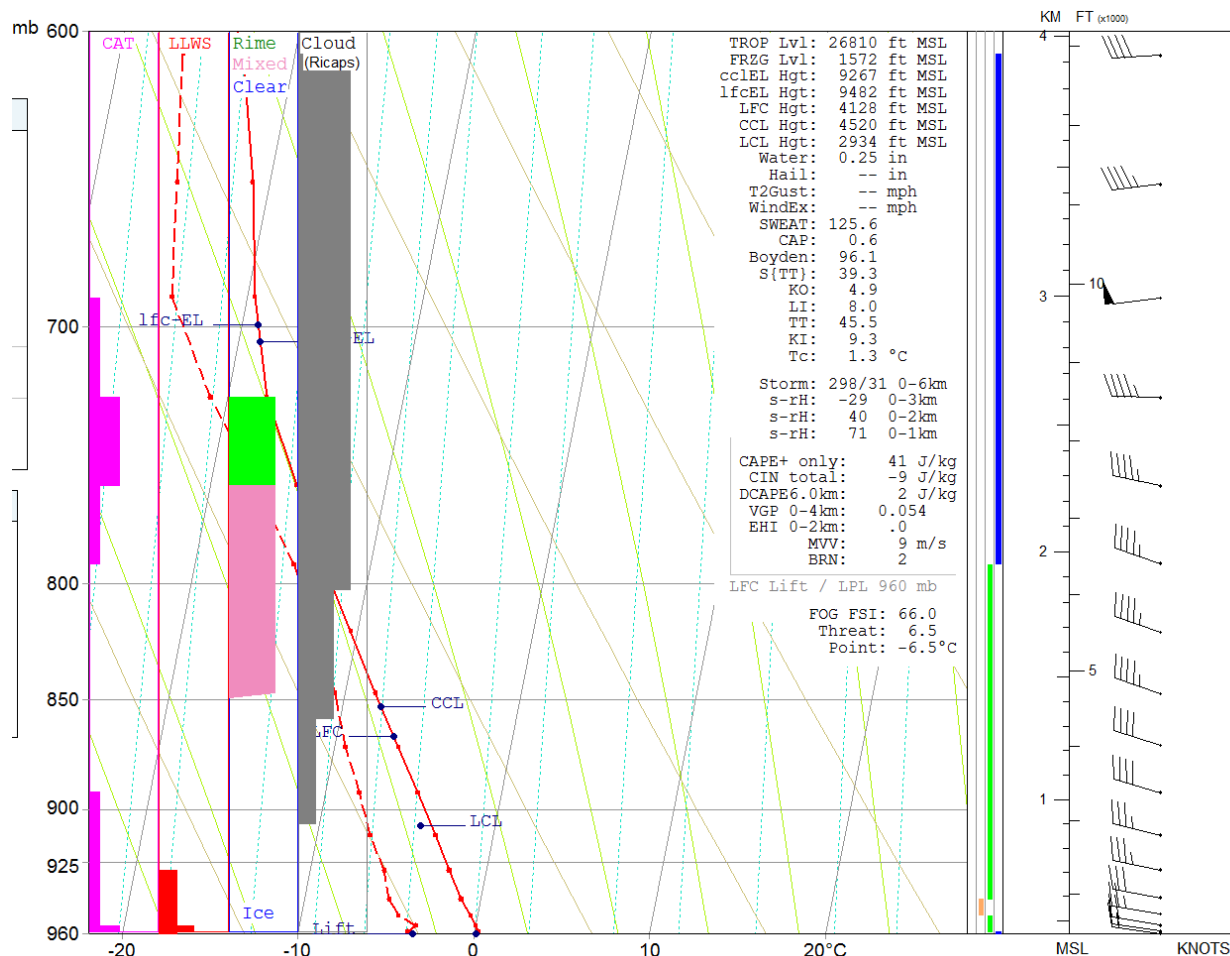


Figure 6 – 1800 EST HRRR sounding.

The 1800 EST HRRR sounding for the accident site indicated a conditionally unstable environment from the surface through 6,000 ft above msl, then a stable environment from 6,000 ft above msl through 14,000 ft above msl. RAOB identified the possibility of clouds between 3,000 ft (~1,500 ft agl) through 14,000 ft above msl. RAOB identified moderate mixed and rime icing between 5,000 and 8,500 ft above msl (~3,500 to 7,000 ft agl).

The 1800 EST HRRR sounding wind profile indicated a near surface wind from 279° at 15 knots with the wind remaining westerly through 14,000 ft above msl. The wind speed increased to 30 knots by 2,000 ft above msl (~500 ft agl). The wind speed increased to 40 knots by 3,500 ft above msl (~2,000 ft agl) with a peak wind near 50 knots at 10,000 ft above msl. RAOB indicated the possibility of moderate low-level wind shear (LLWS) between the surface and 750 ft agl. RAOB indicated that a chance of moderate clear-air turbulence existed in two layers between the surface and 10,000 ft above msl.

4.0 Satellite Data

Geostationary Operational Environmental Satellite number 16 (GOES-16) visible and infrared data were obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison in Madison, Wisconsin, and processed using the Man-computer Interactive Data Access System software. Visible and infrared imagery (GOES-16 bands 2 and 13) at wavelengths of 0.64 microns (μm) and 10.3 μm , respectively, were retrieved for the period from 1400 EST through 2000 EST and reviewed, and the closest images to the time of the accident were documented.

Figure 7 presents the GOES-16 infrared imagery from 1600 EST at 4X magnification with the accident site highlighted with a red square. The lower brightness temperatures (yellow colors; higher cloud tops) were located above the accident site. Based on the brightness temperatures above the accident site and the vertical temperature profile provided by the 1800 EST HRRR sounding, the approximate cloud-top heights over the accident site were 8,000 ft above msl at 1750 EST (256 Kelvin). It should be noted these figures have not been corrected for any parallax error. The Nighttime Microphysics Red, Green, Blue (RGB) imagery¹⁵ indicated the cloud cover above the accident site was a combination of mid- and low-level ice and water clouds (attachment 1).

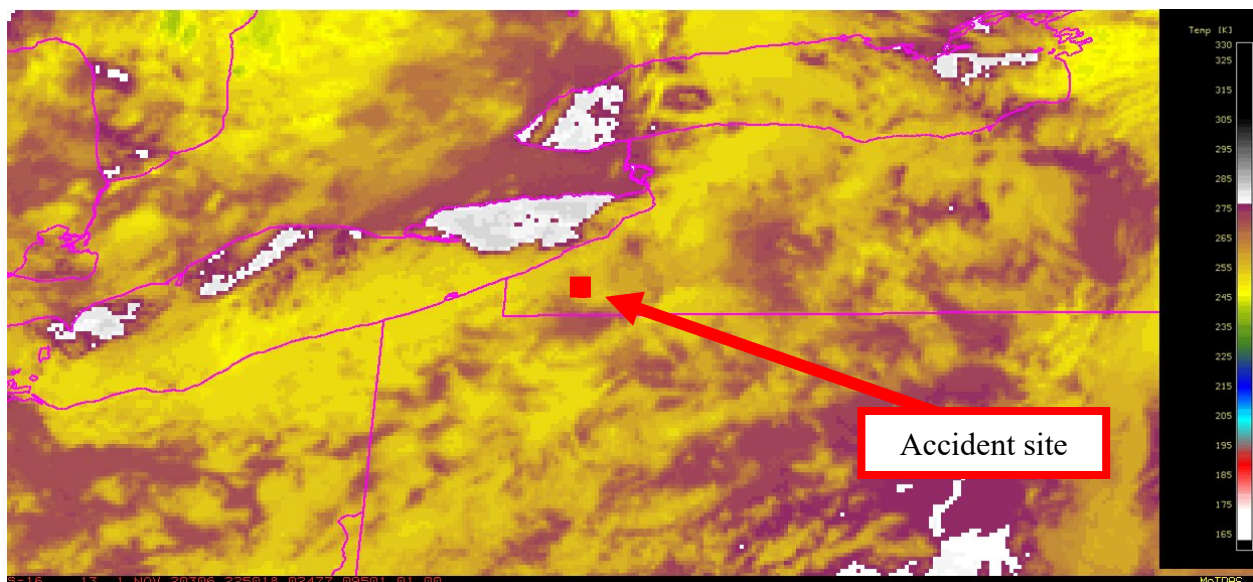


Figure 7 – GOES-16 infrared image at 1750 EST.

5.0 Regional Radar Imagery Information

A regional view of the NWS national composite radar mosaic is included as figure 8 for 1750 EST with the approximate location of the accident site marked within a red circle. The image depicted echoes from 20 to 35 decibels (dBZ)¹⁶ above the accident site.

¹⁵

https://weather.msfc.nasa.gov/sport/training/quickGuides/rgb/QuickGuide_NtMicro_GOESR_NASA_SPoRT_2019_1206.pdf

¹⁶ 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.

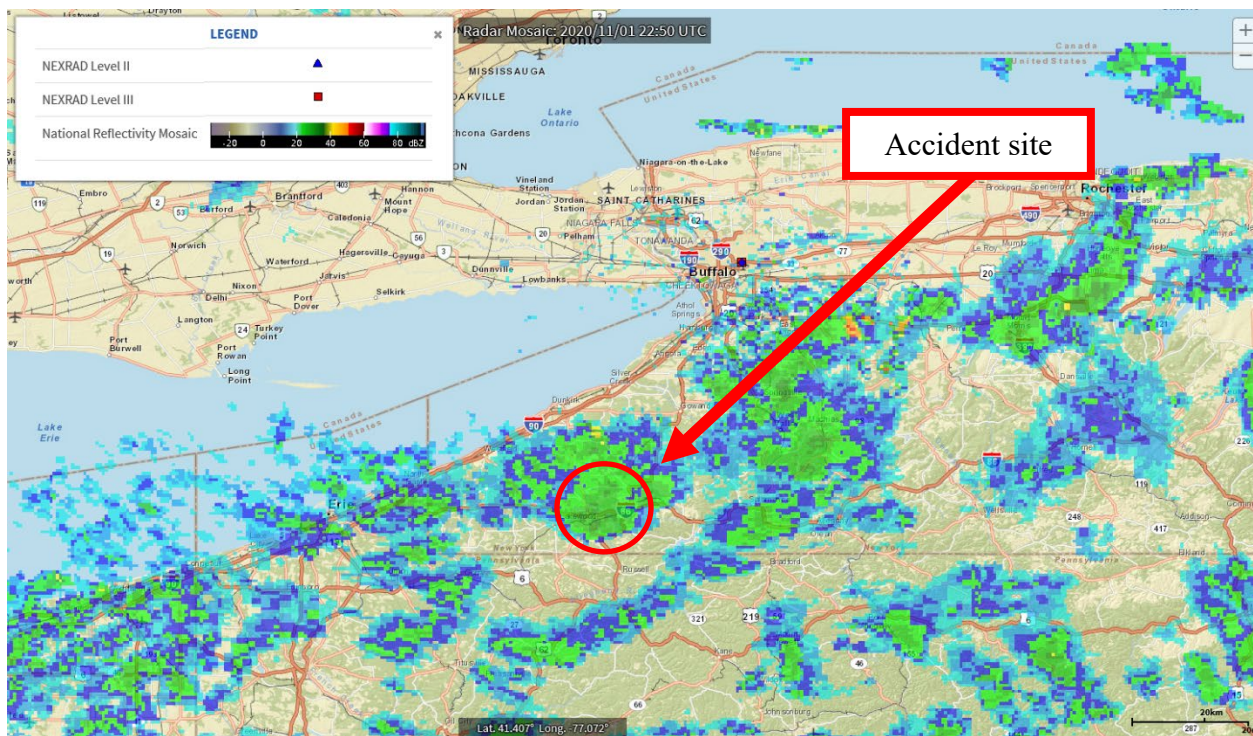


Figure 8 – Regional Composite Reflectivity image for 1750 EST.

6.0 Radar Imagery Information

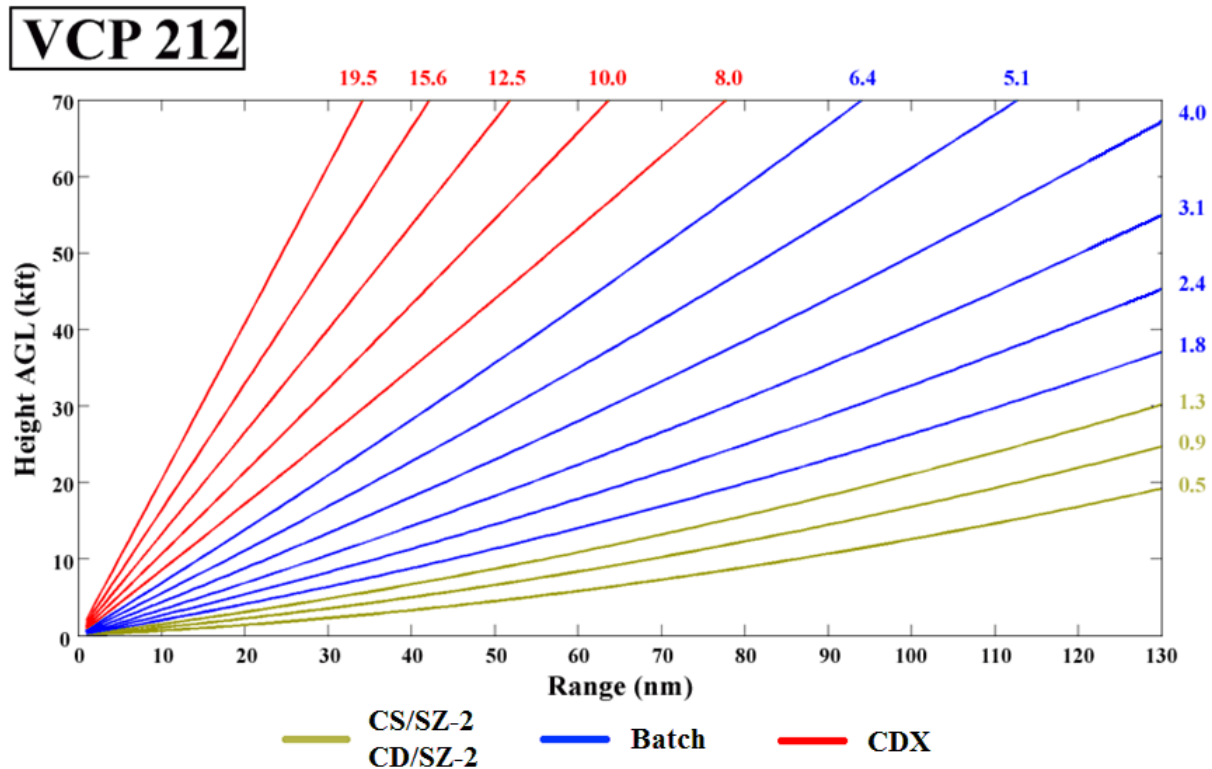
The closest NWS Weather Surveillance Radar-1988, Doppler (WSR-88D)¹⁷ to the accident site was Buffalo, New York (KBUF) located 52 miles north-northeast of the accident site. Level II archive radar data were obtained from the NCEI utilizing the NEXRAD Data Inventory Search and displayed using the NOAA’s Weather and Climate Toolkit software.

6.1 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. Products that require data from multiple elevation scans are not available until the end of the five to ten minute volume scan.

¹⁷ 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 between a 0.87° and 0.96° beam width. The radar produces three basic types of products: base reflectivity, base radial velocity, and base spectral width.

The WSR-88D operates in several different scanning modes, identified as Mode A and Mode B. Mode A is the precipitation scan and has three common scanning strategies¹⁸. 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 9 elevation scans during a ten-minute period. During the period surrounding the accident, the KBUF WSR-88D radar was operating in the precipitation mode 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.

¹⁸ Contiguous Surveillance (CS)--The low Pulse Repetition Frequency (PRF) scan of the split cut. Gives a high R_{max} value to determine proper target location and intensity, but a low V_{max} value limits the velocities that can be measured. Contiguous Doppler (CD)--The high PRF scan of the split cut. Gives a low R_{max} value causing more range folded (multiple trip) echoes, but a high V_{max} value to get higher, more accurate velocity values.

Batch Mode – Uses alternating low and high PRFs on each radial for one full rotation at each elevation angle. The two resulting data sets (low PRF and high PRF) are combined to resolve range ambiguity. Used in the middle elevation angles.

W – With range unfolding (W)

WO – Without range unfolding (WO)

6.2 Beam Height Calculation

Assuming standard refraction¹⁹ of the KBUF WSR-88D radar beam with the antenna elevation at 790 ft, and considering a beamwidth²⁰ of 0.95°, the following table shows the approximate heights for the radar beam center, base, and top for antenna elevations over the accident site. These heights have been rounded to the nearest 10 ft.

ANTENNA ELEVATION	BEAM CENTER	BEAM BASE	BEAM TOP
KBUF 0.3°	4,410 ft	1,850 ft	6,970 ft

Based on the radar height calculations, the elevation scans from KBUF listed in the above table depicted the conditions between 1,850 ft and 6,970 ft above msl over the accident site and these scans “saw” the closest altitudes to the surface.

6.3 Reflectivity

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors²¹ 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 dBZ and is a general measure of echo intensity. FAA Advisory Circular AC 00-24C²², “Thunderstorms,” dated February 19, 2013, also defines the echo intensity levels and weather radar echo intensity terminology associated with those levels. For dBZ values less than 30 the weather radar echo intensity terminology should be “light.” For dBZ values between 30 and 40, the terminology should be “moderate.” “Heavy” terminology is used for dBZ values greater than 40 dBZ but less than 50 dBZ, inclusive. Finally, any dBZ values above 50 dBZ shall be described as “extreme.”

¹⁹ Standard Refraction in the atmosphere is when the temperature and humidity distributions are approximately average, and values set at the standard atmosphere.

²⁰ Beamwidth - the angular separation between the half power points on the antenna radiation pattern, where the gain is one half the maximum value.

²¹ 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.

²²

https://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/1020774

6.4 Base Reflectivity and Lightning Data

Figures 9 and 10 present the KBUF WSR-88D base reflectivity images for the 0.3° elevation scans initiated at 1747:16 and 1752:21 EST, with a resolution of 0.5° X 250 m. Reflectivity values between 20 and 37 dBZ were located above the accident site at the accident time and indicative of light to moderate precipitation (section 6.3). The band of precipitation was moving from northwest to southeast over the accident site at the accident time (attachment 2).

There were no lightning flashes²³ near the accident site at the accident time.²⁴

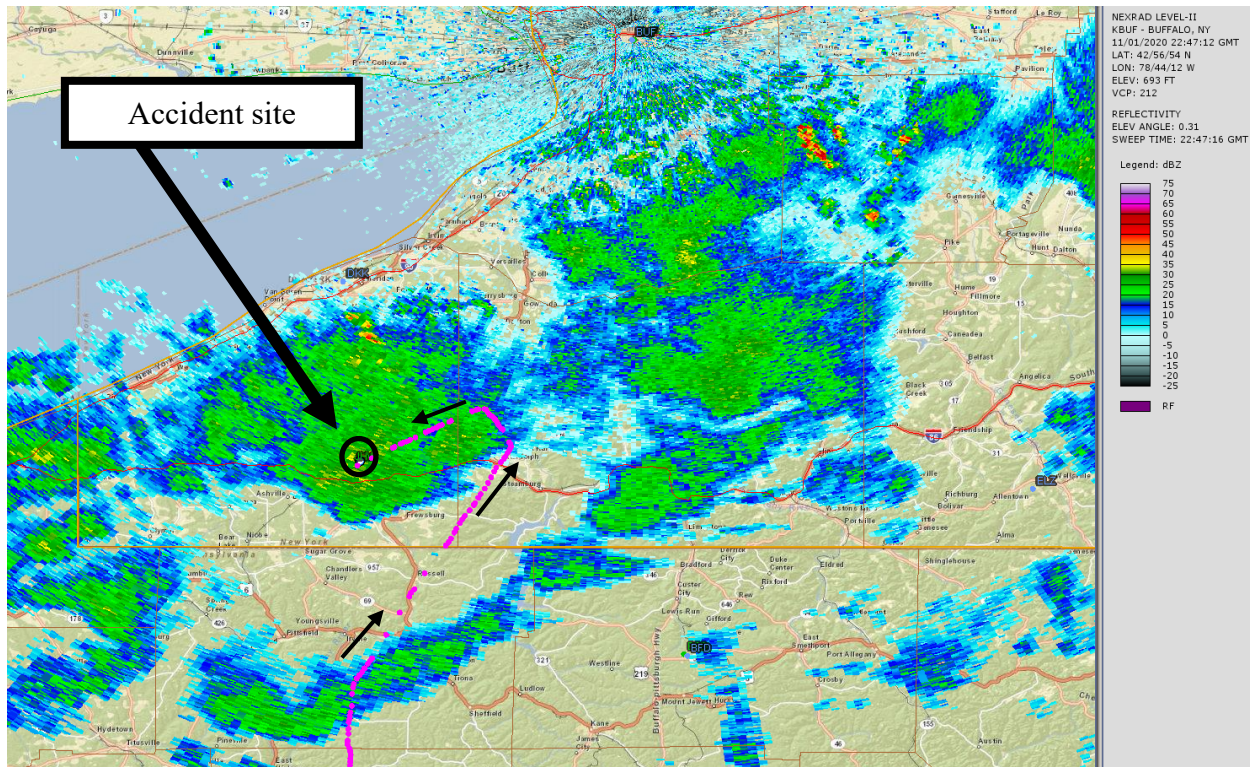


Figure 9 – KBUF WSR-88D reflectivity for the 0.5° elevation scan initiated at 1747:16 EST with the accident site marked with black circle and the accident flight track in pink with arrows pointing in the direction of travel.

²³ 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.

²⁴ A review of Earth Networks Total Lightning network was done.

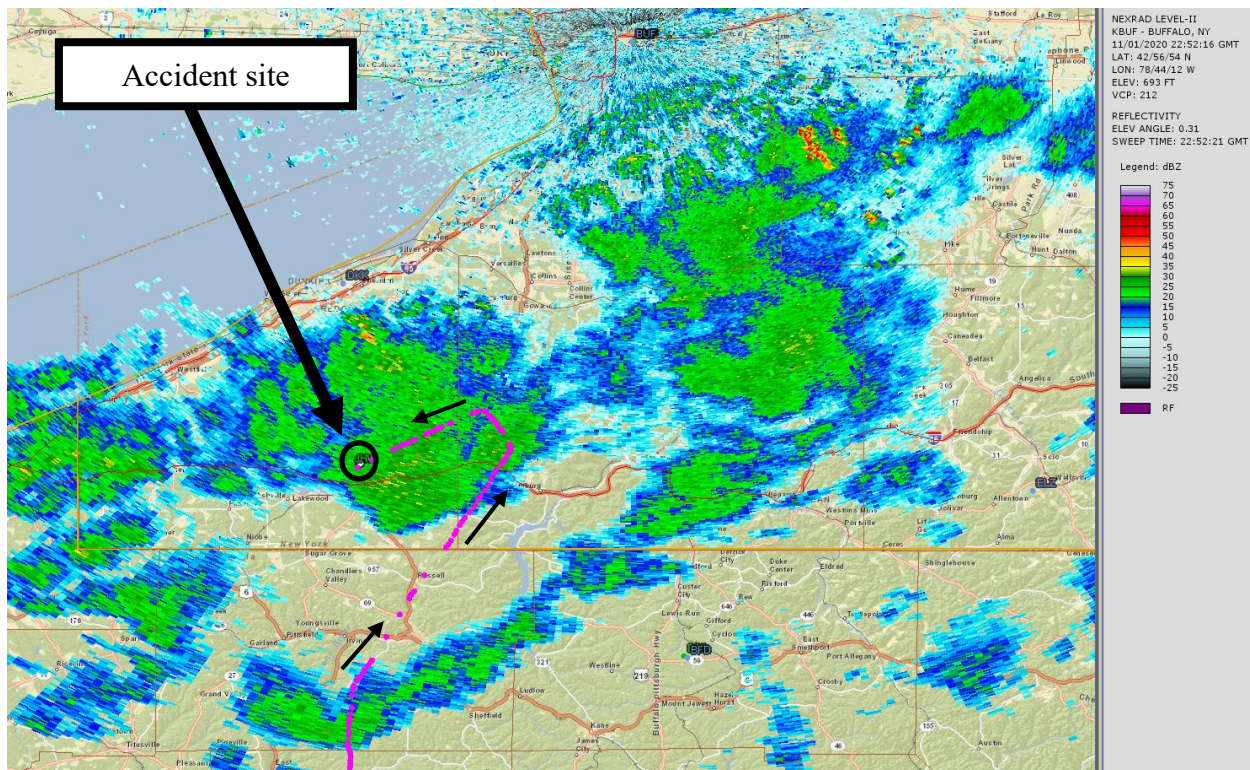


Figure 10 – KBUF WSR-88D reflectivity for the 0.5° elevation scan initiated at 1752:21 EST with the accident site marked with black circle and the accident flight track in pink with arrows pointing in the direction of travel.

7.0 Pilot Reports²⁵

The following are the publicly longline-disseminated pilot reports²⁶ (PIREPs) distributed into the national airspace (NAS) within 100 miles of the accident site from about two hours prior to the accident time to two hours after the accident time for below 18,000 ft above msl. In addition, the accident airplane was solicited by ATC to provide a PIREP at 1741 EST, and that PIREP information was passed along to the next airplane on approach, but the accident airplane PIREP was not publicly distributed longline. The PIREP provided by the accident airplane stated that it was experiencing light to moderate chop, was in and out of the clouds, and encountered snow and a lot of up and downdrafts on its descent. At 1741 EST the accident flight was located approximately 9 miles east-northeast of the accident site at around 3,675 ft above msl.²⁷

YNG UA /OV YNG21018/TM 2052/FL040/TP C130/TA -4/IC LGT-MOD RIME/RM DURD

BUF UA /OV BUF22010/TM 2115/FL090/TP B737/SK BKN090/TA M04/IC LIGHT RIME

BUF UA /OV BUF230020/TM 2210/FL090/TP E170/SK BKN090/TA M01/IC LGT RIME/RM DURD

²⁵ Only pilot reports with the World Meteorological Organization headers UBPA**, UBNY**, and UBOH** were considered.

²⁶ These do not include pilot reports only broadcast via radio.

²⁷ For more information please see the ATC data located in the docket for this accident.

FKL UA /OV CIP/TM 2211/FL090/TP GA7/TA M11/IC LGT RIME

ROC UA /OV ROC/TM 2235/FL070/TP LJ95/TA M18/IC LGT RIME/RM ALT 070-108

8.0 SIGMET

There were no convective or non-convective Significant Meteorological Information (SIGMET) advisories valid for the accident site at the accident time.

9.0 CWSU Advisories

The Cleveland (ZOB) Air Route Traffic Control Center (ARTCC) Center Weather Service Unit (CWSU) was responsible for the accident region. The ZOB CWSU issued a Meteorological Impact Statement (MIS) for the accident area at 1249 EST which warned of surface gusts between 35 to 45 knots, occasional moderate turbulence below 10,000 ft, with isolated severe turbulence after 1700 EST, and occasional IFR to LIFR in snow showers. No Center Weather Advisory (CWA) was issued by ZOB CWSU for the accident time:

FAUS20 KZOB 011749

ZOB MIS 02 VALID 011749-020200

...FOR ATC PLANNING PURPOSES ONLY...

**THRUT ZOB.. SFC GUSTS 35-45KT. OCNL MOD TURB AOB 100 BECMG FRQ
MOD-ISOL SEV AFT 22Z. PA/NY BORDER REGION.. OCNL IFR-LOCAL LIFR
SHSN. ISOL SNOWFALL 1 INCH/HR OR GTR.**

=

10.0 AIRMETs

Airmen's Meteorological Information (AIRMET) advisories Sierra, Tango, and Zulu were valid for the accident site at the accident time (issued at 1545 EST). The AIRMETs warned of IFR conditions due to precipitation and mist, mountain obscuration conditions due to clouds, precipitation, and mist, moderate turbulence below 10,000 ft, and moderate icing below 16,000 ft:

WAUS41 KPCI 012045

WA1Z

-BOSZ WA 012045

AIRMET ZULU UPDT 4 FOR ICE AND FRZLVL VALID UNTIL 020300

.

AIRMET ICE...ME NH VT MA RI CT NY NJ PA MD DE VA NC AND CSTL WTRS
FROM 50NW PQI TO 40ENE PQI TO 200SE ACK TO 160SE SIE TO 190ESE
ECG TO 70ESE ILM TO 60W ECG TO 30W CYN TO 20NNE HTO TO ENE TO YSC
TO 50NW PQI

MOD ICE BTN FRZLVL AND FL220. FRZLVL 050-120. CONDS CONTG BYD 03Z
THRU 09Z.

.

AIRMET ICE...ME NH VT MA RI CT NY LO NJ PA DE AND CSTL WTRS
FROM YSC TO ENE TO 20NE HTO TO 50SSE ETX TO 20S HAR TO 90SW YOW
TO YSC

MOD ICE BTN FRZLVL AND 170. FRZLVL 030-060. CONDS CONTG BYD 03Z
THRU 09Z.

.
AIRMET ICE...NY LO PA OH LE WV MD VA
FROM 90SW YOW TO 20S HAR TO 30SSW BKW TO 40S APE TO CVG TO FWA TO
DXO TO BUF TO 90SW YOW
MOD ICE BLW 160. CONDS CONTG BYD 03Z ENDG 03-06Z.

.
FRZLVL...RANGING FROM SFC-110 ACRS AREA
MULT FRZLVL 040-100 BOUNDED BY 20SE EMI-40ESE SIE-160SE SIE-
40NE ILM-20SW IRQ-30W ATL-GQO-HMV-20SE BKW-20SE EMI
MULT FRZLVL 050-070 BOUNDED BY 70SE YQB-30SW MLT-60SW BGR-
40NW ENE-30N MPV-YSC-70SE YQB
SFC ALG 30N CVG-20SSE APE-EKN-30SW SLT-30NNE APE-20SW DXO
040 ALG 30NE GSO-20SW SBY-SIE-20E YSC-70NW PQI
080 ALG 60E ORF-100SE SBY-70E BOS-140SSE BGR

....

WAUS41 KPCI 012045
WAIT
-BOST WA 012045
AIRMET TANGO UPDT 3 FOR TURB STG WNDZ AND LLWS VALID UNTIL 020300

.
AIRMET TURB...ME NH VT MA RI CT NY LO NJ PA DE AND CSTL WTRS
FROM 70NW PQI TO 40NE PQI TO 40ESE HUL TO 150ESE ACK TO 210S ACK
TO 60SW SYR TO 20N MSS TO 20S YSC TO 70NW PQI
MOD TURB BTN FL180 AND FL410. CONDS CONTG BYD 03Z THRU 09Z.

.
AIRMET TURB...NY NJ PA OH WV MD DC DE VA AND CSTL WTRS
FROM 60SW SYR TO 210S ACK TO 120SE SBY TO 20NE ECG TO HMV TO HNN
TO 60SW SYR
MOD TURB BTN FL180 AND FL410. CONDS CONTG BYD 03Z THRU 09Z.

.
AIRMET TURB...NJ PA WV MD DC DE VA NC SC GA AND CSTL WTRS
FROM 60SE JFK TO 60E ORF TO 50NE ILM TO 30SSE FLO TO 50E MCN TO
LGC TO GQO TO HMV TO 50WSW BKW TO 20NE EKN TO 60SE JFK
MOD TURB BLW 140. CONDS CONTG BYD 03Z THRU 09Z.

.
AIRMET TURB...NY LO PA OH LE WV MD
FROM YOW TO 30SE SYR TO 20ENE EKN TO 20NW BKW TO 50WSW BKW TO
HNN TO CVG TO FWA TO 30SE ECK TO YOW
MOD TURB BLW 100. CONDS CONTG BYD 03Z ENDG 03-06Z.

.
AIRMET TURB...ME NH VT MA RI CT NY LO NJ PA WV MD DE VA AND CSTL
WTRS
FROM 70NW PQI TO 40NNE PQI TO 20SSE HUL TO 60SW YSJ TO 60E ENE
TO 30ESE PVD TO 50SSE JFK TO 30ENE EKN TO 30SE SYR TO YOW TO YSC
TO 70NW PQI
MOD TURB BLW 120. CONDS CONTG BYD 03Z ENDG 03-06Z.

.
AIRMET STG SFC WNDZ...NY LO
FROM 70SSW YOW TO 20NNE SYR TO 40W SYR TO 20NE BUF TO 30SW YYZ
TO 50ENE YYZ TO 70SSW YOW
SUSTAINED SURFACE WINDS GTR THAN 30KT EXP. CONDS ENDG BY 00Z.

.
AIRMET STG SFC WNDZ...NY PA OH LE
FROM BUF TO 20ENE ERI TO 30ENE CLE TO 30WSW CLE TO 30S DXO TO
40WNW ERI TO BUF

SUSTAINED SURFACE WINDS GTR THAN 30KT EXP. CONDS CONTG BYD 03Z
ENDG BY 09Z.

.
AIRMET STG SFC WND...MA RI NY NJ MD DE VA AND CSTL WTRS
FROM 140E ACK TO 200SE ACK TO 170S ACK TO 160SE SIE TO 20NE ECG
TO 50SW SBY TO 20ENE CYN TO 30SW HTO TO 50SE HTO TO 120S ACK TO
80SSE ACK TO 140E ACK
SUSTAINED SURFACE WINDS GTR THAN 30KT EXP. CONDS DVLPG 21-00Z.
CONDS CONTG BYD 03Z THRU 09Z.

.
LLWS POTENTIAL...ME NH VT MA NY PA
BOUNDED BY 70NW PQI-50NE PQI-60SSE HUL-20E BGR-20NNW CON-20WNW
SAX-50S MSS-30ESE YOW-20ESE YSC-70NW PQI
LLWS EXP. CONDS CONTG BYD 03Z ENDG 03-06Z.

.
OTLK VALID 0300-0900Z
AREA 1...TURB PA OH WV MD DC VA NC SC GA AND CSTL WTRS
BOUNDED BY 20WSW JST-50ESE EMI-100SE ECG-60SSE ILM-50S ODF-40S
GQO-GQO-HMV-HNN-20WSW JST
MOD TURB BTN FL180 AND FL390. CONDS CONTG THRU 09Z.

.
AREA 2...TURB VT MA CT NY LO NJ PA OH LE WV MD DC DE VA NC SC GA
AND CSTL WTRS
BOUNDED BY YSC-30WSW BDL-50SE JFK-60E ORF-50NE ILM-30SSE FLO-50E
MCN-20NNE LGC-GQO-HMV-HNN-20W CLE-30ENE BUF-50NW SYR-MSS-YSC
MOD TURB BLW 120. CONDS CONTG THRU 09Z.

.
AREA 3...STG SFC WND...LO
BOUNDED BY 60NNW SYR-20N SYR-50W SYR-30SSE YYZ-60NNW SYR
SUSTAINED SURFACE WINDS GTR THAN 30KT EXP. CONDS DVLPG AFT 09Z.
CONDS ENDG BY 09Z.

.
AREA 4...STG SFC WND...MA RI NY NJ MD DE VA NC SC GA FL AND CSTL
WTRS
BOUNDED BY 30W ACK-90ESE ACK-150E ACK-200SE ACK-160SE SIE-190ESE
ECG-130SSE ILM-210SE CHS-50E ORL-CRG-40SSW CHS-60ENE ILM-40SSE
ECG-40N ORF-JFK-40SSW PVD-30W ACK
SUSTAINED SURFACE WINDS GTR THAN 30KT EXP. CONDS CONTG THRU 09Z.

....

WAUS41 KPCI 012045
WA1S
-BOSS WA 012045
AIRMET SIERRA UPDT 6 FOR IFR AND MTN OBSCN VALID UNTIL 020300

.
AIRMET IFR...ME NH MA AND CSTL WTRS
FROM 70NW PQI TO 60NE PQI TO 140E ACK TO 80ESE ACK TO 50SSE YQB
TO 70NW PQI
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 03Z THRU 09Z.

.
AIRMET IFR...NY LO PA LE
FROM 30NNW SYR TO 50WSW SYR TO 50S JHW TO 30NW EWC TO 20NNE ERI
TO 30N BUF TO 30NNW SYR
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS DVLPG 00-03Z. CONDS CONTG
BYD 03Z THRU 09Z.

AIRMET IFR...NH VT MA RI CT NY NJ PA MD DE AND CSTL WTRS
FROM 20NNE ALB TO 20WNW BOS TO 90SSW ACK TO 20NNE SBY TO DCA TO
50E PSB TO 50S JHW TO 50WSW SYR TO 20NNE ALB
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS ENDG 00-03Z.

AIRMET MTN OBSCN...ME NH VT MA NY PA WV MD VA
FROM 70NW PQI TO MLT TO CON TO 50S ALB TO 60SSE JST TO 20SSW PSK
TO 50SW BKW TO EKN TO AIR TO JHW TO SYR TO MSS TO YSC TO 70NW PQI
MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG BYD 03Z THRU 09Z.

OTLK VALID 0300-0900Z
AREA 1...IFR ME NH VT MA AND CSTL WTRS
BOUNDED BY 70NW PQI-60NE PQI-130E ACK-80SE ACK-60WSW BGR-40ESE
MPV-50SSW YSC-70NW PQI
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG THRU 09Z.

AREA 2...IFR NY LO PA LE WV MD VA
BOUNDED BY 70S MSS-20E HNK-40S PSB-30SSE EKN-20W EKN-30WSW SLT-
30NW EWC-20NNE ERI-40ESE YYZ-70S MSS
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG THRU 09Z.

....

11.0 Graphical Forecasts for Aviation

The Graphical Forecasts for Aviation (GFA) products made available before the accident flight and valid at 1900 EST are shown in attachment 3. The GFA surface forecast products indicated VFR surface visibilities, a greater than 60 percent chance of snow showers, and a surface wind from the west at 15 knots with gusts to 25 knots. A graphical-AIRMET (G-AIRMET)²⁸ was valid for IFR conditions. The GFA cloud forecast valid before departure for around the accident time indicated scattered clouds around 2,300 ft above msl, overcast skies at 3,500 to 4,500 ft above msl, with cloud tops to 13,000 ft above msl. G-AIRMETs were valid for mountain obscuration and icing conditions. For more information please see attachment 3.

12.0 Terminal Aerodrome Forecast

KJHW was the closest airport to the accident site with an NWS²⁹ Terminal Aerodrome Forecast (TAF). The KJHW TAF valid at the time of the accident was issued at 1721 EST and was valid for a 20-hour period beginning at 1700 EST. The 1721 EST TAF for KJHW was as follows:

KJHW 012221Z 0122/0218 **27017G25KT 3SM -SHSN SCT007 OVC015**
TEMPO 0122/0202 3/4SM -SN BR BKN007
FM020300 28017G25KT 1/2SM -SHSN BLSN OVC015
FM020700 31019G30KT 2SM -SHSN BLSN OVC015
FM021600 30017G25KT 6SM BLSN BR BKN015=

²⁸ <https://aviationweather.gov/gairmet>

²⁹ According to NWS Instruction 10-813: "A NWS TAF consists of the expected meteorological conditions significant to aviation at an airport for a specified time period. For the U.S., this is the area within five (5) statute miles (SM) of the center of an airport's runway complex." www.nws.noaa.gov/directives/sym/pd01008013curr.pdf

After 1700 EST, the forecast expected a wind from 270° at 17 knots with gusts to 25 knots, 3 miles visibility, light snow showers, scattered clouds at 700 ft agl, and an overcast ceiling at 1,500 ft agl. Temporary conditions³⁰ were forecast between 1700 and 2100 EST which forecast ¾ of a mile visibility, light snow and mist, and a broken ceiling at 700 ft agl. The KJHW TAF had been updated at 1606, 1517, and 1238 EST.

The KJHW TAF valid at the time of departure was issued at 1238 EST and was valid for a 24-hour period beginning at 1300 EST. The 1238 EST TAF for KJHW was as follows:

TAF KJHW 011738Z 0118/0218 **27017G29KT 6SM -RA OVC015**
FM012300 28015G27KT 2SM -SHSN BKN020
FM020300 28017G25KT 1/2SM -SHSN BLSN OVC015
FM020700 31019G30KT 2SM -SHSN BLSN OVC015
FM021600 30017G25KT 6SM BLSN BR BKN015=

After 1300 EST, the forecast expected a wind from 270° at 17 knots with gusts to 29 knots, 6 miles visibility, light rain, and an overcast ceiling at 1,500 ft agl.

13.0 NWS Area Forecast Discussion

The NWS office in Buffalo, New York, (WFO BUF) issued the following Area Forecast Discussion (AFD) at 1544 EST (closest AFD to the accident time with an aviation section). The aviation section of the AFD discussed rain changing to snow between 1500 and 1700 EST near KJHW with gusty winds and LIFR visibilities in the snow and blowing snow:

FXUS61 KBUF 012044
AFDBUF

Area Forecast Discussion
National Weather Service Buffalo NY
344 PM EST Sun Nov 1 2020

.SYNOPSIS...

A strong cold front will cross the region this afternoon. Significant lake effect snow is possible east of Lake Ontario late Monday into Monday night, but even before that, several inches of snow will occur in the northwest wind snowbelts east of Lake Erie and east of Lake Ontario tonight into early Monday. Looks likely that all areas will see their first accumulating snow of the season, though in many areas the accumulations will be just a dusting. The early taste of winter will not last though, with a significant warm up likely mid to late week.

&&

.NEAR TERM /THROUGH MONDAY/...

Regional radar shows rain spreading across western NY and north central NY this afternoon. A cold front is located across western Lake Ontario to the western Finger Lakes and will continue to move

³⁰ Temporary conditions - fluctuations to forecast conditions which are expected to last less than one hour in each instance and, in the aggregate, to cover less than half of the indicated period.

east this afternoon. While gusty winds continue across the region this afternoon, deep mixing across far western NY will result in gusts 45-50 mph into this evening. Water vapor imagery clearing picks up on a deep trough over the Great Lakes. The southern, leading edge of the trough corresponds with a PV anomaly of about 600 mb across Ohio, western Pennsylvania, and West Virginia. Thunder has been reported in this area. Temperatures at 850mb are falling rapidly behind the front with -3 C across Buffalo and +2 C across Watertown. As the cold air filters across the region from the west to east into this evening, rain showers will transition to snow across the western Southern Tier.

The setup will become favorable for lake enhanced snow downwind of both lakes this evening. Lake equilibrium levels start climbing to over 10kft early this evening off Lake Erie and not much later off Lake Ontario as the deep trough stays progressive. Winds in the building lake effect convective layer are strong, so that will limit residence time over the lakes, limiting snow ratios and snow accumulations. Even so, as the period of strongest lake enhancement occurs late evening through the early overnight, snowfall rates could reach 1 inch per hour for a few hours. Total snow accumulations by late tonight in the areas favored by northwest flow east of Lake Erie and Lake Ontario could reach 6 inches. Higher terrain of the Chautauqua Ridge and on the Tug Hill would be where heaviest snow is expected. That said, much of higher terrain over western New York will see at least a few inches of snow along with some blowing snow due to the strong winds.

Winter weather advisories remain over western Southern Tier into the higher terrain of Southern Erie and Wyoming county and also for the eastern Lake Ontario region. Outside of these areas, light snow with the gusty winds will result in areas of lower visibility which could linger into the Monday morning commute. Lull in lake effect will be brief as another round of heavy lake effect snow is possible late Monday afternoon into Monday night especially for westerly to northwest flow targeting the Tug Hill region. See details on this in the short term discussion.

&&

.SHORT TERM /MONDAY NIGHT THROUGH TUESDAY/...
...Significant accumulating lake snows possible east of Lake Ontario during this period...

A secondary potent shortwave will drop southeast channeling down the back side of the broader trough. While lake snows weaken off Lake Erie, the exact opposite can be said east of Lake Ontario where westerly flow across the lake will make use of the longer fetch to produce what could be our first significant snowfall, especially across the Tug Hill. The only hindrance right now appears to be residence time of the band over any given location which is expected to gradually settle southward over the course of the night. However, confident enough that there will be time for snowfall accumulation greater than +7 inches east of Lake Ontario in the most intense portion of the

band. A Winter storm watch has been issued for this potential from Monday evening through Tuesday morning. Some minor accumulations can still anticipated east of Lake Erie overnight but with drier air moving in and equilibrium levels falling this will limit the lake response off Lake Erie.

The aforementioned mid-level trough then moves well east of the region by early Tuesday morning. The loss of background moisture with the departing trough and lowering equilibrium levels will then aid in gradually weakening and diminishing lake snows over the course of the day.

After Tuesday, dry weather returns as sfc ridging builds off the Mid-Atlantic and Northeast coast. This will not only provide dry weather through the end of this period but also initiate a big warm up. Temperatures anticipated to climb well above normal with highs climbing into the 60s for the later half of the week.

&&

.LONG TERM /TUESDAY NIGHT THROUGH SUNDAY/...

This period will be marked by a dry stretch that will also feature mild temperatures that could push to near daily record levels by the end of the period.

A flat zonal flow to start the period will become more amplified as a sharp upper level trough drops down across the western US. There will be a pause to the amplification...this on Thursday and into Friday as a shortwave passes across southern Canada. This feature will bring a few more clouds to the region Thursday...and may even allow for afternoon temperatures to dip a degree lower than the previous day (Wednesday). By the weekend, temperatures at 850 hPa will push towards +12 to +13C. A look at past soundings for KBUF, the moving maximum temperature at 850 hPa next weekend is right around +12 to +13C...thus with sunny skies will place highs Saturday and Sunday close to daily record values. The one factor that may keep us from reaching near record highs is with the upper level and down to the surface ridge axis right over us...boundary layer mixing may not be that deep, which would keep afternoon temperatures a few degrees cooler than a well mixed lower atmosphere. None the less next weekend is shaping up to be pleasantly mild.

&&

.AVIATION /21Z SUNDAY THROUGH FRIDAY/...

Rain continues across the region this afternoon. A cold front is east of KROC and will move through KART by 21z. Strong gusty winds are expected behind the front into this evening. Some gusts of 40-45kts are possible at KIAG/KBUF. Ceilings will fall to MVFR with periods of IFR visibility with moderate to heavy rain.

Rain will change to snow across the higher terrain including KJHW between 20-22Z. Rain will eventually change over to snow elsewhere this evening. Cold air will continue to deepen resulting in lake effect snow east and southeast of the lakes. Given strong winds and

accumulating snow, blowing snow will also increase. LIFR vsby in the heaviest snow and blowing snow. Otherwise, IFR to lower MVFR conditions expected. Lake effect snow will become confined to east of Lake Ontario and taper off east of Lake Erie Monday. Any snow bands will produce sub-VFR conditions at the terminals however terminals should be on the outskirts of the bands into Monday afternoon.

Outlook...

Monday through Tuesday...MVFR/IFR possible in lake effect snow showers southeast of the lakes. VFR elsewhere.

Wednesday through Friday...VFR.

&&

.MARINE...

Winds will become west then northwest behind a cold frontal passage this afternoon through at least Monday night. Small Craft Advisories will transition to Gale Warnings later today. The strongest winds should be Monday night over Lake Ontario with possible gusts over 45 knots.

&&

.TIDES/COASTAL FLOODING...

Strong cold front crossing early this afternoon will result in a period of westerly gale force winds and increasing water levels on Lake Erie through tonight. Water levels could reach 75 inches above low water datum.

Later Monday into Monday night, even though water levels are not as high as we have seen recently, westerly gales on Lake Ontario will result in potential for significant wave action and lakeshore flooding on east end of the lake. Thus, a lakeshore flood watch remains in effect.

&&

.BUF WATCHES/WARNINGS/ADVISORIES...

NY...Winter Weather Advisory from 7 PM this evening to 10 AM EST

Monday for NYZ006>008.

Lakeshore Flood Watch from Monday evening through Tuesday morning for NYZ005>007.

Winter Storm Watch from Monday afternoon through Tuesday morning for NYZ006>008.

Wind Advisory until 7 AM EST Monday for NYZ001-010-019-085.

Winter Weather Advisory until 7 AM EST Monday for NYZ012-019-020-085.

Lakeshore Flood Advisory until 4 AM EST Monday for NYZ010-019-085.

MARINE...Gale Warning until 6 AM EST Monday for LEZ040-041.

Small Craft Advisory until 6 AM EST Tuesday for LEZ020.

Small Craft Advisory until 1 PM EST Monday for LOZ030.

Small Craft Advisory until 2 AM EST Monday for LOZ043>045.

Gale Warning from 2 AM Monday to 7 AM EST Tuesday for

LOZ043>045-063>065.
Small Craft Advisory until midnight EST tonight for LOZ042.
Gale Warning from midnight tonight to 2 AM EST Tuesday for
LOZ042-062.

&&

\$\$

14.0 Winds and Temperature Aloft Forecast

The NWS 1455 EST Winds and Temperature Aloft forecast valid for the closest point to the accident site is included below:

```
FBUS31 KWN0 011955  
FD1US1  
DATA BASED ON 011800Z  
VALID 020000Z    FOR USE 2000-0300Z. TEMPS NEG ABV 24000  
  
FT   3000    6000    9000   12000   18000   24000   30000   34000   39000  
BUF 2836 2938-12 2736-19 2737-22 2641-31 2448-37 235141 235340 245642
```

The accident site was located closest to the Buffalo, New York, (BUF) forecast point. The 1455 EST BUF forecast for use between 1500 EST and 2200 EST indicated a wind at 3,000 ft from 280° at 36 knots, a wind at 6,000 ft from 290° at 38 knots with a temperature of -12°C, and a wind at 9,000 ft from 270° at 36 knots with a temperature of -19°C.

15.0 Pilot Weather Briefing

The accident pilot did not request a weather briefing from Flight Service Leidos.

A search of archived ForeFlight information indicated that the accident pilot did request weather information for a flight at 9,000 ft via ForeFlight (attachment 4) at 0805 EST with a planned departure of 1500 EST. The 0805 EST weather briefing information contained weather information valid at 0805 EST including AIRMETs, a surface analysis chart, current METARs valid along the route of flight, PIREPs, a GFA forecast (including G-AIRMETs), TAFs, turbulence cross section information, and the winds aloft information. There is no record of the accident pilot receiving or retrieving any other weather information before or during the accident flight from ForeFlight or other providers.

16.0 Icing Potential³¹

Current Icing Potential (CIP) and Forecast Icing Potential (FIP) products are created by the NWS Aviation Weather Center (AWC) and are intended to supplement other icing advisories (e.g. AIRMETs and SIGMETs). Figures 11 through 13 are the FIP icing probabilities and icing severity products and 1-hour forecast valid at 1800 EST at 2,000, 3,000, and 4,000 ft above msl. The FIP images in figures 11 through 13 indicated a 30 to 60% probability of icing at 2,000 to 4,000 ft at 1800 EST above the accident site. The FIP also indicated that the icing near the accident site would likely be in the “trace” or “light” categories. The FIP indicated an unknown probability of Supercooled Large Droplets (SLD) over the accident site at the accident time (attachment 5).³²

The CIP product indicated a 10 to 70% probability of icing at 2,000 to 4,000 ft at 1800 EST above the accident site (figures 14, 15, and 16). The CIP also indicated that the icing near the accident site would be in the “trace,” “light” or “moderate” categories above 2,000 ft above msl. The CIP also indicated an unknown probability of SLD at the accident site at the accident time (attachment 5). For more FIP and CIP data please see attachment 5.

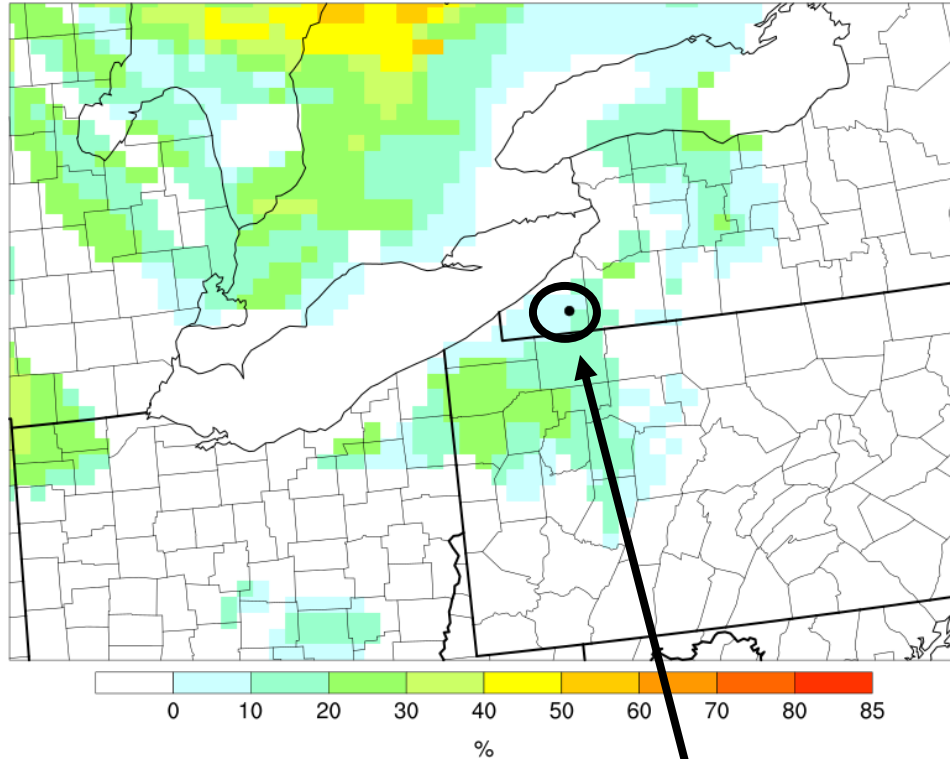
³¹ B.C. Bernstein, F. McDonough, M. K. Politovich, B. G. Brown, T. P. Ratvasky, D. R. Miller, C.A. Wolff, and G. Cuning, Current Icing Potential: Algorithm Description and Comparison with Aircraft Observations (Journal of Applied Meteorology, 2005), pp. 969-986.

C.A. Wolff, F. McDonough, M. K. Politovich, B.C. Bernstein, and G. Cuning, FIP Severity Technical Document (Prepared for the Aviation Weather Technology Transfer Technical Review Board), pp. 1-44.

<https://arc.aiaa.org/doi/abs/10.2514/6.2009-3531>

³² <https://www.aviationweather.gov/icing/fip>

ICING PROBABILITY at FL 020 01 Hour forecast valid at: 11/1/2020 2300 UTC



ICING SEVERITY CATEGORY at FL 020 01 Hour forecast valid at: 11/1/2020 2300 UTC

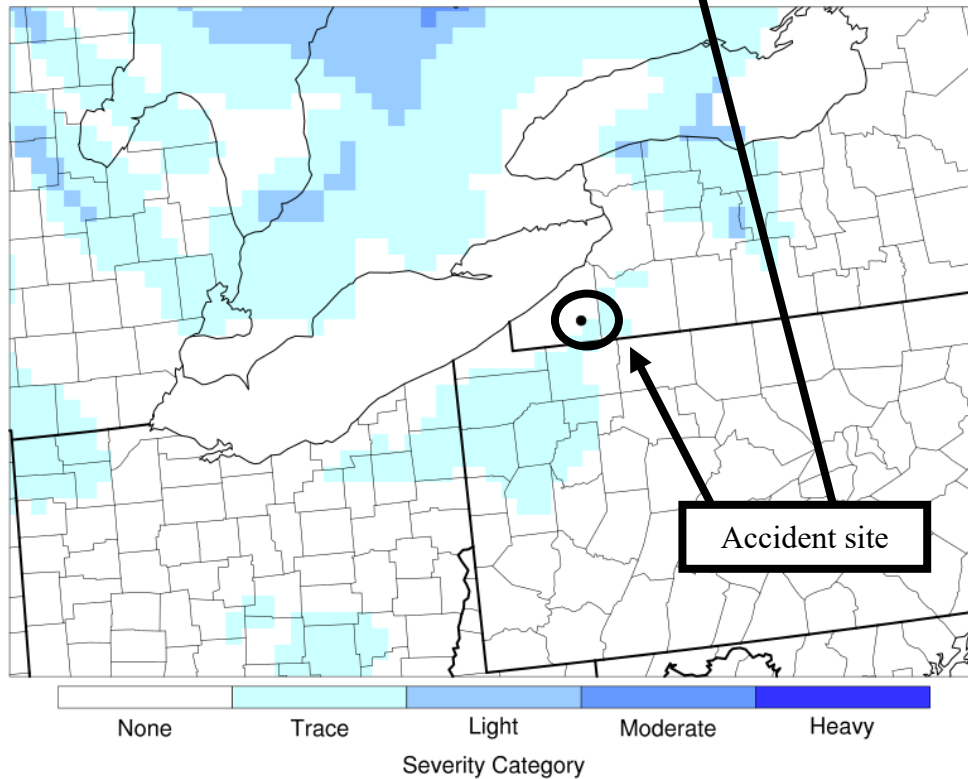
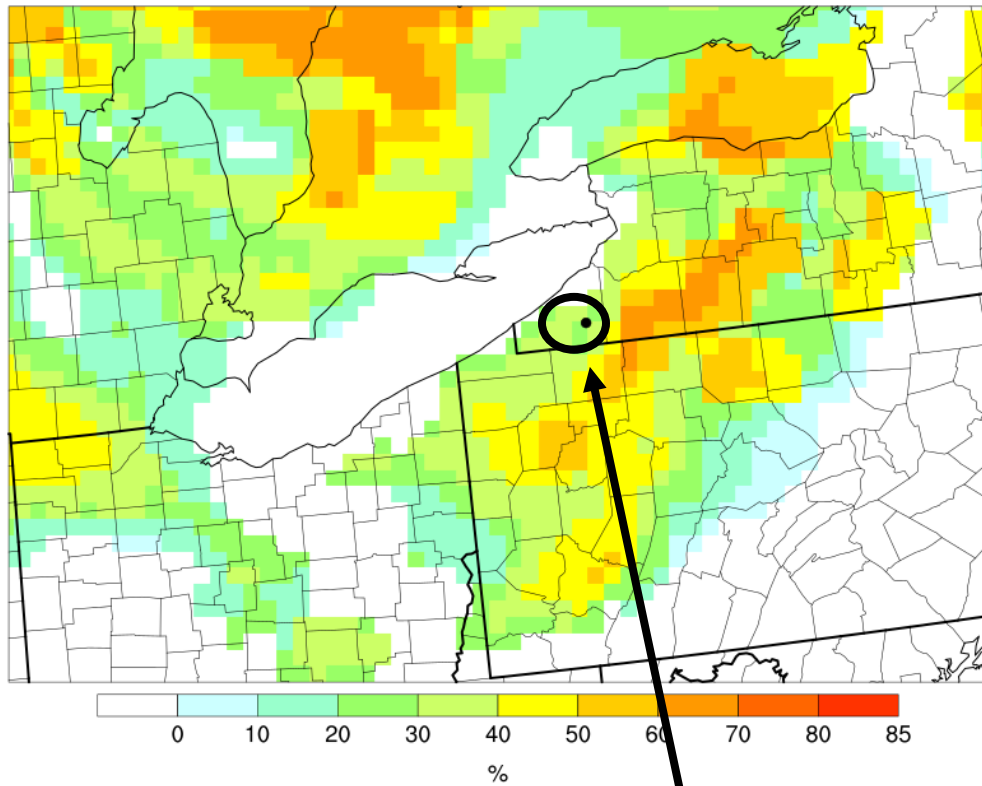


Figure 11 – (top) FIP probability of icing at 2,000 ft above msl and (bottom) FIP severity of icing at 2,000 ft above msl. 1-hour forecast valid for 1800 EST.

ICING PROBABILITY at FL 030

01 Hour forecast valid at: 11/1/2020 2300 UTC



ICING SEVERITY CATEGORY at FL 030

01 Hour forecast valid at: 11/1/2020 2300 UTC

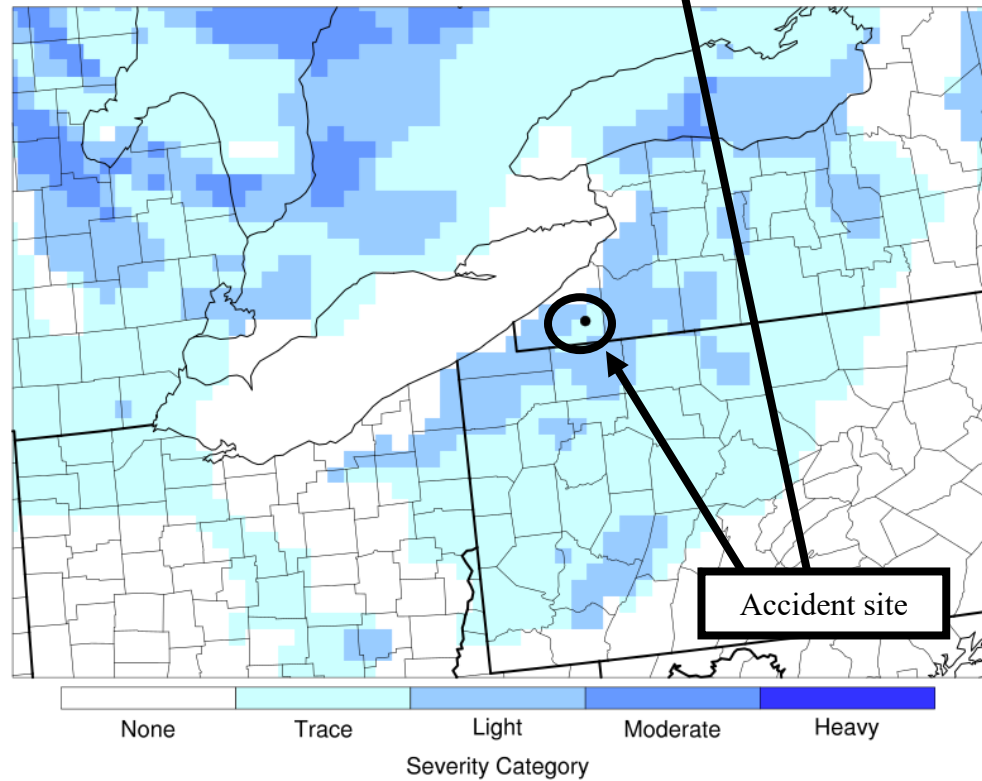
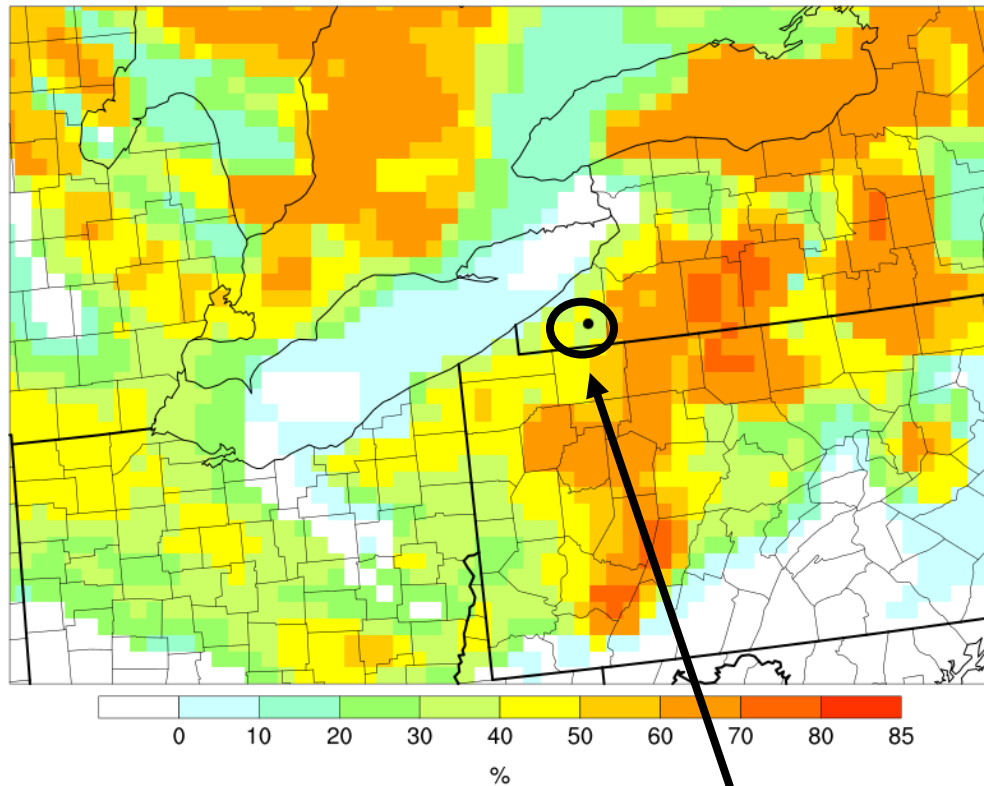


Figure 12 – (top) FIP probability of icing at 3,000 ft above msl and (bottom) FIP severity of icing at 3,000 ft above msl. 1-hour forecast valid for 1800 EST.

ICING PROBABILITY at FL 040

01 Hour forecast valid at: 11/1/2020 2300 UTC



ICING SEVERITY CATEGORY at FL 040

01 Hour forecast valid at: 11/1/2020 2300 UTC

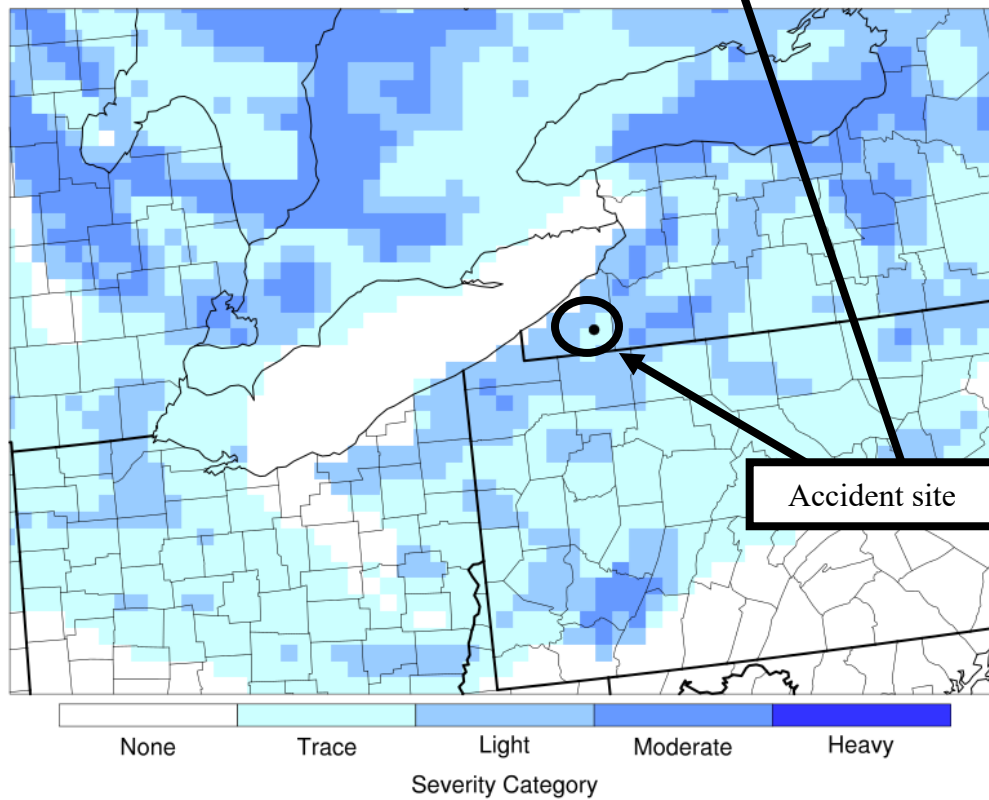
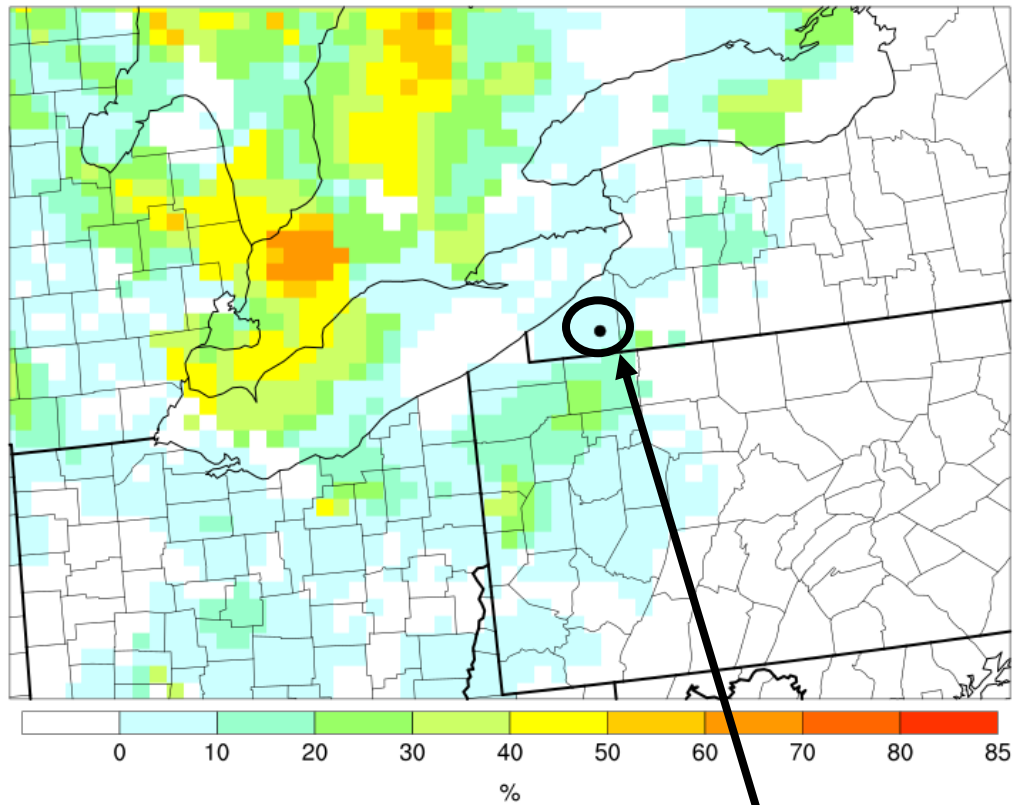


Figure 13 – (top) FIP probability of icing at 4,000 ft above msl and (bottom) FIP severity of icing at 4,000 ft above msl. 1-hour forecast valid for 1800 EST.

ICING PROBABILITY at FL 020

11/1/2020 2308 UTC



ICING SEVERITY at FL 020

11/1/2020 2308 UTC

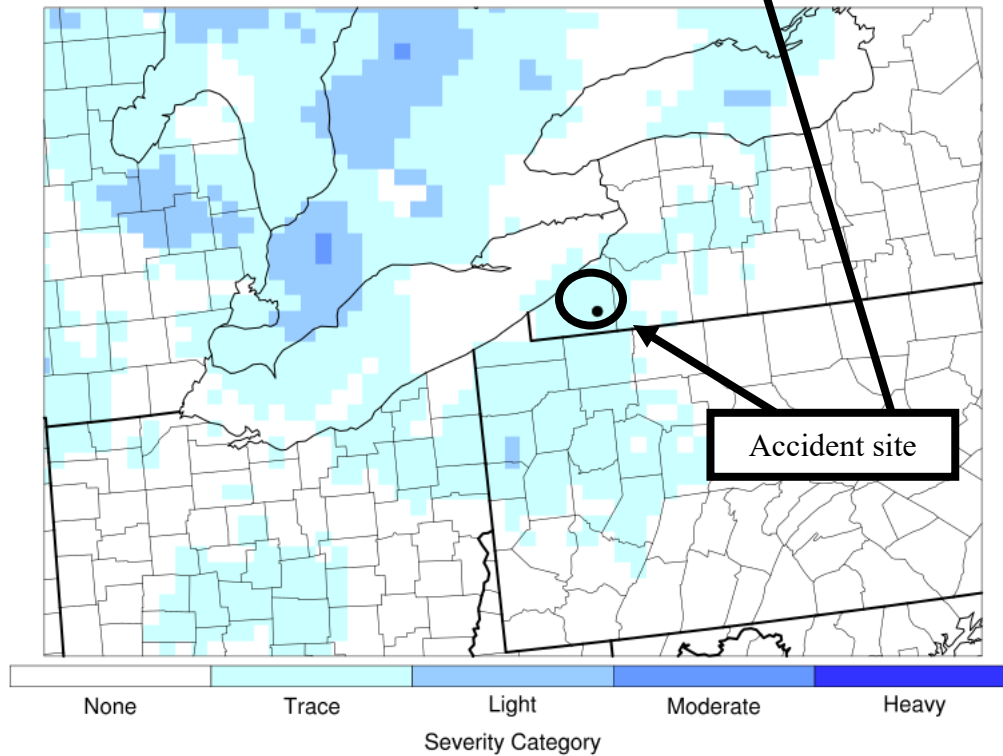


Figure 14 – (top) CIP probability of icing at 2,000 ft above msl and (bottom) CIP severity of icing at 2,000 ft above msl. valid for 1800 EST.

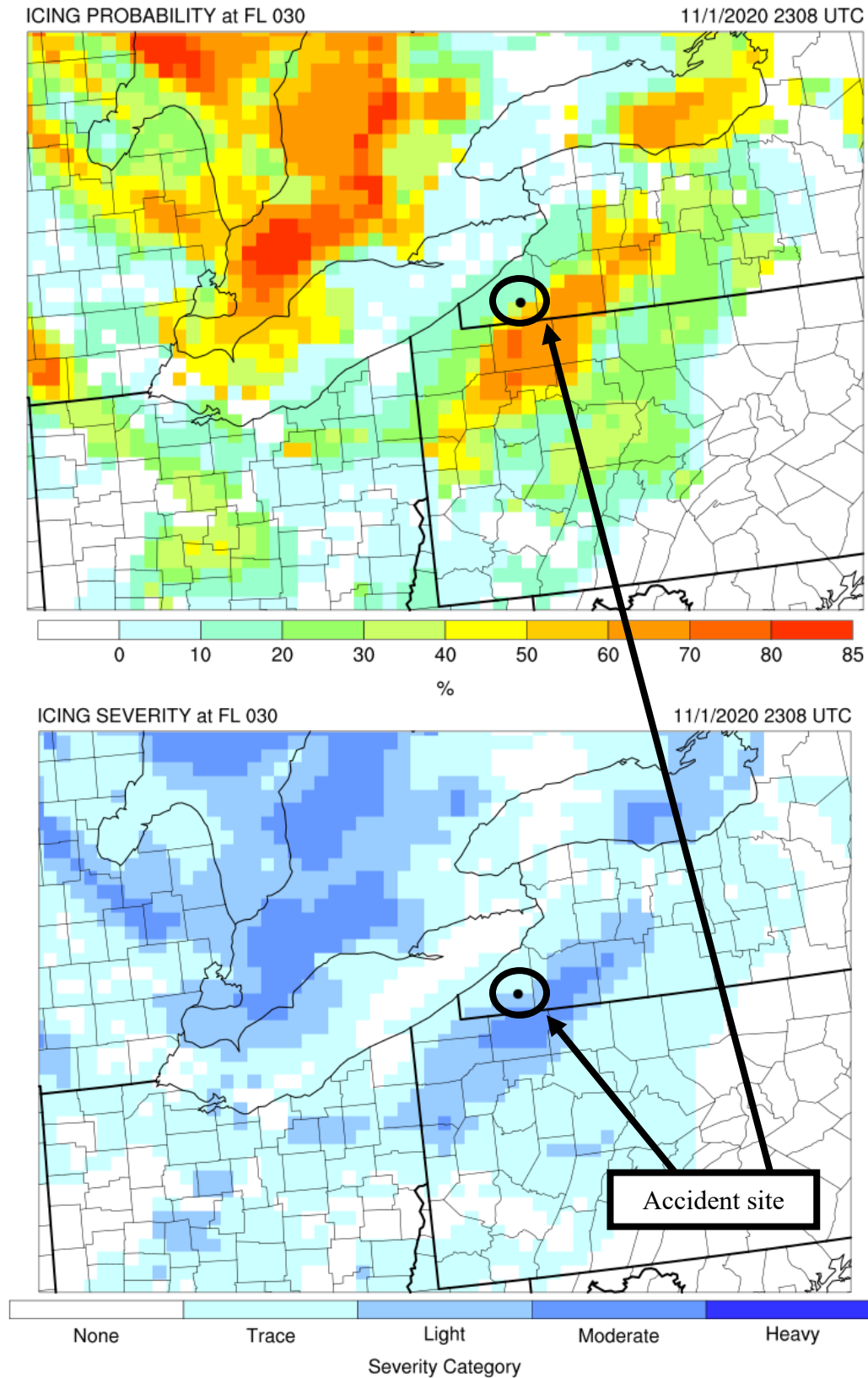


Figure 15 – (top) CIP probability of icing at 3,000 ft above msl and (bottom) CIP severity of icing at 3,000 ft above msl. valid for 1800 EST.

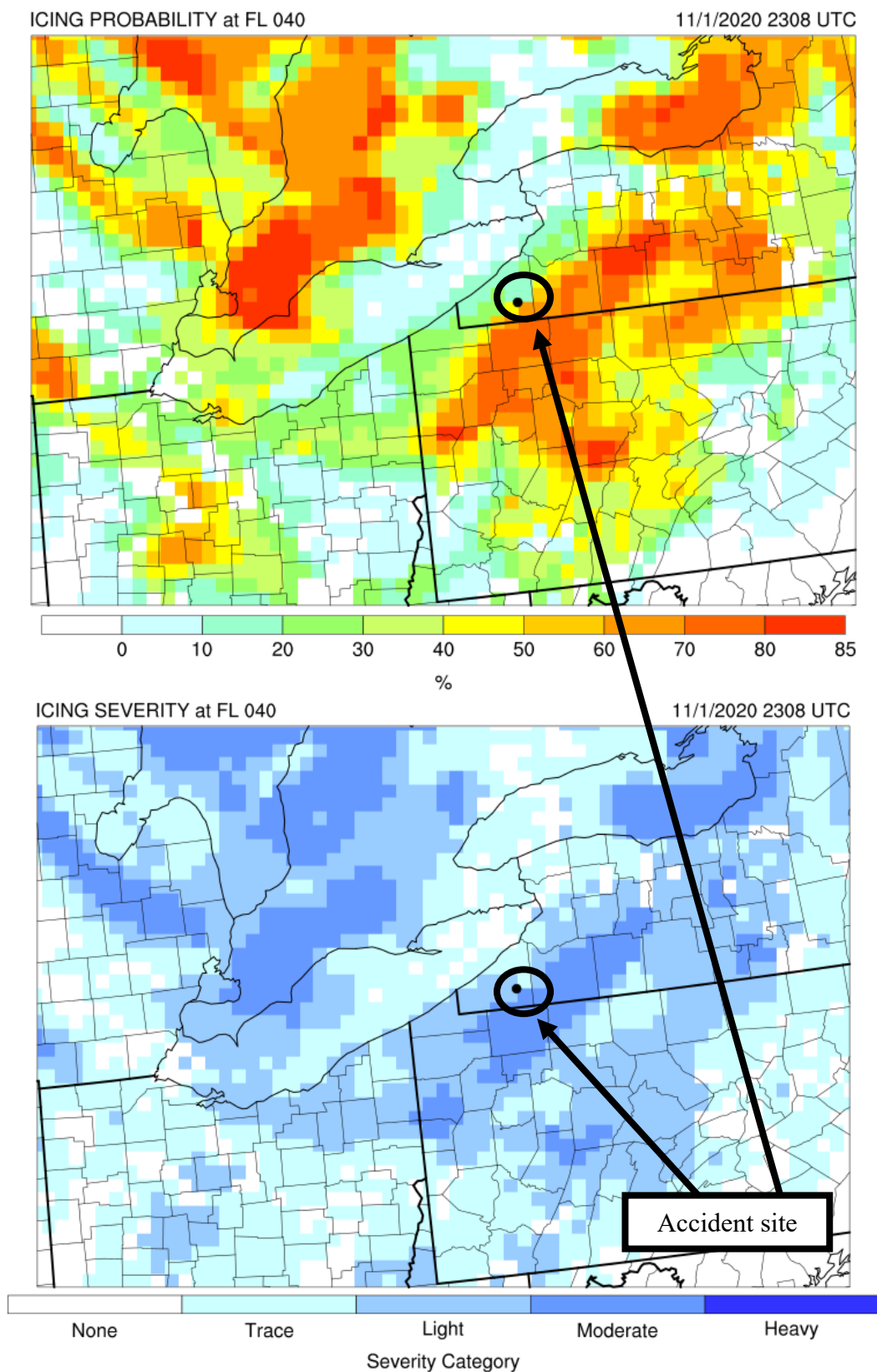


Figure 16 – (top) CIP probability of icing at 4,000 ft above msl and (bottom) CIP severity of icing at 4,000 ft above msl. valid for 1800 EST.

17.0 Astronomical Data

The astronomical data obtained for the accident site on November 1, 2020, indicated the following:

SUN

Begin civil twilight	0621 EST
Sunrise	0650 EST
Sun transit	1200 EST
Sunset	1710 EST
End civil twilight	1739 EST
Accident time	1748 EST³³

MOON

Accident time	1748 EST³⁴
Moonrise	1758 EST
Moon transit	0030 EST on November 2
Moonset	0739 EST on November 2

E. LIST OF ATTACHMENTS

Attachment 1 – GOES-16 Nighttime Microphysics RGB imagery from 1701 to 1831 EST

Attachment 2 – KBUF base reflectivity animation from 1731 to 1802 EST

Attachment 3 – GFA products valid for the accident flight

Attachment 4 – ForeFlight correspondence

Attachment 5 – FIP and CIP information valid for the accident flight

Submitted by:

Paul Suffern
Senior Meteorologist

³³ Inserted accident time for reference and context.

³⁴ Inserted accident time for reference and context.