



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

February 6, 2020

Weather Study

METEOROLOGY

ERA19FA161

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A. ACCIDENT

Location: Tyrone, Pennsylvania
Date: May 1, 2019
Time: 1251 eastern daylight time
1651 Coordinated Universal Time (UTC)
Aircraft: Cessna 172N, Registration: N733KZ

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 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). All times are eastern daylight time (EDT) on May 1, 2019, and are based upon the 24-hour clock, where local time is -4 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 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 40.7644° N, longitude 78.2111° W at an approximate elevation of 2,181 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

https://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/1030

1.1 Surface Analysis Chart

The Mid-Atlantic United States section of the NWS Surface Analysis Chart for 1100 EDT is provided as figure 1 with the location of the accident site marked within the red circle. The chart indicated a low pressure system over southern Lake Michigan with a central pressure of 1010-hectopascals (hPa) and a high pressure system over Massachusetts with a central pressure of 1023-hPa. A warm front stretched from Lake Michigan eastward to western New York then southward to Virginia. The warm front then stretched eastward from Virginia into the western Atlantic Ocean and became a cold front. The accident site was located east of the warm front on the cool side of the frontal boundary.

The station models around the accident site depicted air temperatures in the mid 50's to low 60's degrees Fahrenheit (°F), dew point temperatures in the low to mid 50's °F with a temperature-dew point spread of 4° or less east of the warm front (on the cool side of the frontal boundary), a southeast wind between 5 and 10 knots, overcast cloud cover, and mist.

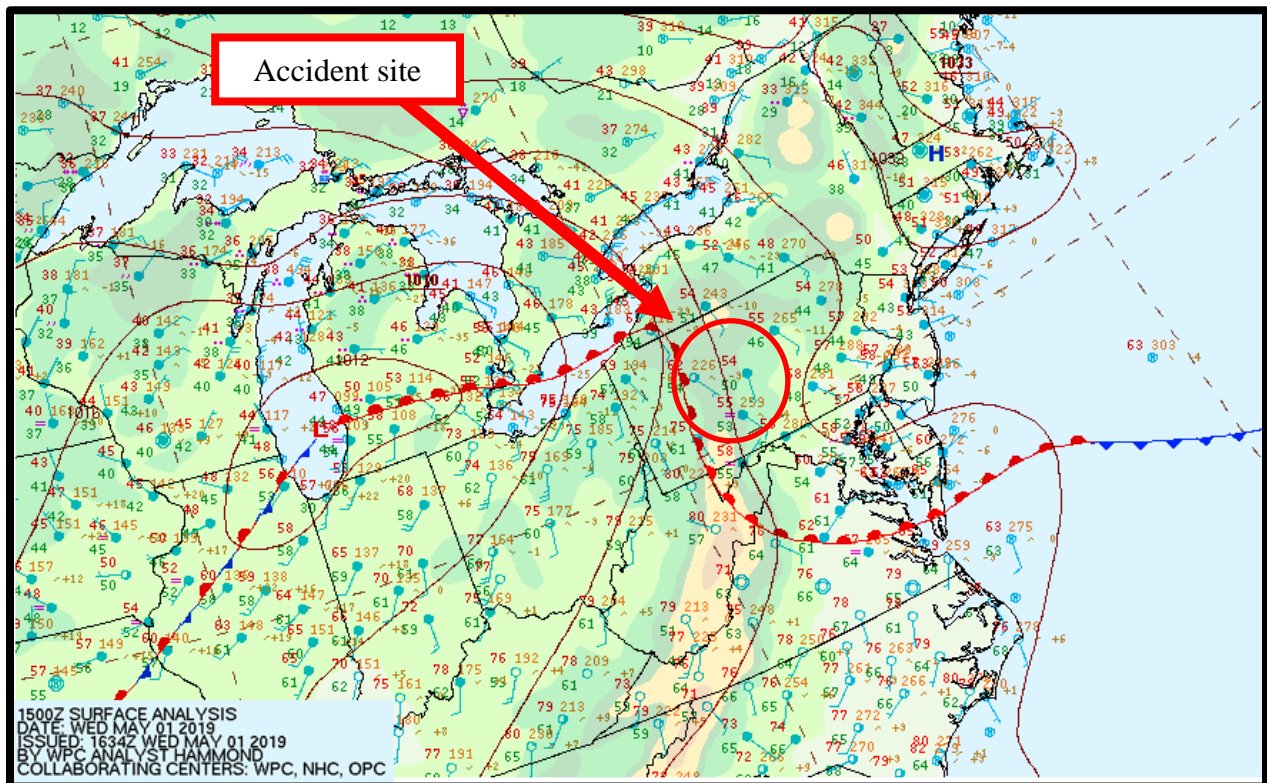


Figure 1 – NWS Surface Analysis Chart for 1100 EDT

1.2 Upper Air Charts

The NWS Storm Prediction Center (SPC) Constant Pressure Charts for 0800 EDT at 925-, 850-, 700-, 500-, and 300-hPa (around 2,500 ft, 5,000 ft, 10,000 ft, 18,000 ft, and 30,000 ft, respectively) are presented in figures 2 through 6. There was a low-level trough² located above the accident site at 925-hPa. Troughs can act as lifting mechanisms to help produce clouds and precipitation if sufficient moisture is present. The wind was from the southwest to southeast at 25 to 30 knots at 925-hPa with the wind becoming southwesterly at 40 knots by 700-hPa (figure 4). At 300-hPa, the wind was from the southwest at 30 knots (figure 6).

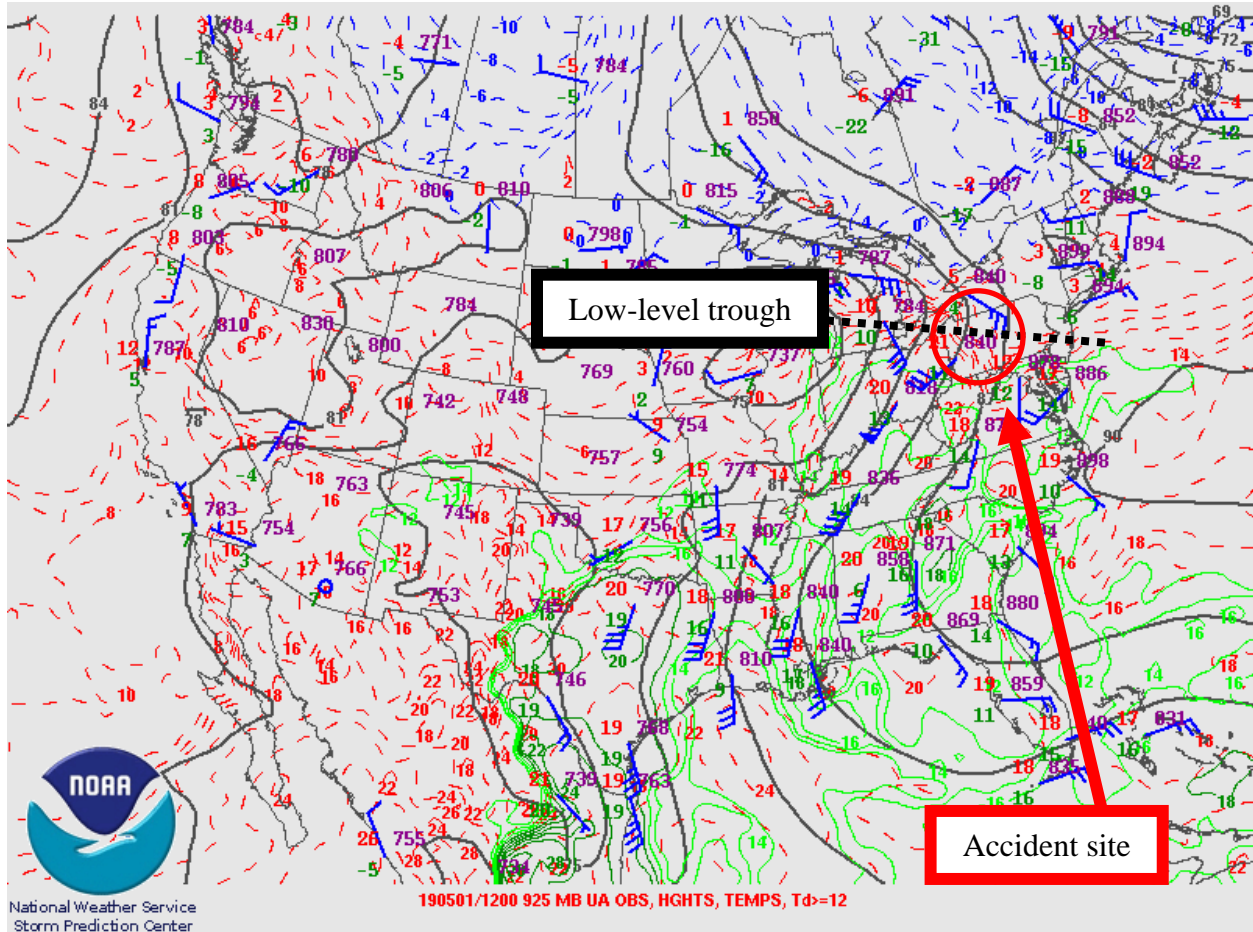


Figure 2 – 925-hPa Constant Pressure Chart for 0800 EDT

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

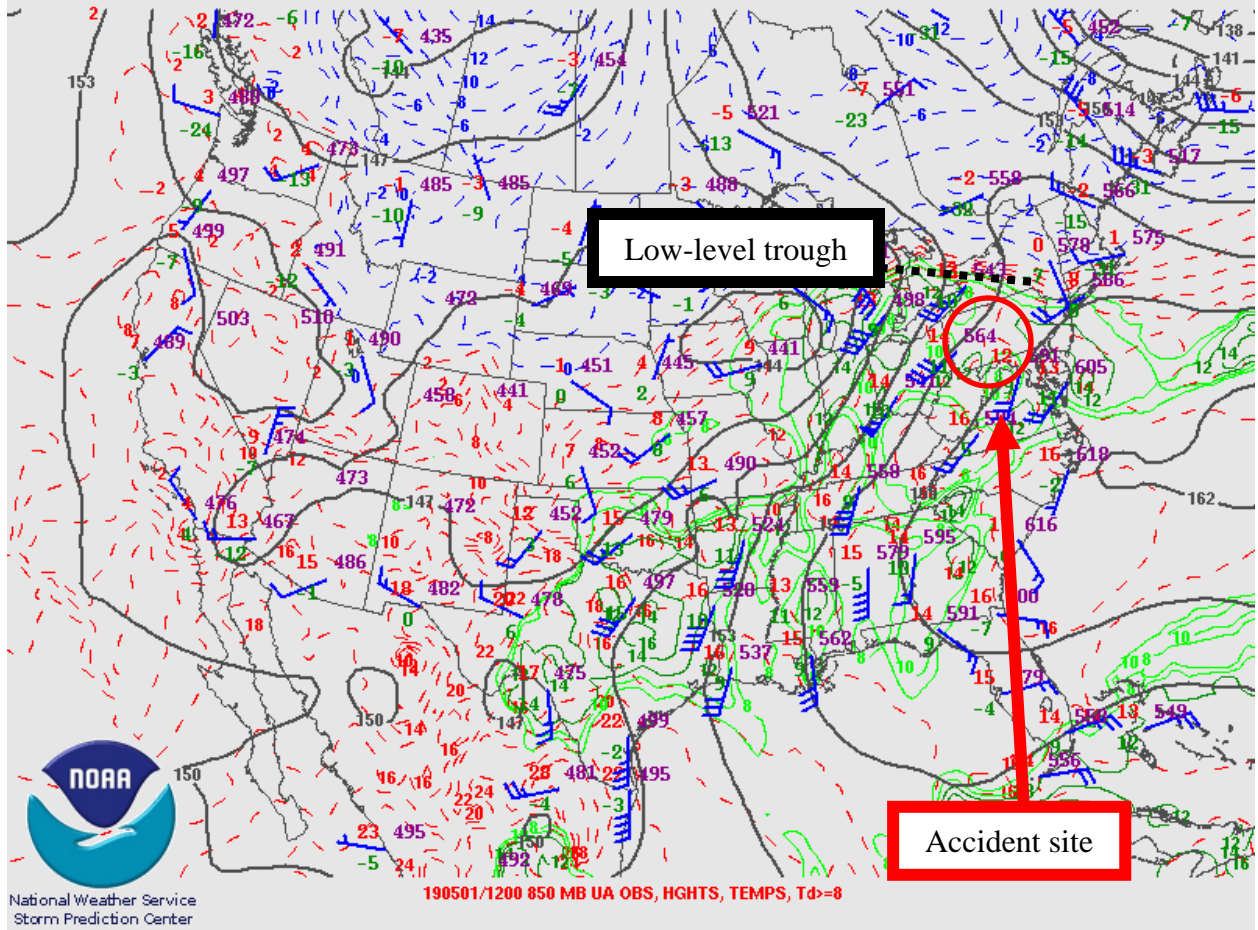


Figure 3 – 850-hPa Constant Pressure Chart for 0800 EDT

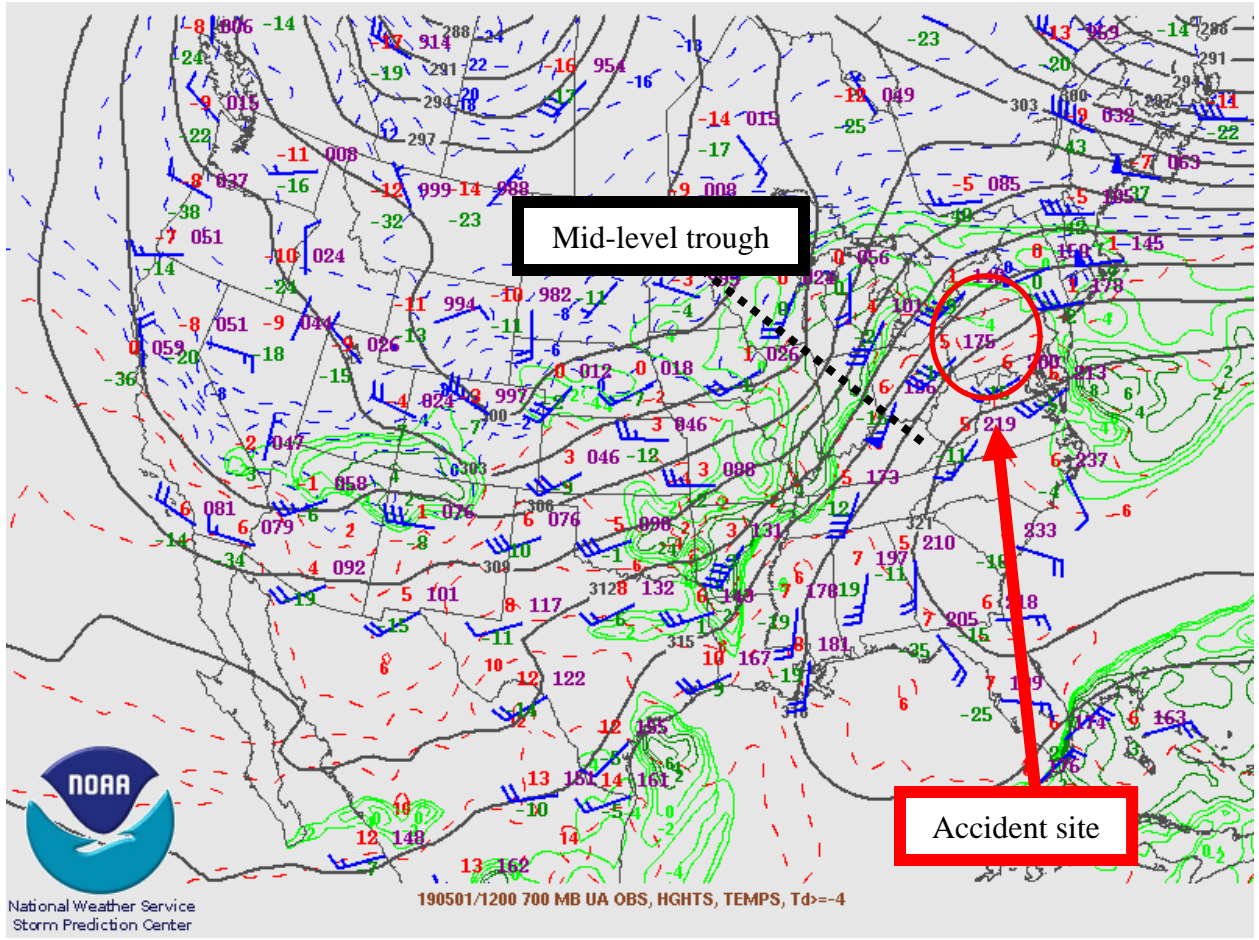


Figure 4 – 700-hPa Constant Pressure Chart for 0800 EDT

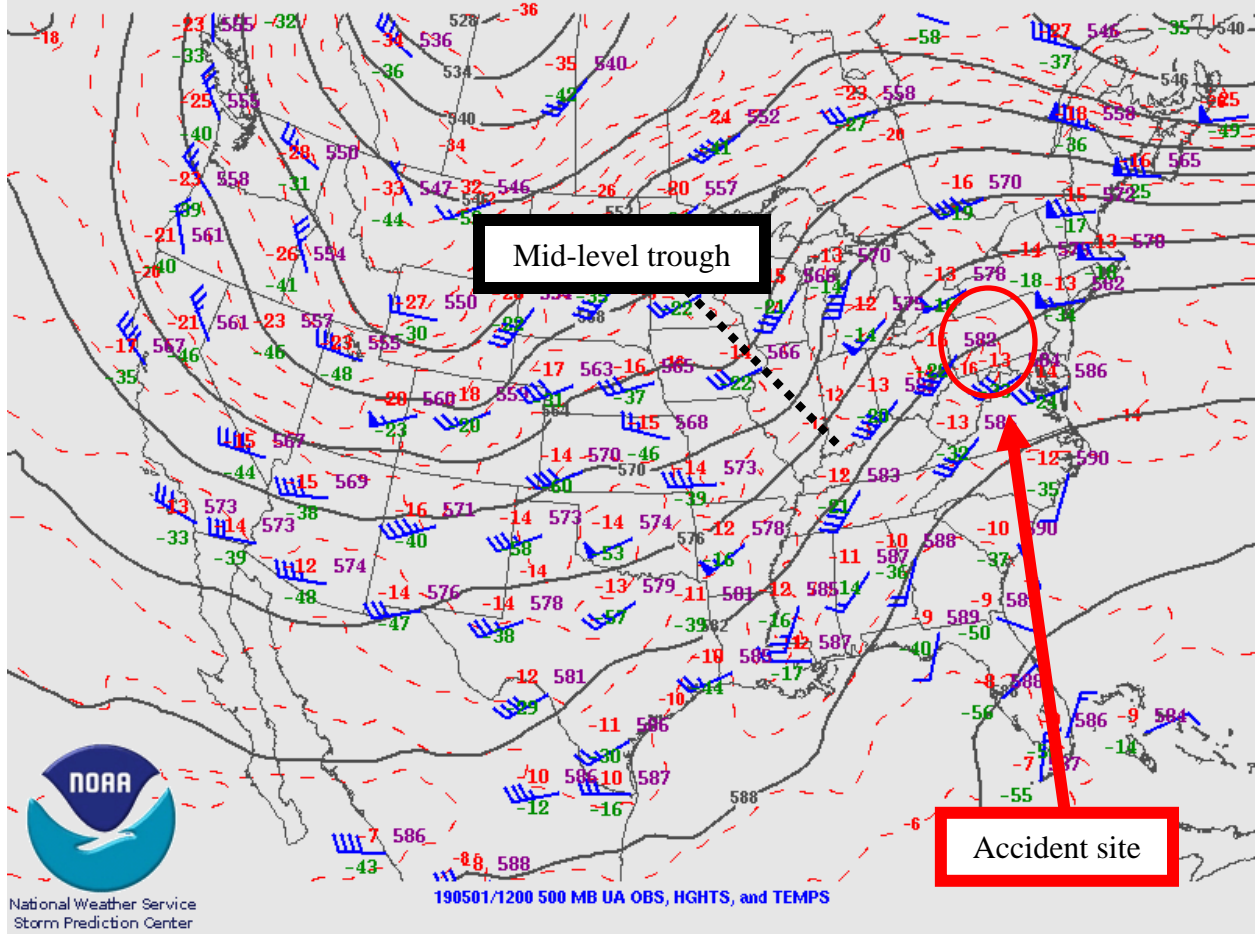


Figure 5 – 500-hPa Constant Pressure Chart for 0800 EDT

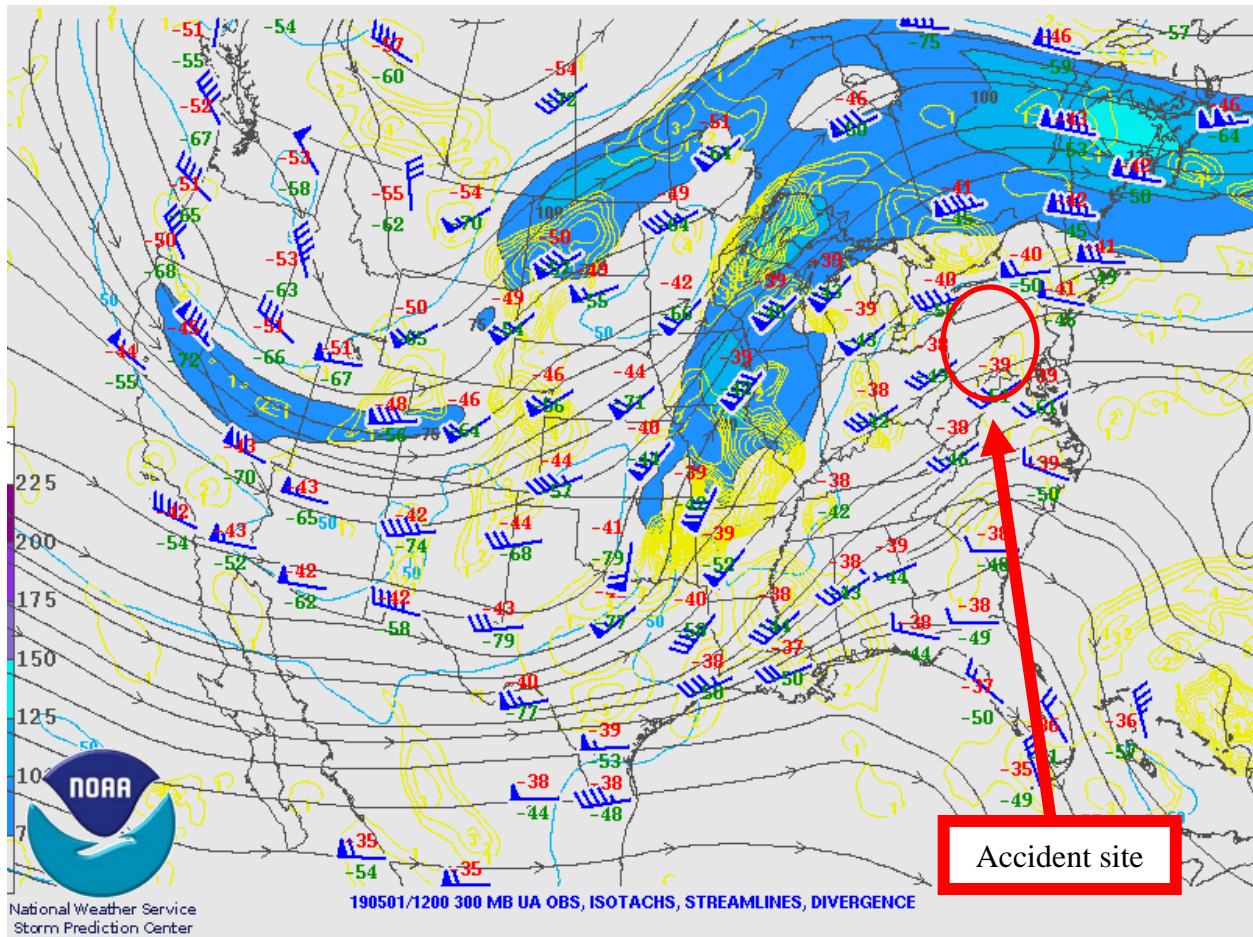


Figure 6 – 300-hPa Constant Pressure Chart for 0800 EDT

2.0 SPC Products

SPC issued the following Day 1 Convective Outlook at 1216 EDT (figure 7) with areas of general thunderstorms forecast for the accident site³. SPC defines the “TSTM” area as an area that encloses where a 10% or higher probability of thunderstorms is forecast during the valid period. The thunderstorms were not forecast to occur near the accident site region until the afternoon and evening hours (1500 to 2000 EDT). The SPC Day 1 Convective Outlook text follows figure 7:

³ The 0800 and 0900 EDT SPC Day 1 Convective Outlook forecast similar conditions and had similar graphics.

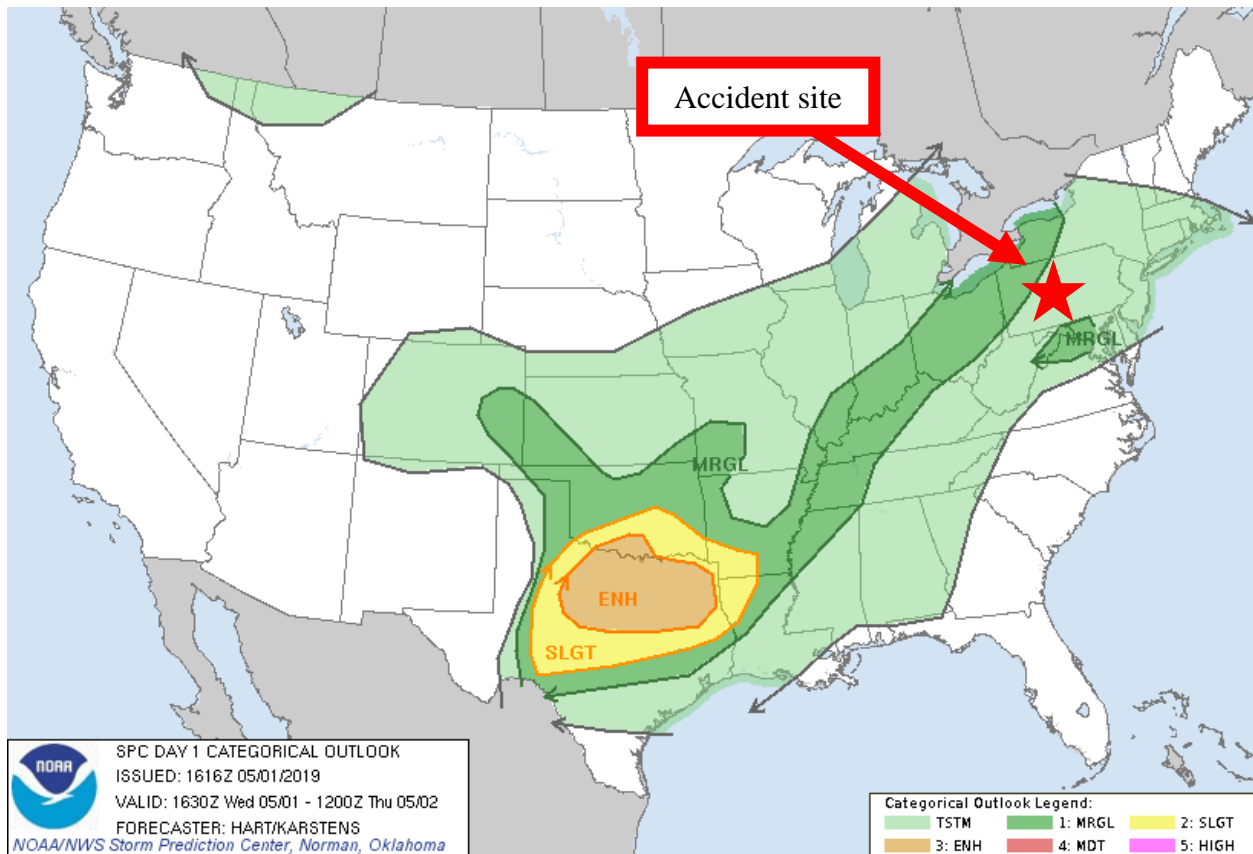


Figure 7 – SPC day 1 Convective Outlook valid at the time of the accident

SPC AC 011616

Day 1 Convective Outlook
 NWS Storm Prediction Center Norman OK
 1116 AM CDT Wed May 01 2019

Valid 011630Z - 021200Z

...THERE IS AN ENHANCED RISK OF SEVERE THUNDERSTORMS THIS AFTERNOON AND EVENING OVER MUCH OF NORTH TEXAS AND FAR SOUTHERN OKLAHOMA....

...SUMMARY...

The greatest potential for severe thunderstorms will be from midday through evening, across parts of north Texas and extreme southern Oklahoma.

...Central TX into southern OK...

The late morning surface analysis shows a remnant outflow boundary from overnight convection lying just south of the Red River across northeast TX. This boundary intersects a weak cold front over south-central OK. The air mass along and south of these boundaries is very moist with dewpoints around 70F, and should warm substantially through the day. This will yield afternoon MLCAPE values over 4000 J/kg and only a weak cap.

Meanwhile, water vapor imagery shows a weak perturbation tracking

across northern Mexico. This feature will move into central TX this evening, enhancing large-scale lift and supporting the development of intense thunderstorms. Activity is expected to initially develop along the aforementioned boundaries over southern OK, and along the weak boundaries extending southward across west-central TX. Initial storms will likely be supercellular capable of very large hail. Low-level shear is rather weak, suggesting the main tornado risk would be proximate to boundaries or if a storm can take full-advantage of the extreme CAPE environment.

Storms are expected to increase in coverage through the evening, spreading eastward through the ENH risk area. An upscale evolution into one or more bowing lines is forecast, with a risk of damaging winds and hail.

...Southeast CO/southwest KS...

Southeasterly/upslope flow is present today over southwest KS and parts of southeast CO. Low-level moisture transport and strong heating will likely lead to a narrow corridor of moderate CAPE values this afternoon. Several 12z CAM solutions show one or two storms forming in this zone - tracking southeastward into KS through early evening. If this occurs, large hail would be possible. Will maintain MRGL risk at this time, but will consider an upgrade to SLGT at 20z if trends warrant.

...OH Valley...

Scattered thunderstorms are expected to form later today along a weak cold front extending from OH into western KY/TN. The stronger cells in this region may pose a risk of locally damaging wind gusts or hail, but the threat is expected to remain marginal.

..Hart/Karstens.. 05/01/2019

CLICK TO GET WUUS01 PTSDY1 PRODUCT

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

3.0 Surface Observations

The area surrounding the accident site was documented using official Meteorological Aerodrome Reports (METARs) and Specials (SPECIs). Figure 8 is a sectional chart with the accident site and the closest weather reporting location to the accident site marked. The pink line is the direct line between the departure airport, University Park Airport (UNV), and the intended destination airport, Pittsburgh/Butler Regional Airport (BTP).

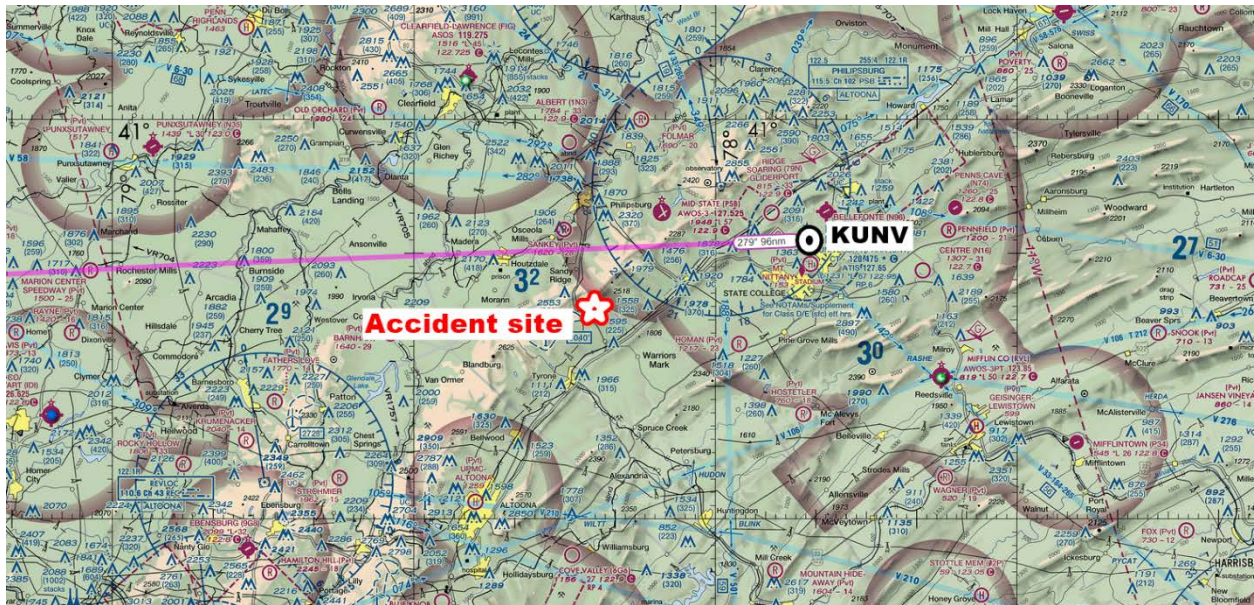


Figure 8 – Sectional chart of accident area with the location of the accident site and the closest surface observation site

The closest official weather reporting facility to the accident site was from University Park Airport equipment (KUNV), at an elevation of 1,231 ft, and was 17 miles east-northeast of the accident site. KUNV had an Automated Weather Observing System (AWOS⁴) whose reports were supplemented by air traffic control (ATC) when the tower was in operation⁵, and KUNV had a 11° westerly magnetic variation⁶ (figure 8). The following observations were taken and disseminated during the times surrounding the accident:⁷

[0853 EDT] METAR KUNV 011253Z 15003KT 4SM BR OVC009 12/11 A3032=

[0939 EDT] SPECI KUNV 011339Z 15006KT 5SM BR OVC011 12/10 A3032=

[0953 EDT] METAR KUNV 011353Z 15006KT 6SM BR OVC012 12/10 A3032=

[1053 EDT] METAR KUNV 011453Z 19007KT 7SM OVC010 12/10 A3030=

[1117 EDT] SPECI KUNV 011517Z 17004KT 7SM OVC013 12/10 A3030=

[1153 EDT] METAR KUNV 011553Z 18007KT 7SM OVC012 13/10 A3029=

⁴ 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 twelve thousand feet, and altimeter setting.

⁵ ATC hours of operation from 0600 to 2200 local.

⁶ Magnetic variation – The angle (at a particular location) between magnetic north and true north. Latest measurement taken from <https://skyvector.com/>

⁷ Bolded sections in this report highlight information that directly reference the weather conditions that affected the accident location around the accident time.

ACCIDENT TIME 1251 EDT

[1253 EDT] METAR KUNV 011653Z 19006KT 7SM OVC012 13/11 A3027=

[1320 EDT] METAR KUNV 011720Z 21003KT 6SM BR OVC012 14/11 A3025=

[1351 EDT] METAR KUNV 011751Z 21007KT 6SM BR OVC012 14/11 A3025=

KUNV weather at 1117 EDT, wind from 170° at 4 knots, 7 miles visibility, an overcast ceiling at 1,300 ft above ground level (agl), temperature of 12 °Celsius (C), dew point temperature of 10 °C, and an altimeter setting of 30.30 inches of mercury (inHg).

KUNV weather at 1153 EDT, wind from 180° at 7 knots, 7 miles visibility, an overcast ceiling at 1,200 ft agl, temperature of 13 °C, dew point temperature of 10 °C, and an altimeter setting of 30.29 inHg.

KUNV weather at 1253 EDT, wind from 190° at 6 knots, 7 miles visibility, an overcast ceiling at 1,200 ft agl, temperature of 13 °C, dew point temperature of 11 °C, and an altimeter setting of 30.27 inHg.

KUNV weather at 1320 EDT, wind from 210° at 3 knots, 6 miles visibility, mist, an overcast ceiling at 1,200 ft agl, temperature of 14 °C, dew point temperature of 11 °C, and an altimeter setting of 30.25 inHg.

The observations from KUNV surrounding the accident time indicated MVFR⁸ ceiling conditions with the surface wind remaining from the south to south-southwest between 3 to 7 knots.

⁸ 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.

4.0 Upper Air Data

A High-Resolution Rapid Refresh (HRRR)⁹ model sounding was created for the accident site for 1300 EDT with a station elevation of 1,654 ft.¹⁰ The 1300 EDT HRRR sounding was plotted on a standard Skew-T Log P diagram¹¹ with the derived stability parameters included in figure 9 with data from the surface to 600-hPa (or approximately 14,000 ft msl). This data was analyzed using the RAOB¹² software package. The sounding depicted the lifted condensation level (LCL)¹³ and the level of free convection (LFC)¹⁴ at 292 ft agl (1,946 ft msl) and the convective condensation level (CCL)¹⁵ at 407 ft agl (2,061 ft msl). The sounding had a greater than 90% relative humidity from the surface through 4,000 ft msl. The freezing level was located at 12,472 ft msl. The precipitable water value was 0.98 inches.

⁹ The HRRR is a NOAA real-time three-kilometer (km) 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.

¹⁰ HRRR sounding was created using NOAA Air Resource Laboratory: <https://ready.arl.noaa.gov/READYamet.php>

¹¹ 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.

¹² RAOB – (The complete Rawinsonde Observation program) is an interactive sounding analysis program developed by Environmental Research Services, Matamoras, Pennsylvania.

¹³ LCL - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.

¹⁴ 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.

¹⁵ 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.

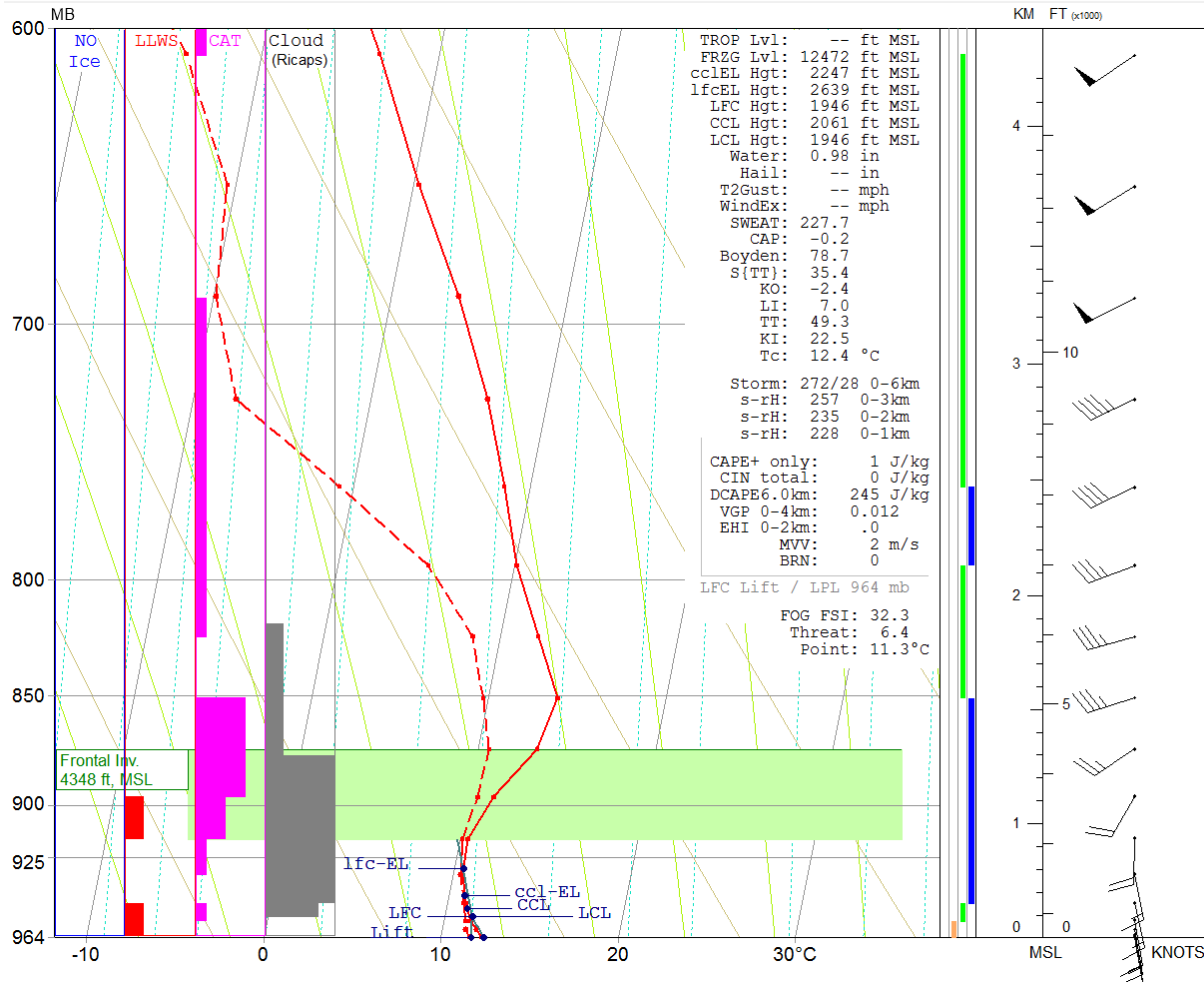


Figure 9 – 1300 EDT HRRR sounding for the accident site

The 1300 EDT HRRR sounding for the accident site indicated alternating layers of stable and conditionally unstable environments from the surface through 8,000 ft. RAOB identified the possibility of clouds from ~350 ft agl (2,000 ft msl) through 6,000 ft msl. RAOB did not indicate the possibility of icing conditions below 14,000 ft msl. RAOB indicated a frontal inversion¹⁶ was in place above the accident site at 4,348 ft msl with clouds indicated below that inversion layer (figure 9).

The 1300 EDT HRRR sounding wind profile indicated a surface wind from 170° at 7 knots with the wind veering¹⁷ to the west-southwest by 5,000 ft msl. The wind speed increased to 35 knots by 5,000 ft and to 50 knots by 10,500 ft msl. RAOB indicated the possibility of light low-level wind shear (LLWS) between the surface and ~2,000 ft agl (~3,500 ft msl). RAOB indicated light to moderate clear-air turbulence (CAT) existed in several layers between the surface and 14,000 ft with the moderate CAT indicated between 3,000 and 5,000 ft msl.

¹⁶ Inversion – A departure from the usual decrease of the value of an atmospheric property with increasing altitude; also, the layer through which this departure occurs (the "inversion layer"), or the lowest altitude at which the departure is found (the "base of the inversion").

¹⁷ A clockwise turning of the wind with height in the northern hemisphere.

5.0 Satellite Data

Data from the Geostationary Operational Environmental Satellite number 16 (GOES-16) data was 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 (band 2) and infrared (band 13) imagery at wavelengths of 0.64 microns (μm) and 10.3 μm , respectively, were retrieved for the period. Satellite imagery surrounding the time of the accident, from 0900 EDT through 1600 EDT at approximately 5-minute intervals were reviewed, and the closest images to the time of the accident are documented here.

Figures 10 and 11 present the GOES-16 visible imagery from 1240 and 1250 EDT at 2X magnification with the accident site highlighted with a red square. The GOES-16 imagery indicated two layers of overcast cloud cover above the accident site and between the accident site and KUNV. Scattered or less cloud cover was apparent west of the higher terrain near the accident site (figures 10 and 11). The lower cloud was stratiform in nature and the higher level cloud was more cirriform in nature. The cirriform cloud cover was moving from west to east with the lower stratiform cloud cover remaining in place east of the higher terrain (attachment 1).

Figure 12 presents the GOES-16 infrared imagery from 1250 EDT at 4X magnification and with a temperature enhancement curve applied with the accident site highlighted with a red square. Inspection of the infrared imagery indicated abundant cloud cover over the accident site at the accident time with the lowest brightness temperatures (green and yellow colors, higher clouds) located above and to the east of the accident site. Based on the brightness temperatures above the accident site (253 Kelvin) and the vertical temperature profile provided by the 1300 EDT HRRR sounding, the approximate cloud-top heights over the accident site were 23,000 ft at 1250 EDT. The lowered cloud cover brightness temperatures were around 284 Kelvin which would correspond to cloud-top heights around 5,000 ft (figure 9). It should be noted that these figures have not been corrected for any parallax error.

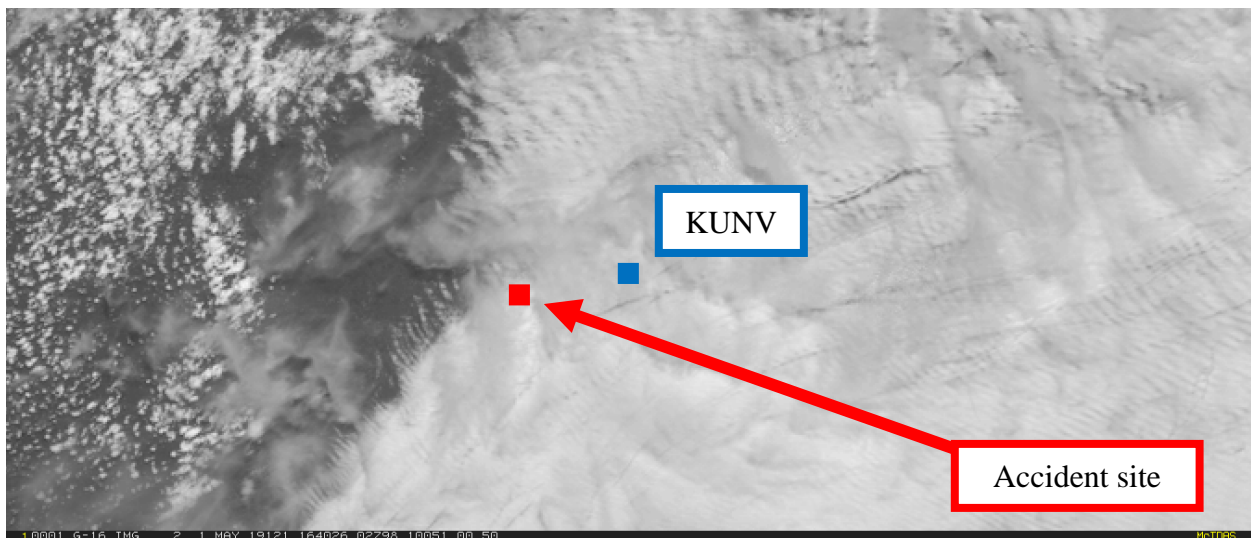


Figure 10 – GOES-16 visible image at 1240 EDT

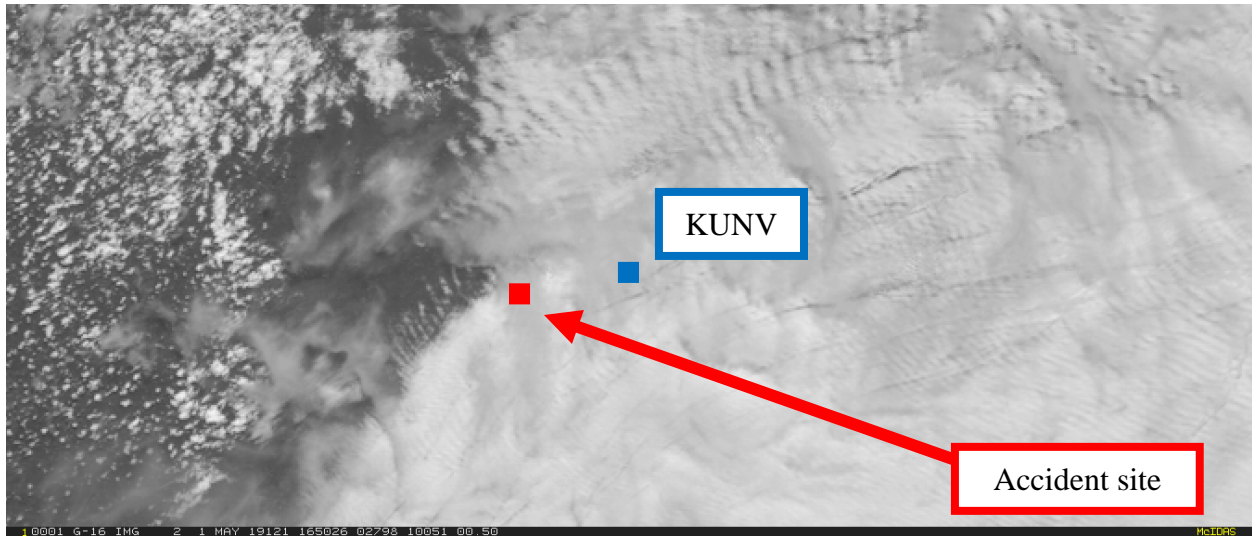


Figure 11 – GOES-16 visible image at 1250 EDT

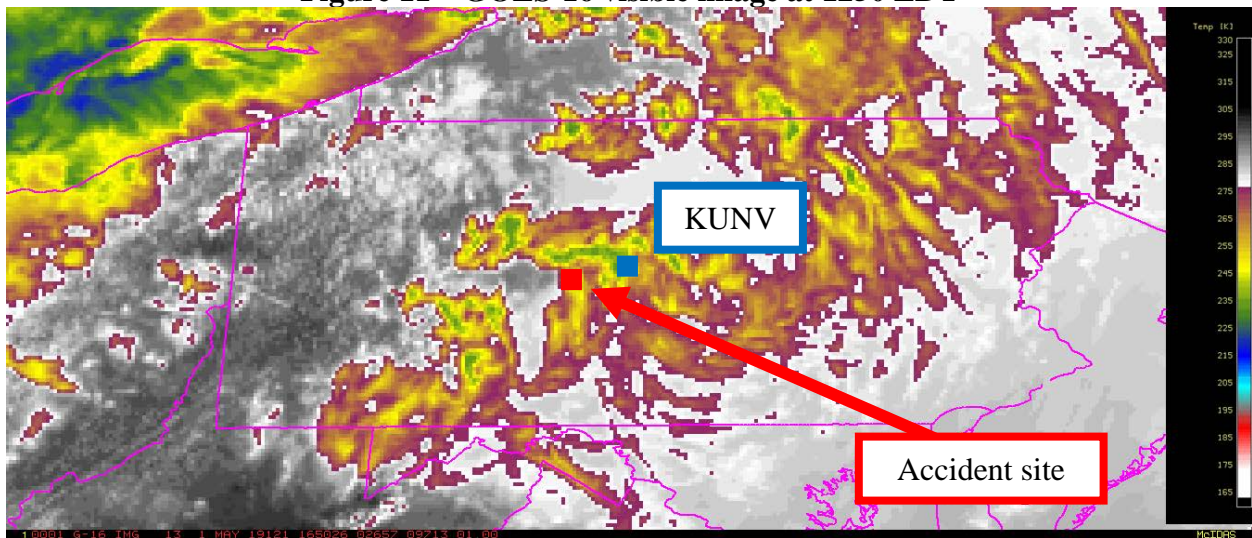


Figure 12 – GOES-16 infrared image at 1250 EDT

A flight profile versus height was created using flight track data¹⁸ and included as figure 13 with the cloud height based on KUNV observations, PIREPs (section 7.0) and the 1300 EDT HRRR sounding information at the accident time (section 4.0). The HRRR sounding information (section 4.0, footnote 9) includes the cloud base near 2,000 ft within ~3 km of the accident site (yellow color fill area on figure 13).

¹⁸ For more information, please see the factual information located in the docket for this accident.

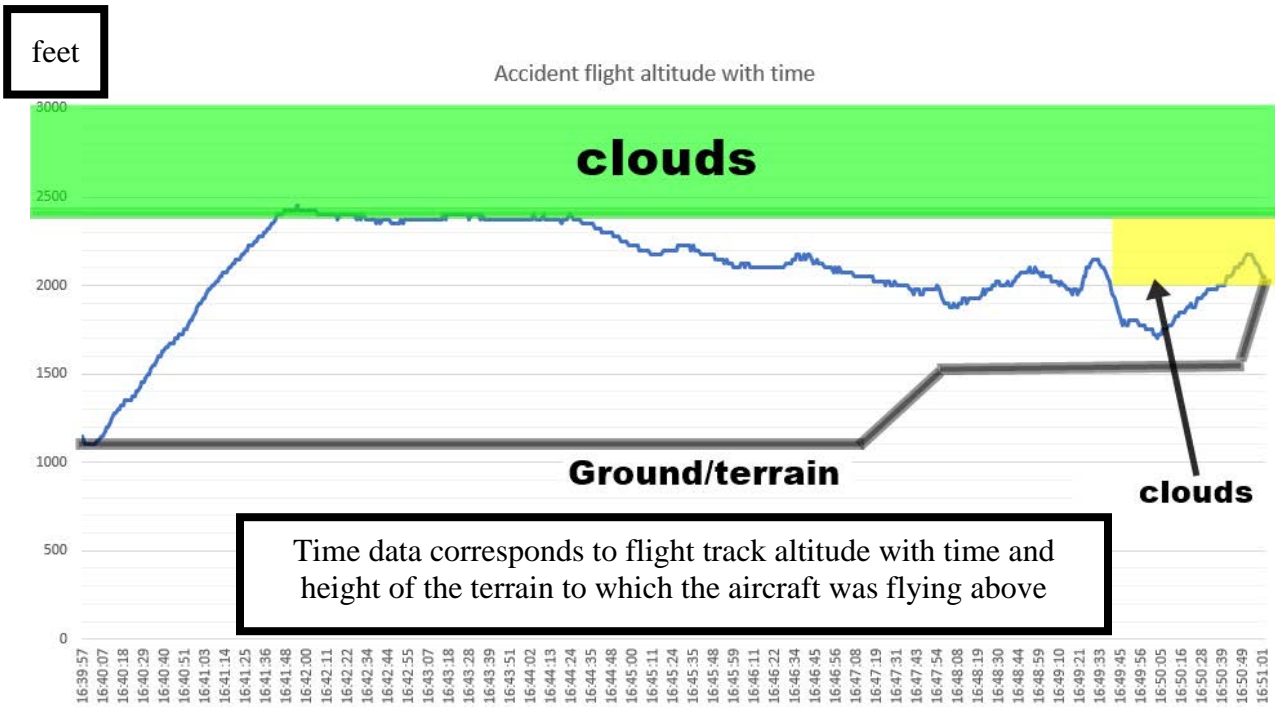


Figure 13 – Clouds (green and yellow color fill), accident flight track¹⁹ (blue line), approximate terrain (grey line)

6.0 Regional Radar Imagery Information

A regional view of the NWS National Composite Radar Mosaic is included as figure 14 for 1255 EDT with the approximate location of the accident site marked by a red circle. The image did not depict any precipitation echoes above the accident site around the accident time.

¹⁹ Flight track altitude data provided by Air Traffic Control (ATC) sources.

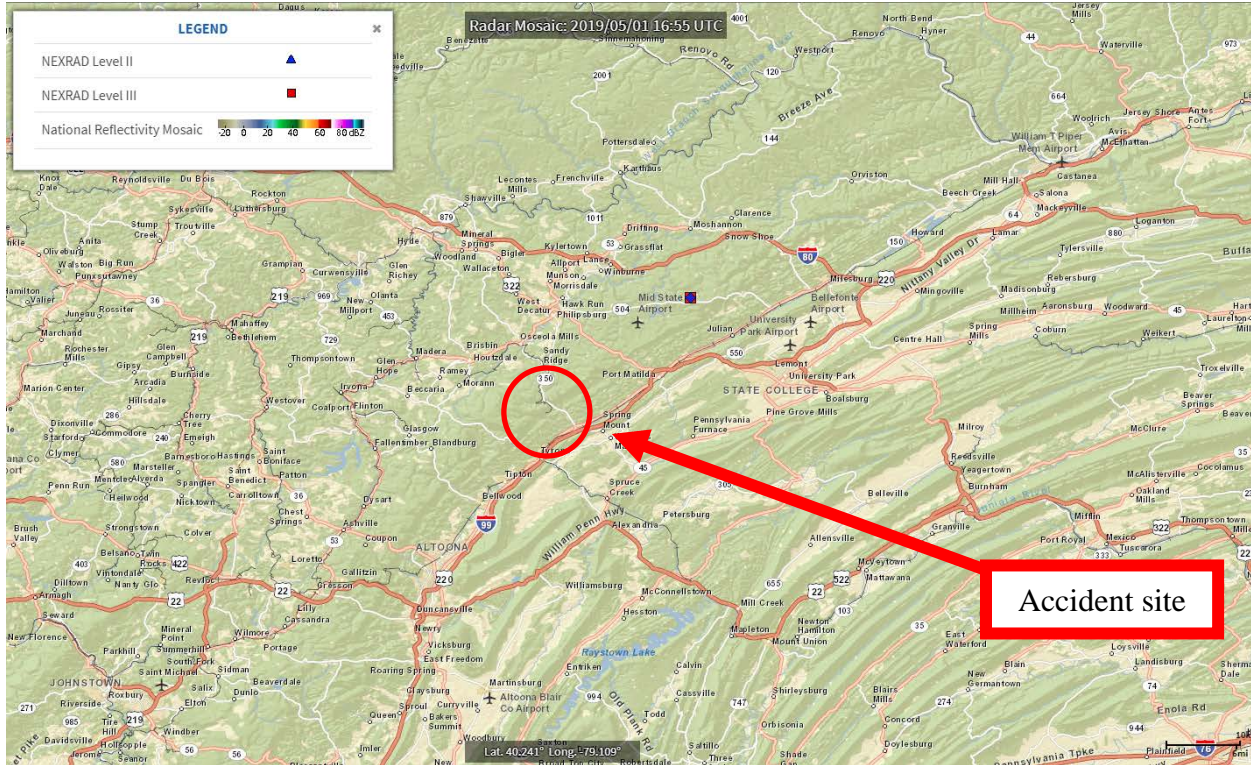


Figure 14 – Regional Composite Reflectivity image for 1255 EDT

7.0 Pilot Reports²⁰

All pilot reports (PIREPs) within 75 miles of the accident site from about two hours prior to the accident time to about two hours after the accident time for below FL180²¹ are provided below:

DUJ UA /OV N35270005/TM 1501/FL030/TP CH2T/TB NEG

BTP UA /OV CIP180010/TM 1625/FL050/TP CH2T/TB CONT LGT OCNL MDT TURB

UNV UA /OV KUNV/TM 1737/FL010/TP CL30/SK OVC010

JST UA /OV JST/TM 1746/FL090/TP BE35/TB NEG

The reports are in plain language taken from standard code and abbreviations, with cloud heights in msl, and time converted to local time, were as follows:

Routine pilot report (UA) Dubois Regional Airport, Pennsylvania (DUJ); Over – 5 miles from Punxsutawney Municipal Airport, Pennsylvania, (N35) on the 270° radial; Time – 1101 EDT (1501Z); Altitude – 3,000 ft; Type aircraft – AMD Alarus; Turbulence – Negative.

²⁰ Only pilot reports with the World Meteorological Organization (WMO) header UBPA**, UBNY**, UBWV**, and UBMD** identifiers were considered.

²¹ Flight Level – A Flight Level (FL) is a standard nominal altitude of an aircraft, in hundreds of ft. This altitude is calculated from the International standard pressure datum of 1013.25-hPa (29.92 inHg), the average sea-level pressure, and therefore is not necessarily the same as the aircraft's true altitude either above mean sea level or above ground level.

Routine pilot report (UA) BTP; Over – 10 miles from Clarion VORTAC, Pennsylvania, (CIP) on the 180° radial; Time – 1225 EDT (1625Z); Altitude – 5,000 ft; Type aircraft – AMD Alarus; Turbulence – Continuous light occasional moderate turbulence.

Routine pilot report (UA) UNV; Over – KUNV; Time – 1337 EDT (1737Z); Altitude – 1,000 ft; Type aircraft – Bombardier Challenger 300; Sky – Overcast skies at 1,000 ft agl.

Routine pilot report (UA) John Murtha Johnstown-Cambria County Airport, Pennsylvania (JST); Over – JST; Time – 1346 EDT (1746Z); Altitude – 9,000 ft; Type aircraft – Beechcraft Bonanza; Turbulence – Negative.

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

There were no Center Weather Service Unit (CWSU) Center Weather Advisories (CWA) valid for the accident site at the accident time. There was a CWSU Meteorological Impact Statement (MIS) issued by the Cleveland Air Route Traffic Control Center (ZOB ARTCC) CWSU at 0658 EDT, which warned of patchy IFR conditions and isolated MVFR conditions at the accident site and intended destination of BTP with conditions valid through 1500 EDT (figure 15):

```
FAUS20 KZOB 011058
ZOB MIS 01 VALID 011058-011900
...FOR ATC PLANNING PURPOSES ONLY...
THRUT...ISOL MOD TURB AOB 140. NW 1/2 PTCHY LGT-ISOL MOD ICE
110-FL240...INCRG W-E. NW CORNER WDSR IFR. SE CORNER PTCHY
IFR...DCR. NE CORNER ISOL MVFR...DCR. SW CORNER AFT 18Z ISOL TS POSS
MOV FROM SW 40-50KT. TOPS TO FL370.
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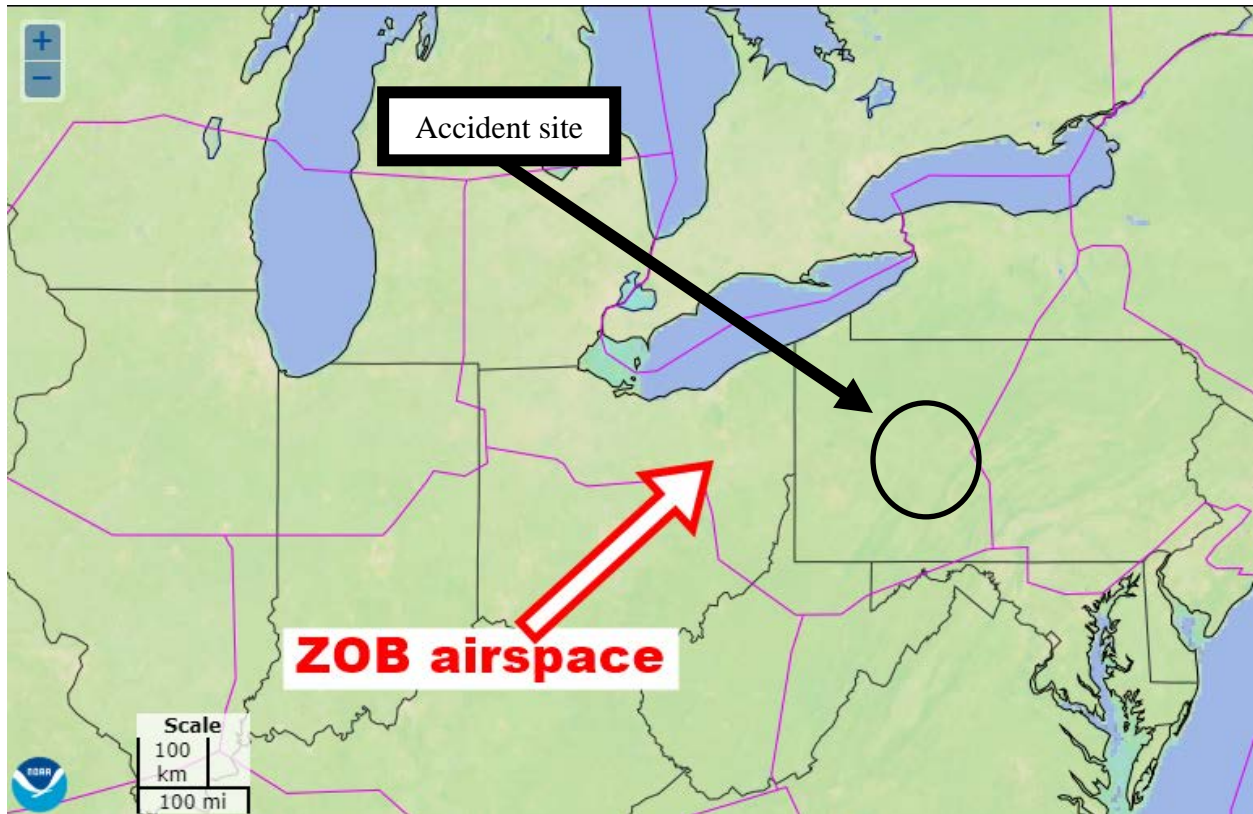



Figure 15 – ZOB airspace image (ZOB boundary highlighted by the pink line)

10.0 AIRMETS

There were Airmen’s Meteorological Information (AIRMET) advisories Sierra and Tango valid for the accident site at the accident time for below FL180. AIRMET Sierra warned of IFR and mountain obscuration conditions due to clouds and mist, while AIRMET Tango warned of moderate turbulence between 2,000 ft msl and FL180 (figures 16 and 17 contain the graphical-AIRMETS (G-AIRMETS) valid at 1200 and 1300 EDT):

WAUS41 KPCI 011445

WA1S

-BOSS WA 011445

AIRMET SIERRA UPDT 3 FOR IFR AND MTN OBSCN VALID UNTIL 012100

.

AIRMET IFR...NY LO LE

FROM YOW TO 40S MSS TO 20SW BUF TO 30SE ECK TO YOW

CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS DVLPG 18-21Z. CONDS CONTG

BYD 21Z THRU 03Z.

.

AIRMET IFR...NY NJ PA WV MD DC DE VA AND CSTL WTRS

FROM 60ESE BUF TO 40ESE PSB TO 40SSE HNK TO 30SW HTO TO 90S HTO

TO 100ESE SBY TO 20NNW ORF TO 40ENE LYH TO 50E EKN TO 20SW JST

TO 20ENE JHW TO 60ESE BUF

CIG BLW 010/VIS BLW 3SM BR. CONDS CONTG BYD 21Z THRU 03Z.

.

AIRMET MTN OBSCN...VT MA NY PA WV MD VA

**FROM SYR TO 30NNE SAX TO HAR TO 50SW CSN TO 60S EKN TO 50SW JST
TO EWC TO JHW TO SYR
MTNS OBSC BY CLDS/BR. CONDS CONTG BYD 21Z THRU 03Z.**

.
AIRMET MTN OBSCN...ME NH VT MA NY
FROM 40WSW YSC TO 20NNW ENE TO 50WSW CON TO 30NNE SAX TO SYR TO
MSS TO 40WSW YSC
MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG BYD 21Z THRU 03Z.

.
OTLK VALID 2100-0300Z
AREA 1...IFR VT NY LO PA OH LE
BOUNDED BY 30W YSC-20WSW MPV-40NW ALB-20WSW SYR-40ESE BUF-20W
CLE-20ENE DXO-YOW-30W YSC
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG THRU 03Z.

.
AREA 2...IFR VT MA RI CT NY NJ PA WV MD DE VA AND CSTL WTRS
BOUNDED BY 30ENE ALB-30W ACK-50S ACK-90ESE SBY-40SSE SBY-SBY-40E
DCA-40W EMI-40S PSB-40NE SLT-30ENE ALB
CIG BLW 010/VIS BLW 3SM BR. CONDS CONTG THRU 03Z.

.
AREA 3...MTN OBSCN ME NH VT NY
BOUNDED BY 40SSE YQB-30W MLT-50NNE ENE-CON-SYR-MSS-YSC-40SSE YQB
MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG THRU 03Z.

....

WAUS41 KPCI 011445
WA1T
-BOST WA 011445
AIRMET TANGO UPDT 2 FOR TURB AND LLWS VALID UNTIL 012100

.
AIRMET TURB...ME NH VT MA NY AND CSTL WTRS
FROM 60WNW PQI TO 20NNE PQI TO 60WSW YSJ TO 200SE ACK TO 160SSE
ACK TO 60SE ACK TO 20SSW BOS TO 40ESE SYR TO 20SW BUF TO 20ESE
YYZ TO 30SSE YOW TO 30SSE YSC TO 60WNW PQI
MOD TURB BTN FL240 AND FL420. CONDS CONTG BYD 21Z ENDG 00-03Z.

.
**AIRMET TURB...NH VT MA CT NY LO NJ PA OH LE WV MD VA
FROM MSS TO 20WSW CON TO 20N HTO TO 20SSW SAX TO 30WNW CSN TO
20W HMV TO HNN TO CVG TO FWA TO 30ENE DXO TO 30WNW CLE TO 30ESE
YYZ TO MSS
MOD TURB BTN 020 AND FL180. CONDS CONTG BYD 21Z THRU 03Z.**

.
AIRMET TURB...ME NH VT MA RI CT NY NJ PA AND CSTL WTRS
FROM 30SSE YSC TO 110SE BGR TO 200SE ACK TO 190SSE ACK TO 180S
ACK TO 40SSW HTO TO 20SSW SAX TO 20N HTO TO 20WSW CON TO MSS TO
30SSE YSC
MOD TURB BTN 050 AND FL180. CONDS CONTG BYD 21Z THRU 03Z.

.
LLWS POTENTIAL...NY NJ PA DE AND CSTL WTRS
BOUNDED BY 30ENE HNK-20SE SAX-60S HTO-120ESE SIE-30WNW SIE-50W
HNK-30ENE HNK
LLWS EXP. CONDS DVLPG 18-21Z. CONDS CONTG BYD 21Z THRU 03Z.

.
LLWS POTENTIAL...NY LO PA OH LE
BOUNDED BY 40N SYR-70SSW SYR-30NE APE-FWA-20ENE DXO-40SSE DXO-
40ESE YYZ-40N SYR

LLWS EXP. CONDS CONTG BYD 21Z THRU 03Z.

OTLK VALID 2100-0300Z

AREA 1...TURB OH LE

BOUNDED BY 30SE ECK-40SSE DXO-20NW ERI-30N APE-60W HNN-CVG-FWA-30SE ECK

MOD TURB BTN FL200 AND FL420. CONDS DVLPG AFT 21Z. CONDS CONTG THRU 03Z.

AREA 2...TURB ME NH VT MA RI CT NY LO NJ PA OH LE WV MD DC DE VA AND CSTL WTRS

BOUNDED BY 20W YOW-60WSW YSC-40ENE BOS-40SSW ACK-20ENE HNV-HNN-CVG-FWA-30SE ECK-20W YOW

MOD TURB BTN 020 AND FL180. CONDS CONTG THRU 03Z.

AREA 3...TURB ME NH VT MA RI CT NY AND CSTL WTRS

BOUNDED BY 70SE YQB-30WSW HUL-50WSW YSJ-200SE ACK-180SSE ACK-50SE HTO-40SSW ACK-50SSE ENE-60WSW YSC-20ESE YSC-70SE YQB

MOD TURB BTN 050 AND FL180. CONDS CONTG THRU 03Z.

....

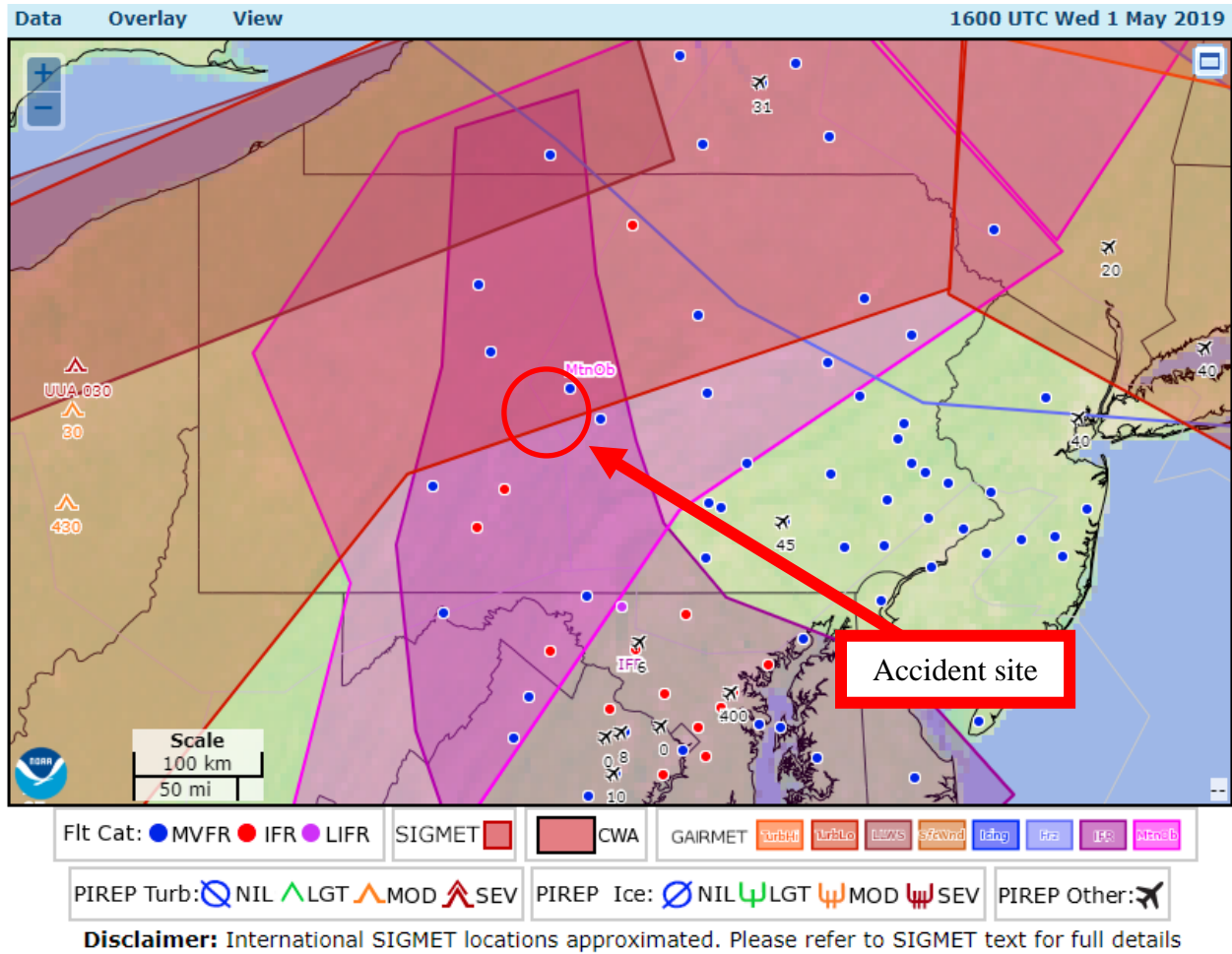


Figure 16 – G-AIRMETs valid at 1200 EDT

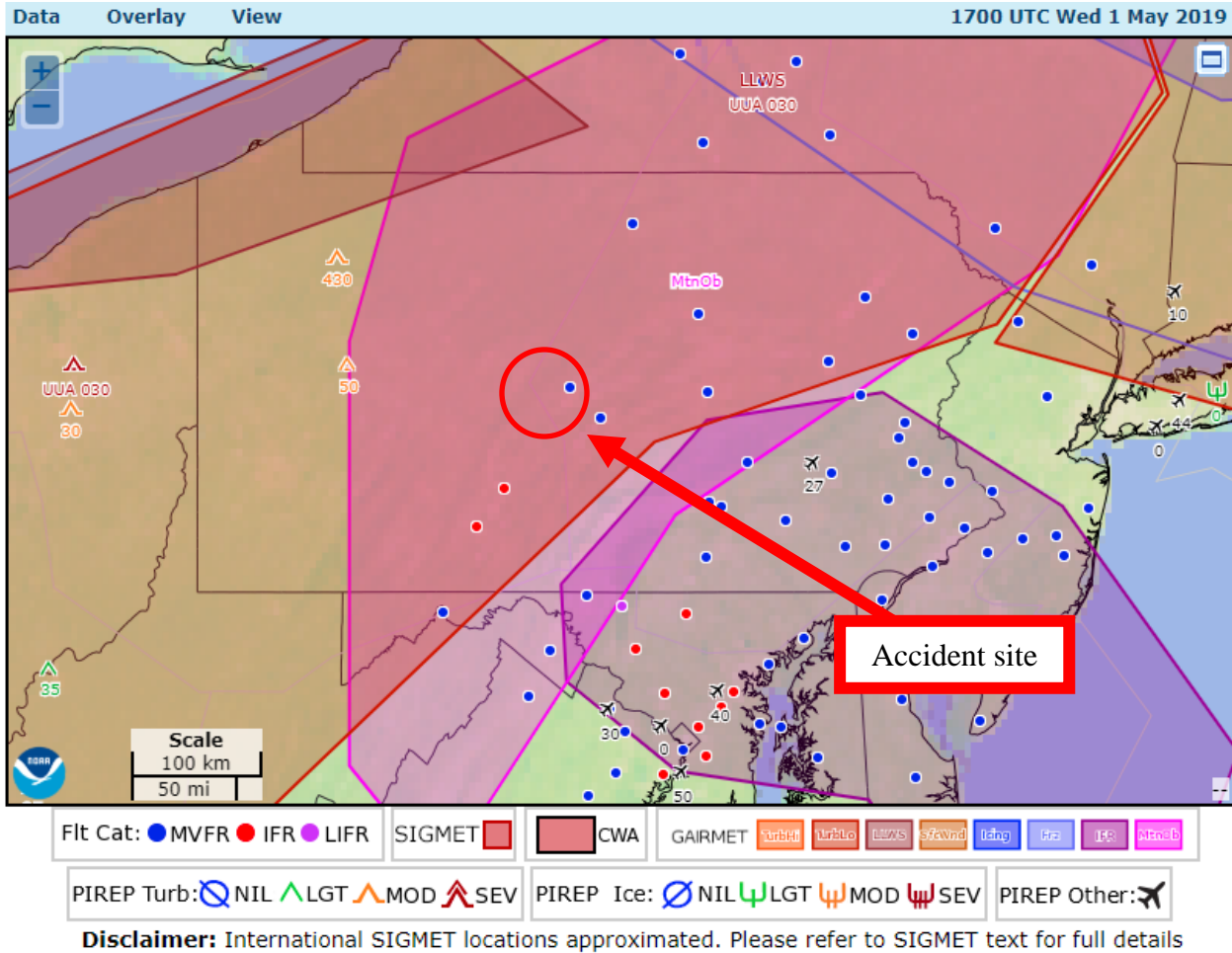


Figure 17 – G-AIRMETs valid at 1300 EDT

11.0 Graphical Forecasts for Aviation

The Graphical Forecasts for Aviation (GFA) products made available before the accident flight are shown in attachment 2. The GFA surface forecast products indicated VFR conditions would be likely with a chance of rain shower activity (30 to 60 percent chance) for 1400 EDT with a surface wind from the southeast at 5 knots. The GFA cloud forecast products indicated a broken to overcast cloud ceiling at 2,100 to 2,500 ft msl with cloud tops at 5,000 ft msl. For more information please see attachment 2.

12.0 Terminal Aerodrome Forecast

KUNV was the closest site with a NWS Terminal Aerodrome Forecast (TAF) and the KUNV TAF valid at the accident time was issued at 1125 EDT and was valid for a 21-hour period beginning at 1100 EDT. The 1125 EDT TAF for KUNV was as follows:

KUNV 011525Z 0115/0212 19007KT P6SM OVC010
 FM011900 15008G15KT P6SM BKN030
 FM012000 20011KT P6SM SCT025 BKN150=

The TAF expected a wind from 190° at 7 knots, greater than 6 miles visibility, and an overcast ceiling at 1,000 ft agl.

13.0 NWS Area Forecast Discussion

The NWS Office in State College, Pennsylvania, issued the following Area Forecast Discussion (AFD) at 0825 EDT (closest AFD to the accident time with an aviation section). The aviation section of the AFD discussed widespread IFR ceilings across the area with the clouds remaining across the area through the morning with conditions improving from west to east in the afternoon:

FXUS61 KCTP 011225
AFDCTP

Area Forecast Discussion
National Weather Service State College PA
825 AM EDT Wed May 1 2019

.SYNOPSIS...

An unsettled spring weather pattern will bring large temperature variations and passing showers/thunderstorms to central Pennsylvania through late week. A period of heavier rain is possible over the weekend before conditions trend drier into early next week.

&&

.NEAR TERM /THROUGH TONIGHT/...

GOES-16 shows low clouds covering most of central PA early this morning. These clouds are the result of low level southeast flow on the cool side of quasi-stationary frontal boundary extending from the Ohio Valley southeastward across the Virginias.

The duration and persistence of the low clouds in the cold air damming (CAD) pattern will be key to the sensible wx (temp/sky cover) forecast today, with most of the area staying mainly dry into the afternoon. This has me a little worried about maxT with some HREF members holding daytime temps much lower than fcst.

The stabilizing influence of the CAD will confine risk of isolated thunderstorms to the far western and southern fringes of the CWA. The D1 SPC MRGL risk extends into south central PA, but this may be overdone with very sharp gradient in HREF mean ML CAPE. Therefore, isolated/strong t-storm risk is most likely confined to counties along the west/southwest CWA border adjacent to PBZ/LWX.

Hires models generally agree in depicting a band of convection moving into northwest PA this evening and continuing into tonight. A few showers will be possible across the central ridge and valley region with decreasing POPs trending into the lower Susquehanna Valley.

As warm front pivots north/east tonight across central PA, cloud cover and increasing dewpoints will contribute to a very mild night with lows in the mid 50s to low 60s or +10 to +20 degrees above early May climo minT.

&&

.SHORT TERM /THURSDAY THROUGH FRIDAY NIGHT/...

A frontal zone should be located near the PA/NY border by early Thursday. Depending on the location of the front, temperatures could bust to the cool-side (fcst too warm) across parts of north-central PA. We've been leary of busting temperature in this pattern with a series of low pressure waves modulating the position of the boundary and influencing temps in a big way. Until a more coherent signal emerges, will run close to NBM for maxT on D2/D3 with back-to-back 80F degree days possible across far south central PA (including HRB/York/Lancaster metro areas).

Area of concern on Thursday afternoon will be anywhere south of the front, where HREF suggests weak to moderate boundary layer destabilization in the presence of modest vertical shear. This environment would be supportive of scattered thunderstorms accompanied by marginal risk (SWODY2) for severe wind and hail. Showers will likely linger into Thursday night near or along the frontal zone.

Shower/t-storm activity on Friday appears to be focused along the main cold front pushing east from the Ohio Valley. So expect more showers and storms to close out the week. The GFS is more progressive by Friday night which has implications for the start of the weekend. High temps on Friday may again be set up for a bust depending on where the boundary is positioned.

&&

.LONG TERM /SATURDAY THROUGH TUESDAY/...

Latest medium-range guidance appears increasingly suggestive that troughing within a branch of westerlies across the southern tier of the U.S. could support fairly significant cyclogenesis along a surface frontal zone, initially across the Tennessee Valley, then to the lee of the central Appalachians to Mid Atlantic coast during the course of the coming weekend. The GFS is again more progressive in returning precip to the area, but both GFS and ECMWF suggest potential for heavier rainfall into Sunday.

A drier trend (at least for now) is projected into early next week. No sign of frost/freeze risk at this time.

&&

.AVIATION /12Z WEDNESDAY THROUGH SUNDAY/...

Widespread IFR cigs will continue over the central and western TAF sites. Latest model soundings keep the clouds through most of the morning. They should slowly erode from the west to east.

Some areas of IFR will persist much of the morning and into early afternoon as increasingly moist southwest flow aloft encounters cool ESE marine flow. Much of the area should return to VFR conditions late in the day, as a southwest flow develops over the area.

The other aviation concern will be the threat of LLWS through the NW affecting mainly BFD. Expect a period of LLWS with a LLJ of 40kts until around 15Z.

Showers and thunderstorms are possible this afternoon, mainly affect BFD and possibly JST. This could bring a brief period of IFR with the main chance between 21Z to 00Z. IFR cigs should build back in after 03Z with IFR cigs forming overnight into Thursday morning.

.Outlook...

Thu...AM low cigs/fog possible eastern PA. Isolated PM tsra impacts, mainly the Laurel Highlands/SC Mtns.

Fri...AM low cigs/fog possible. Scattered PM tsra impacts possible.

Sat...Showers/cig reductions possible, mainly southern PA.

Sun...Slowly improving conditions. Still a small chance of Showers, mainly over the southeast.

&&

.CTP WATCHES/WARNINGS/ADVISORIES...

None.

&&

\$\$

14.0 Winds and Temperature Aloft Forecast

The NWS 0959 EDT Winds and Temperature Aloft forecast valid for 1400 EDT for the closest point to the accident site is included below:

FBUS31 KWNO 011359
 FD1US1
 DATA BASED ON 011200Z
 VALID 011800Z FOR USE 1400-2100Z. TEMPS NEG ABV 24000

FT 3000 6000 9000 12000 18000 24000 30000 34000 39000
 PSB **2536+13 2444+08** 2452+01 2642-13 2637-23 263438 273549 274461

The accident site was closest to the Philipsburg, Pennsylvania, (PSB) forecast point.²² The PSB forecast for use between 1000 EDT and 1700 EDT indicated a wind at 6,000 ft from 250° at 36 knots with a temperature of 13 °C and at 9,000 ft a wind from 240° at 44 knots with a temperature of 8 °C.

15.0 Pilot Weather Briefing

The accident pilot did not request nor receive a weather briefing through Leidos.

A check of ForeFlight revealed that the accident pilot filed a flight plan and requested a weather briefing at 1125 EDT for the accident flight through ForeFlight (attachment 3). The weather briefing package contained all the standard weather information including valid and active AIRMETs Sierra and Tango, current surface analysis graphic, METARs, the 1101 EDT PIREP (section 7.0), GFA valid from around 0900 EDT (section 11.0), TAFs and winds aloft forecasts. The accident pilot last checked the KUNV airport information (which can include text METAR and TAF information) at 1234:38 EDT (attachment 3). In addition, Leidos captured the ForeFlight weather briefing information in text form from the 0854 and 1125 EDT requests (attachments 4, 5, and 6). It is unknown if the accident pilot checked or received any additional weather information before or during the accident flight.

16.0 Astronomical Data

The astronomical data obtained from the United States Naval Observatory for the accident site on May 1, 2019, indicated the following:

SUN	
Begin civil twilight	0542 EDT
Sunrise	0612 EDT
Accident	1251 EDT²³
Sun transit	1310 EDT
Sunset	2009 EDT
End civil twilight	2039 EDT

²² The winds aloft forecast point “PSB” does not have a 3,000 foot wind because the point starts at ~2,400 ft elevation. The weather forecast model information doesn’t have good enough vertical resolution to provide the 3,000 ft wind forecast. The HRRR dataset figure 9 depicted the 3,000 ft wind was from 181° at 19 knots (section 4.0).

²³ Inserted accident time for reference and context.

E. LIST OF ATTACHMENTS

Attachment 1 – GOES-16 visible animation from 1006 to 1406 EDT

Attachment 2 – GFA products available before the accident flight for around the accident time

Attachment 3 – Accident flight information via ForeFlight

Attachment 4 – ForeFlight text weather briefing information captured by Leidos part 1

Attachment 5 – ForeFlight text weather briefing information captured by Leidos part 2

Attachment 6 – ForeFlight text weather briefing information captured by Leidos part 3

Submitted by:

Paul Suffern
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