

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



ERA22LA404

METEOROLOGY

Specialist's Factual Report

November 16, 2022

TABLE OF CONTENTS

A. ACCIDENT.....	3
B. METEOROLOGY INVESTIGATOR	3
C. DETAILS OF THE INVESTIGATION	3
D. WEATHER INFORMATION.....	3
1.0 SURFACE OBSERVATIONS	3
2.0 WEATHER RADAR.....	4
3.0 CIWS.....	6
4.0 LIGHTNING.....	6
5.0 HRRR MODEL SOUNDING.....	7
6.0 SATELLITE IMAGERY	8
7.0 PILOT REPORTS	10
8.0 TERMINAL AERODROME FORECASTS.....	10
9.0 AREA FORECAST DISCUSSION.....	11
10.0 SIGMETs.....	12
11.0 CWSU PRODUCTS.....	13
12.0 CONVECTIVE OUTLOOK	14

A. ACCIDENT

Location: Saint Cloud, Florida

Date: September 9, 2022

Time: 1502 eastern daylight time (1902 UTC¹)

Aircraft: Type - Cirrus SF50; Registration - N77VJ

B. METEOROLOGY INVESTIGATOR

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C. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's meteorological specialist did not travel in support of this accident investigation and gathered all weather data remotely. Unless otherwise noted, all times are in eastern daylight time for September 9, 2022 (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). The accident site was located at about: 28.204722° north latitude; 81.3725° west longitude at an elevation of about 60 feet.

This report provides information on the weather conditions and forecasts applicable to the accident time and location.

D. WEATHER INFORMATION

1.0 Surface Observations

An Automated Weather Observing System (AWOS) was located at Kissimmee Gateway Airport (ISM²) which was in Orlando, Florida, about 6 miles north-northwest of the

¹ UTC - abbreviation for Coordinated Universal Time

² This report uses the 3-digit International Air Transport Association format for airport identification, which does not use the geographic designating digit (e.g., "K" for stations in the continental U.S. and "P" for U.S. stations in Alaska and the Pacific region) as found in the 4-digit International Civil Aviation Organization (ICAO) identifier format. Weather observations from airports in this report are referenced by their reporting station's identifier (using ICAO format that includes the geographic designating digit), not by the airport at which the reporting station is located.

accident location at an elevation of about 80 feet. It had a magnetic variation of about 6°30' west. Augmented longline³ reports from the ISM AWOS during the times surrounding the accident time are presented here, and the observation closest in time to the accident time is highlighted by bold text.

[1356] METAR KISM 091756Z 18008KT 10SM BKN030 BKN035 31/24 A2981
RMK AO2 LTG DSNT W AND NW SLP093 6//// T03110244 10311 20222
58009 PNO \$=

[1456] METAR KISM 091856Z 23017G20KT 6SM VCTS +RA BKN036 OVC048
27/23 A2985 RMK AO2 LTG DSNT N AND SW TSB54RAB51 PRESRR
SLP106 T02670233 PNO \$=

**[1503] SPECI KISM 091903Z 25023G28KT 1 3/4SM +TSRA BR SCT036
OVC048 26/23 A2984 RMK AO2 PK WND 25028/1903 WSHFT
1847 VIS 1V5 LTG DSNT N AND SW PNO \$=**

[1518] SPECI KISM 091918Z 21008KT 3SM +TSRA BR FEW034 BKN048 OVC065
23/23 A2984 RMK AO2 PK WND 24028/1904 WSHFT 1847 LTG DSNT N
AND SE PNO \$=

At 1503, the ISM AWOS reported a wind from 250° at 23 knots with gusts to 28 knots, visibility 1 3/4 statute miles, thunderstorm and heavy rain, mist, scattered clouds at 3,600 feet above ground level (agl), ceiling overcast at 4,800 feet agl, temperature of 26° Celsius (C) and dew point temperature of 23°C, altimeter setting of 29.84 inches of mercury; Remarks included: automated station with a precipitation discriminator, peak wind from 250° at 28 knots at 1503, wind shift occurred at 1447, visibility variable between 1 and 5 statute miles, distant⁴ lightning to the north and southwest, precipitation information not available, maintenance needed on the system.

2.0 Weather Radar

WSR-88D⁵ Level-II base reflectivity weather radar imagery from the Melbourne, Florida, site (KMLB) is presented in Figure 1. KMLB was located approximately 38 miles east of the accident location with an antenna elevation of about 150 feet. Assuming standard

³ "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.

⁴ "Distant" indicates more than 10 miles from the aerodrome.

⁵ Weather Surveillance Radar 88 Doppler (WSR-88D)

refraction and considering the 0.95° beam width⁶ for the WSR-88D radar beam, the KMLB 0.483° tilt would have “seen” altitudes above the accident location of between about 1,100 and 5,000 feet. Figure 1 indicates that the accident aircraft’s flight path terminated amidst extreme⁷ values of precipitation.

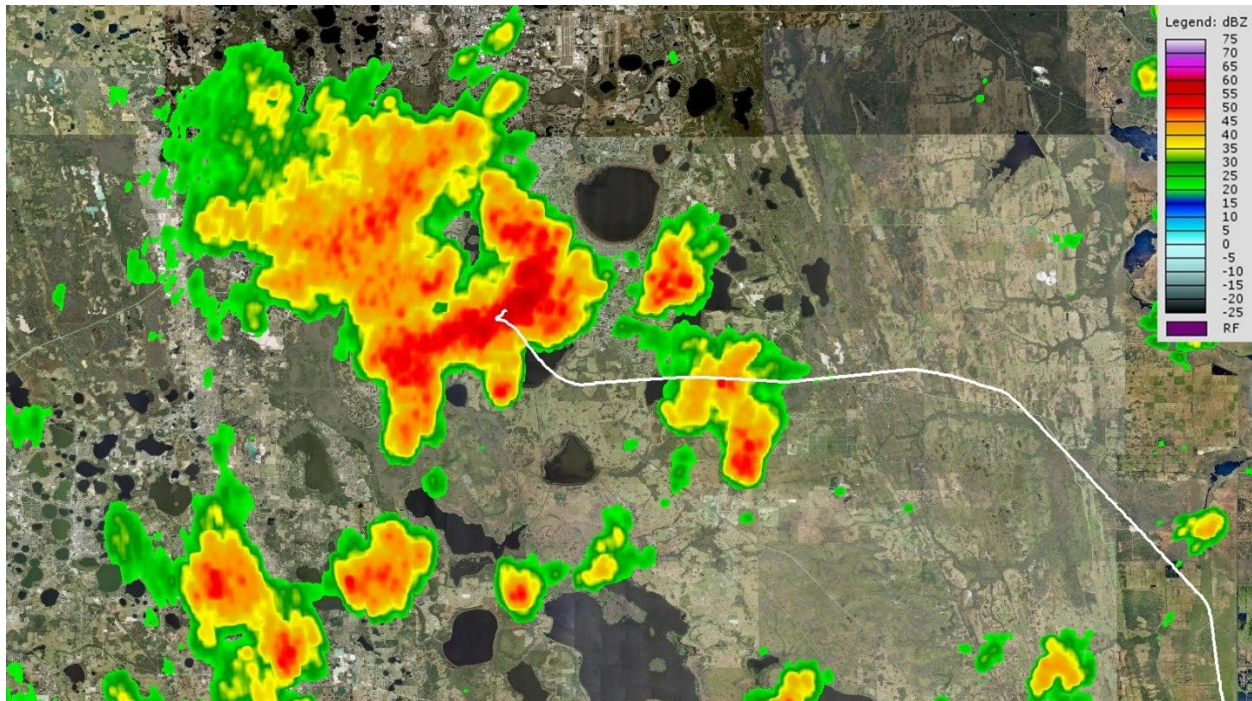


Figure 1 - KMLB 0.483° Level-II base reflectivity product from a sweep initiated at 1502:09. Final portion of the accident aircraft’s flight path, which terminates at 1502:05, is depicted by the white line. Reflectivity has been “smoothed” and dBZ values less than 20 have been masked out.

⁶ Here we define the angular width of the radar beam as the region of transmitted energy that is bounded by one-half the maximum power. The maximum power lies along the beam centerline and decreases outward from the radar antenna.

⁷ Precipitation intensities are defined in the Federal Aviation Administration’s Advisory Circular 00-24C: https://www.faa.gov/documentlibrary/media/advisory_circular/ac%2000-24c.pdf

3.0 CIWS

Archive data from the Federal Aviation Administration's Corridor Integrated Weather System (CIWS) for the accident region at 1500 are presented in Figure 2. This image presents precipitation and convective growth and decay (brown and blue hatched areas, respectively). Figure 2 indicates the accident location was under an area of convective growth at about the time of the accident. There are no areas of decay near the accident location.

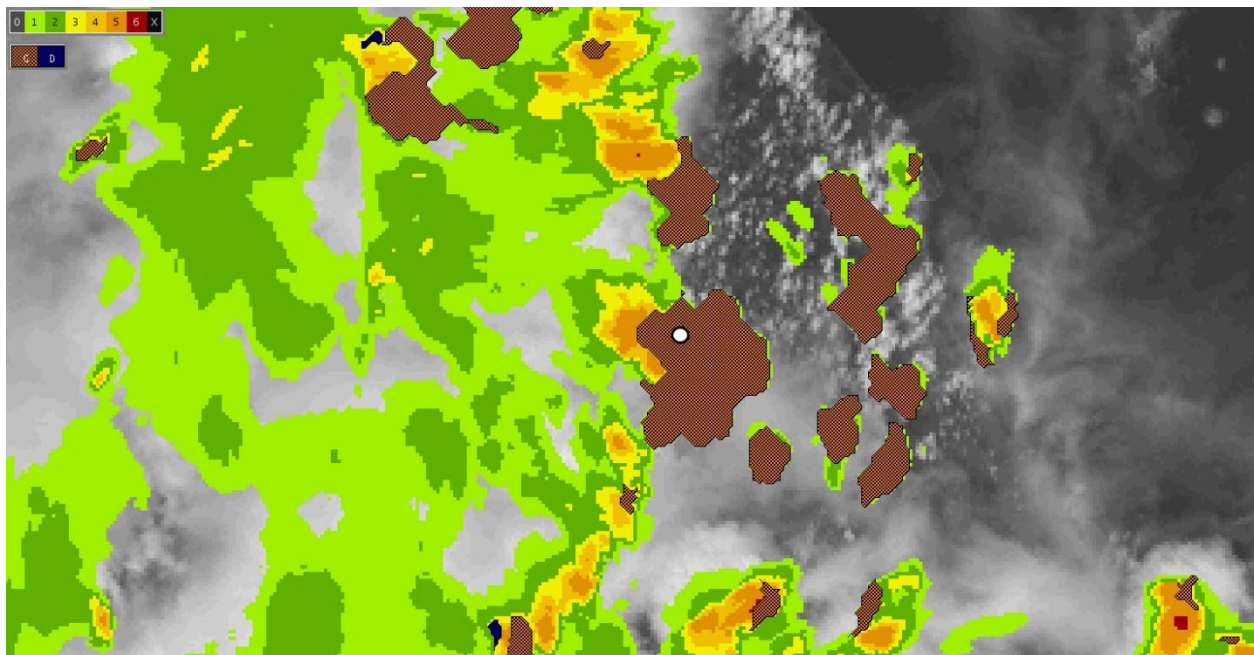


Figure 2 – Archive CIWS display from 1500. Areas of convective growth are identified by the brown hatched areas. Accident location is denoted by the white dot.

4.0 Lightning

A review of the Earth Networks Total Lightning Network (ENTLN) lightning database revealed the flash total lightning activity near the accident location between 1455 and 1505 (Figure 3).⁸

⁸ The ENTLN was queried for a geographic area bounded by latitudes 28.3854°N and 28.009°N, and longitudes 81.6284°W and 81.0743°W.

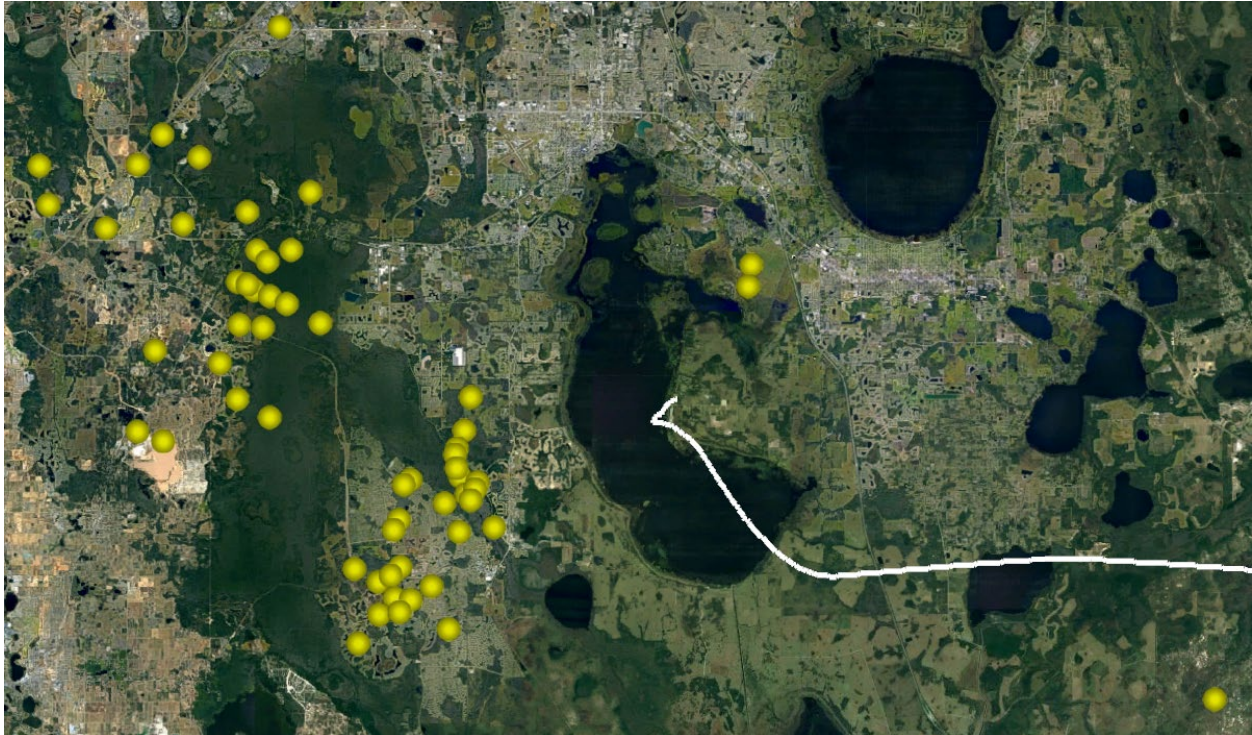


Figure 3 - ENTNLN total flash lightning activity between 1455 and 1505 (yellow circles). Final portion of the accident aircraft's flight path is depicted by the white line.

5.0 HRRR Model Sounding

A High-Resolution Rapid Refresh (HRRR) model⁹ sounding (Figure 4) for near the accident site¹⁰ at 1500 using an elevation of about 50 feet was retrieved from the National Oceanic and Atmospheric Administration's Air Resources Laboratory and analyzed by the RAwinsonde OBservation (RAOB) program. The freezing level was noted at about 16,000 feet. The wind below 2,000 feet was from the south-southwest at magnitudes of between 10 and 20 knots. The most-unstable Convective Available Potential Energy (CAPE) parameter was 3,270 Joules/kilogram (from 1001 hectopascals [hPa]). The Lifting Condensation Level (LCL) was at 2,462 feet and the Level of Free Convection (LFC) was at 3,518 feet. Downdraft CAPE (DCAPE; 6 kilometers above ground level; coldest wetbulb temperature method) was measured at 761 Joules/kilogram. The T2Gust ("Severe Weather Gust Potential") and WindEx ("Microburst Gust Potential") parameters were 37 knots and 43 knots, respectively.

⁹ 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.

¹⁰ Coordinates used for the model were 28.20, -81.37.

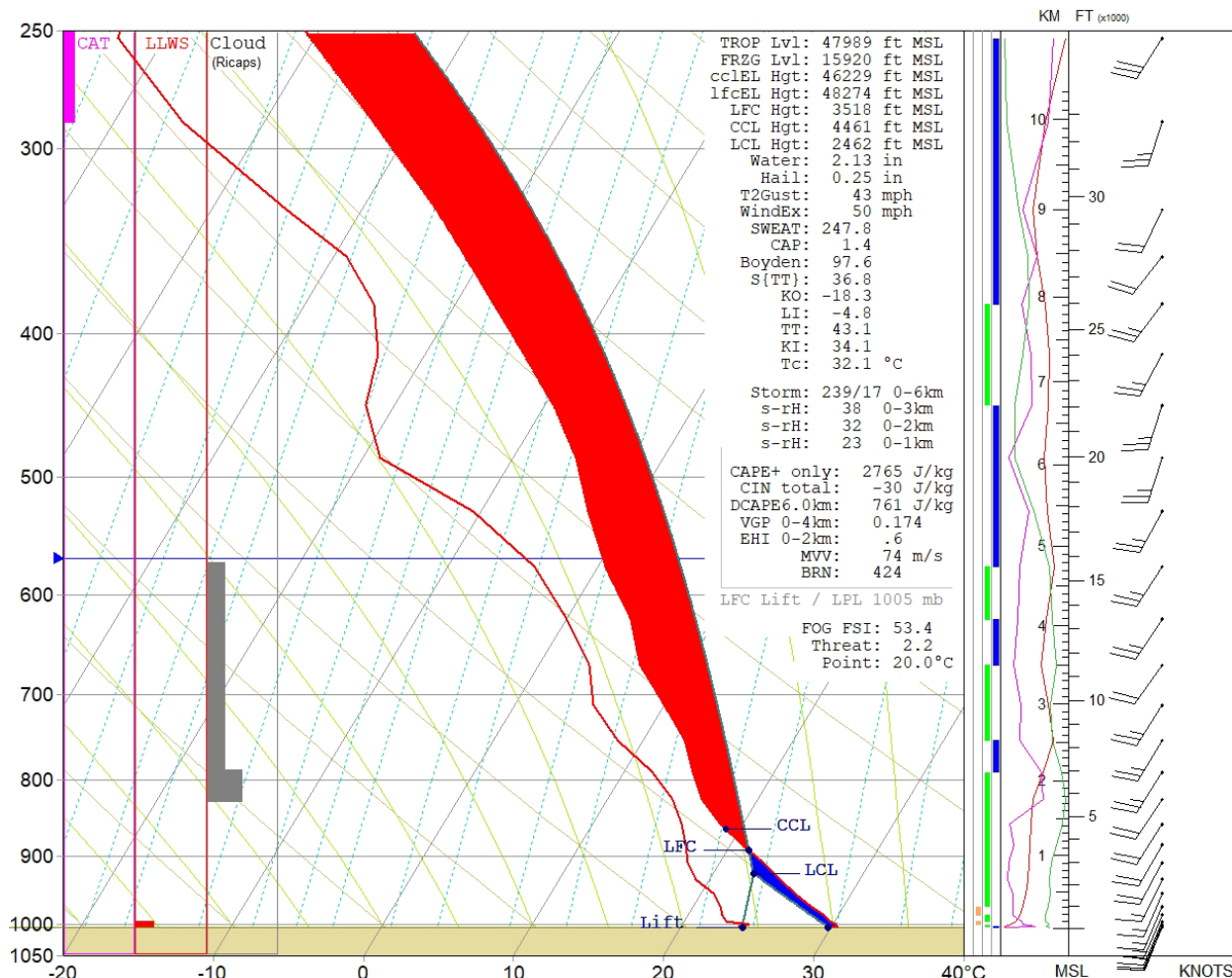


Figure 4 - HRRR model sounding data in SkewT/LogP format for 1500 near the accident site, surface to 250 hPa.

6.0 Satellite Imagery

Geostationary Operational Environmental Satellite (GOES)-16 visible (0.64 μ m) and infrared (10.3 μ m) data were obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison. Images from 1501 are presented in Figures 5 and 6. The GOES-16 visible imagery depicted cloudy conditions over the accident region. Infrared cloud-top temperatures near the accident site ranged between -13°C and -67°C, which, when considering the 1500 HRRR sounding, corresponded to cloud top heights of about 24,000 and 47,000 feet, respectively (-67°C is not depicted in Figure 4).

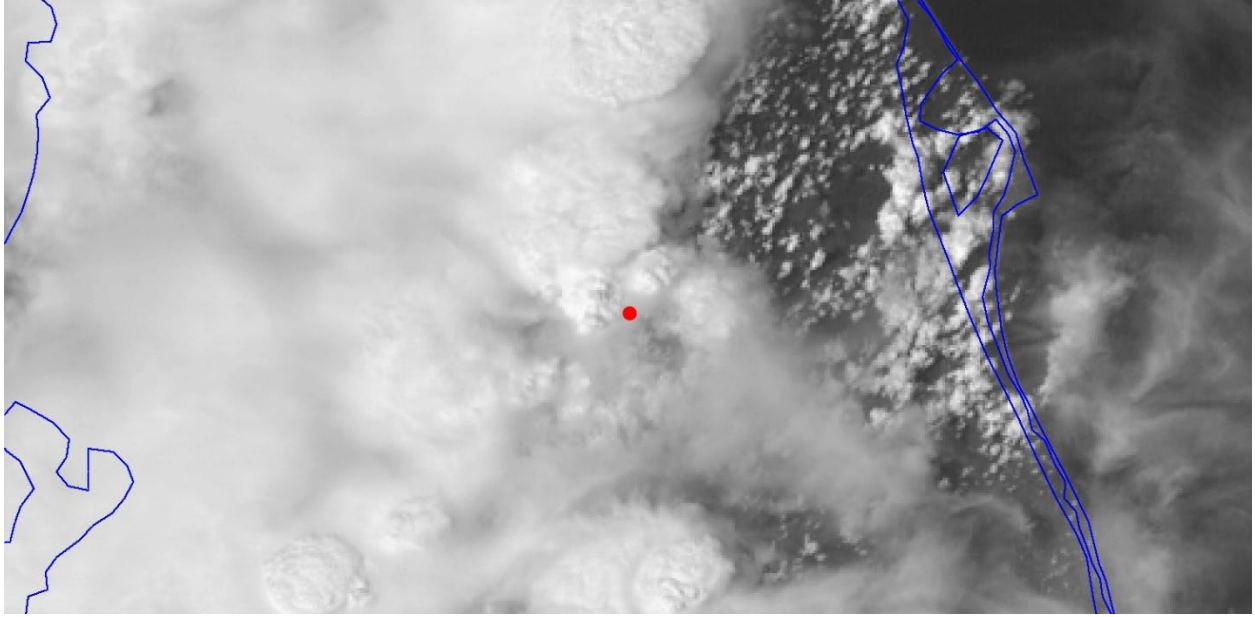


Figure 5 - GOES-16 visible imagery from 1501. Accident location denoted by the red dot. Image is not corrected for parallax error.

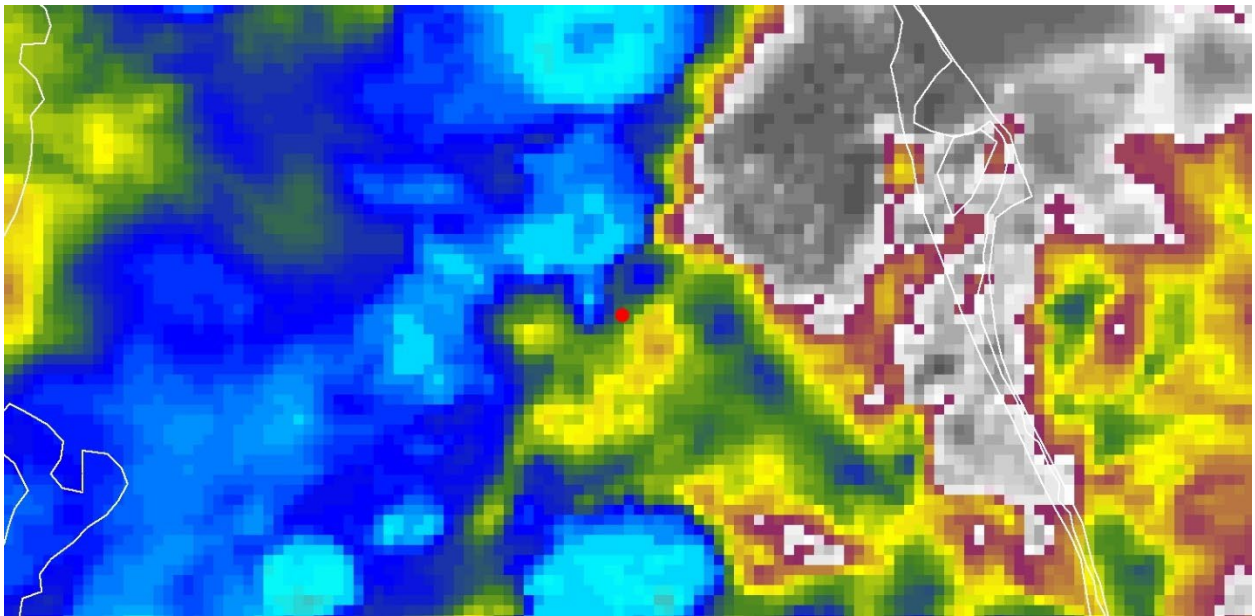


Figure 6 - GOES-16 infrared brightness temperature imagery from 1501 Accident location is denoted by the red dot. This image is not corrected for parallax error.

7.0 Pilot Reports

The following are the longline-disseminated pilot reports¹¹ (PIREPs) reported within 1 hour of the accident time that were applicable within 20 miles of the accident location below 10,000 feet.

ISM UA /OV ISM300010/TM 1828/FL040/TP SW3/WX +RA/TB LTG CHOP

MCO UA /OV ISM320015/TM 1845/FL050/TP F300/WX -RA/TB LGT CHOP

MCO UA /OV KMCO350003/TM 1850/FLDURD/TP B753/RM 10KT TAILWIND
ON RWY 17L FINAL

MCO UA /OV KMCO350003/TM 1855/FLDURD/TP B739/TB + -10KT ON RWY
18R FINAL

MCO UA /OV KMCO/TM 1856/FLDURD/TP A321/TB LTG TURB/RM +-7KTS
ON RWY 17L FINAL

ORL UA /OV ORL/TM 1915/FL015/TP H25B/RM SMOOTH ON FINAL

MCO UA /OV RWY 35R FINAL/TM 1920/FLDURD/TP A321/WX +RA /TB CHOP

MCO UA /OV RWY 36L/TM 1938/FLDURD/TP B737/TB CHOP/RM 10KT
TAILWIND

MCO UA /OV RWY 17R DEPARTURE END/TM 1943/FL010/TP B737/WX
+RA/TB SMOOTH

MCO UA /OV MCO360006/TM 1946/FL018/TP A320/SK BKN018/WX 6SM -
RA/TA 24/WV 15005/TB NEG/RM ILS 18R

8.0 Terminal Aerodrome Forecasts

The National Weather Service (NWS) produced Terminal Aerodrome Forecasts (TAF) for ISM. 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."¹²

At 1325 a TAF was issued by the NWS for ISM that forecasted for the accident time: a wind from 130° at 9 knots, visibility greater than 6 statute miles, thunderstorms in the vicinity¹³, scattered clouds at 4,500 feet agl of cumulonimbus type, ceiling broken at

¹¹ These do not include pilot reports only broadcast via radio.

¹² www.nws.noaa.gov/directives/sym/pd01008013curr.pdf

¹³ "In the vicinity" indicates within 5 to 10 miles of the aerodrome.

12,000 feet agl; temporary conditions¹⁴ between 1400 and 1800 of visibility of 3 statute miles, thunderstorm with moderate rain, ceiling broken at 2,500 feet agl with clouds of cumulonimbus type.

KISM 091725Z 0918/1018 **13009KT P6SM VCTS SCT045CB BKN120**

TEMPO 0918/0922 3SM TSRA BKN025CB

FM100100 17006KT P6SM SCT040 BKN140 BKN200

FM101400 15006KT P6SM SCT030 SCT250=

At 1503 a TAF was issued by the NWS for ISM that forecasted for the accident time: a wind from 130° at 9 knots, visibility greater than 6 statute miles, thunderstorms in the vicinity, scattered clouds at 4,500 feet agl of cumulonimbus type, ceiling broken at 12,000 feet agl; temporary conditions between 1500 and 1800 of wind from variable directions at 15 knots with gusts to 25 knots, visibility of 3 statute miles, thunderstorm with moderate rain, ceiling broken at 2,500 feet agl with clouds of cumulonimbus type.

KISM 091903Z 0919/1018 **13009KT P6SM VCTS SCT045CB BKN120**

TEMPO 0919/0922 VRB15G25KT 3SM TSRA BKN025CB

FM100100 17006KT P6SM SCT040 BKN140 BKN200

FM101400 15006KT P6SM SCT030 SCT250=

9.0 Area Forecast Discussion

The NWS Weather Forecast Office in Melbourne, Florida, issued the following Aviation section of an Area Forecast Discussion at 1410, applicable for a region that included the accident location.

FXUS62 KMLB 091810

AFDMLB

Area Forecast Discussion

National Weather Service Melbourne FL

210 PM EDT Fri Sep 9 2022

.AVIATION...

(18Z TAFS)

Issued at 128 PM EDT Fri Sep 9 2022

Numerous showers and storms to the west have begun to move into ECFL.

TEMPOs for inland terminals at the top of the TAF package for VIS/CIG reductions as these storms move over terminals. The inland movement of the

¹⁴ 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.

seabreeze working against prevailing SW flow will aid in storm development along the coast. TEMPOs starting around 19z for most coastal terminals. Showers and storms should begin to diminish or move offshore around 00/01z. Flow from the south will prevail overnight. VFR outside of convection.

10.0 SIGMETs

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

At 1455, the NWS Aviation Weather Center issued the following Convective SIGMET (#51E) that was active for the accident location and was valid until 1655 that advised of an area of thunderstorms (Figure 7).

WSUS31 KKCI 091855

SIGE

-MKCE WST 091855

CONVECTIVE SIGMET 51E

VALID UNTIL 2055Z

FL GA AND FL CSTL WTRS

FROM 50WNW CRG-50NNE OMN-50NNW EYW-90WNW EYW-100W PIE-50WNW CRG

AREA TS MOV LTL. TOPS ABV FL450.

REF INTL SIGMET FOXTROT SERIES.

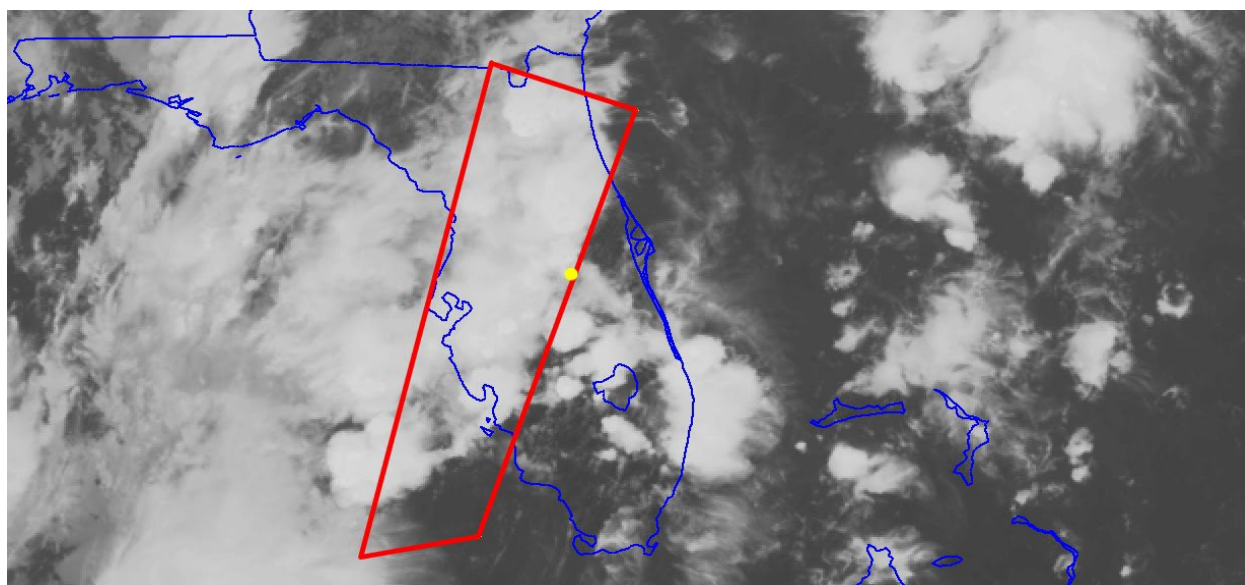


Figure 7 - Convective SIGMET #51E. Accident location is denoted by the yellow dot.

11.0 CWSU Products

At 1435, the NWS Center Weather Service Unit at the Miami Air Route Traffic Control Center issued the following Center Weather Advisory (CWA) that was active for the accident location and was valid until 1535 that advised of an area of developing thunderstorms with heavy to extreme precipitation (Figure 8).

*FAUS22 KZMA 091835
ZMA2 CWA 091835
ZMA CWA 201 VALID UNTIL 091935
FROM 55SE OMN-25ESE PBI-40E SRQ-20W ORL-55SE OMN
DVLPG AREA OF TS WITH HVY-EXTRM PCPN MOV FM 23020KT. TOPS ABV
FL450.
EXP INCRG COVG THRU 1935Z.
FL*

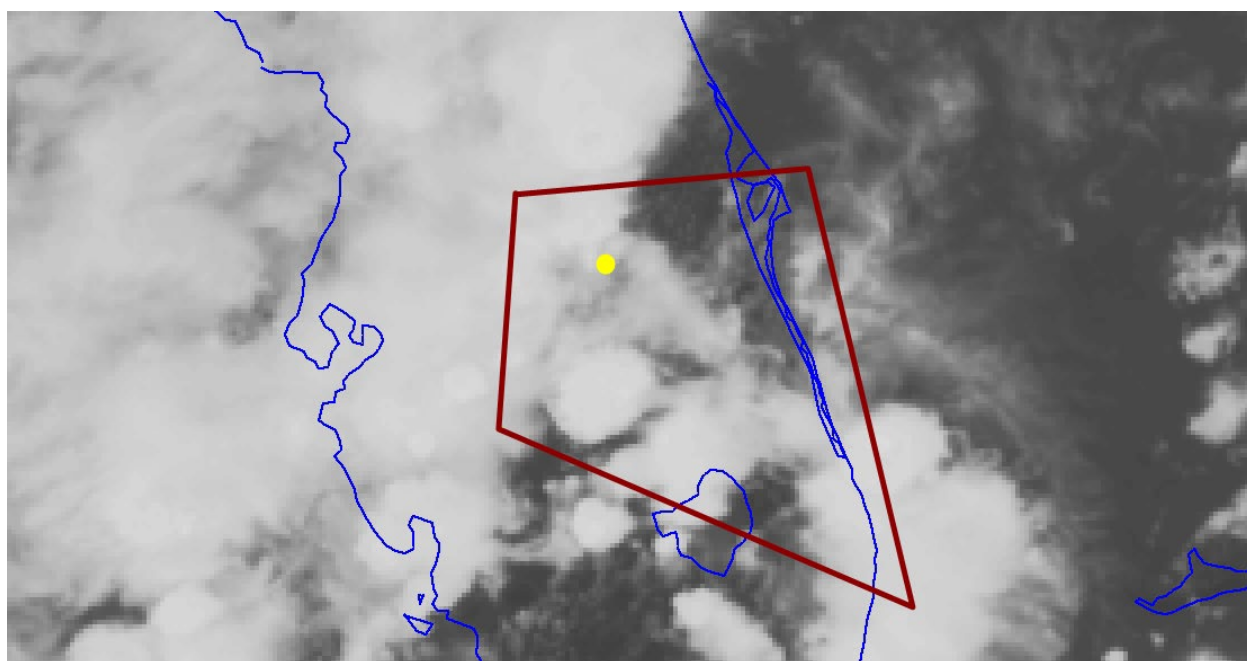


Figure 8 - Center Weather Advisory issued at 1435. Accident location is denoted by the yellow dot.

12.0 Convective Outlook

At 1235, the NWS Storm Prediction Center issued a Convective Outlook that identified a general “thunderstorm” risk for the accident site (Figure 9). Figure 10 provides a description of the different categories found in the Convective Outlook.

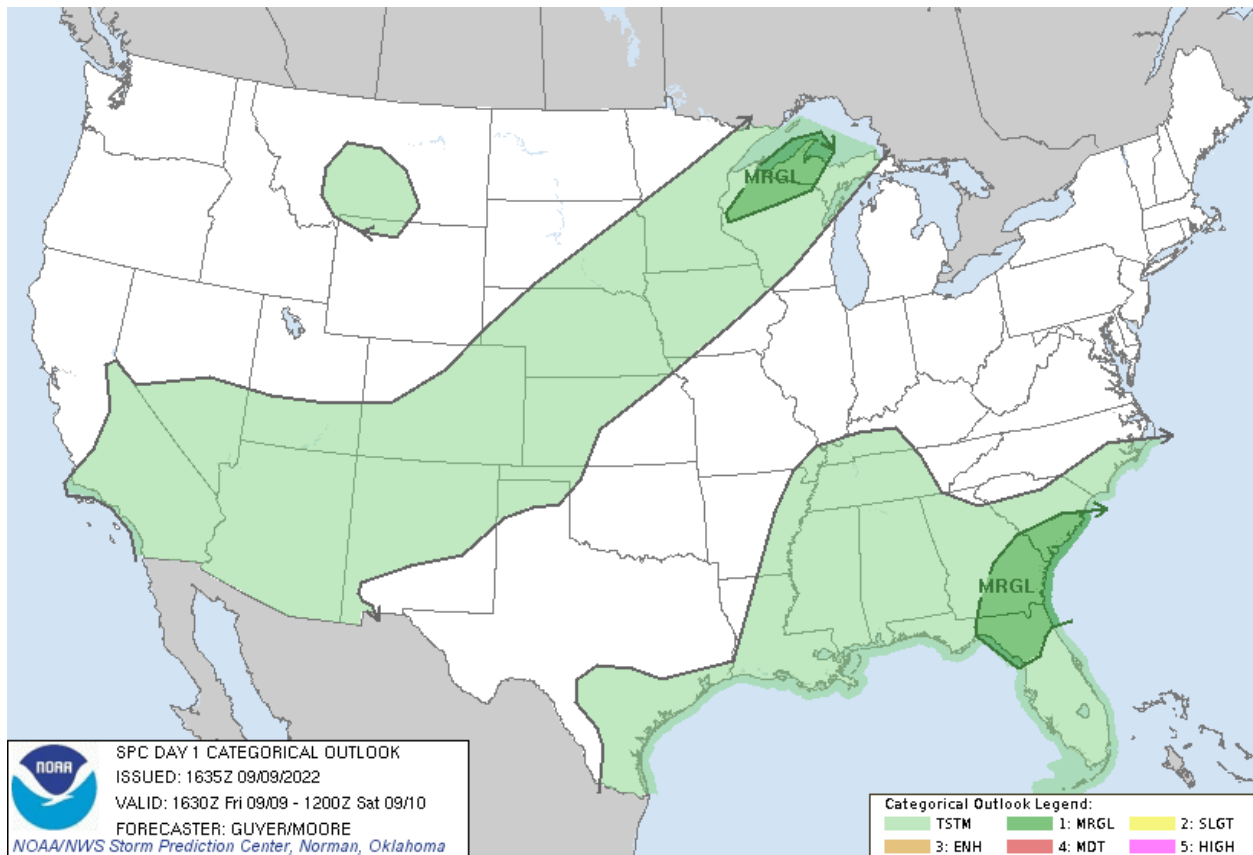


Figure 9 - SPC Convective Outlook issued at 1235.

Understanding Severe Thunderstorm Risk Categories

THUNDERSTORMS (no label)	1 - MARGINAL (MRGL)	2 - SLIGHT (SLGT)	3 - ENHANCED (ENH)	4 - MODERATE (MDT)	5 - HIGH (HIGH)
No severe* thunderstorms expected	Isolated severe thunderstorms possible	Scattered severe storms possible	Numerous severe storms possible	Widespread severe storms likely	Widespread severe storms expected
Lightning/flooding threats exist with <u>all</u> thunderstorms	Limited in duration and/or coverage and/or intensity	Short-lived and/or not widespread, isolated intense storms possible	More persistent and/or widespread, a few intense	Long-lived, widespread and intense	Long-lived, very widespread and particularly intense
					
• Winds to 40 mph • Small hail	• Winds 40-60 mph • Hail up to 1" • Low tornado risk	• One or two tornadoes • Reports of strong winds/wind damage • Hail ~1", isolated 2"	• A few tornadoes • Several reports of wind damage • Damaging hail, 1 - 2"	• Strong tornadoes • Widespread wind damage • Destructive hail, 2" +	• Tornado outbreak • Derecho
* NWS defines a severe thunderstorm as measured wind gusts to at least 58 mph, and/or hail to at least one inch in diameter, and/or a tornado. All thunderstorm categories imply lightning and the potential for flooding. Categories are also tied to the probability of a severe weather event within 25 miles of your location.					

Figure 10 - Convective Outlook categories.

Submitted by:

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