

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



WPR24FA083

METEOROLOGY

Specialist's Factual Report

April 9, 2024

TABLE OF CONTENTS

A. ACCIDENT.....	3
B. METEOROLOGY INVESTIGATOR	3
C. DETAILS OF THE INVESTIGATION	3
D. WEATHER INFORMATION.....	3
1.0 WEATHER RADAR.....	3
2.0 HRRR MODEL SOUNDING.....	5
3.0 SATELLITE IMAGERY	6
4.0 PILOT REPORTS	7
5.0 AREA FORECAST DISCUSSION.....	7
6.0 CURRENT ICING POTENTIAL AND FORECAST ICING POTENTIAL	7
7.0 SIGMETs.....	9
8.0 CWSU PRODUCTS.....	10
9.0 G-AIRMETs FOR ICING	10
10.0 GRAPHICAL FORECASTS FOR AVIATION.....	10
E. LIST OF ATTACHMENTS	12

A. ACCIDENT

Location: Westwater, Utah

Date: 7 February 2024

Time: 1048 mountain standard time (1748 UTC¹)

Aircraft: Type - Hawker 900XP; Registration - N900VA

B. METEOROLOGY INVESTIGATOR

Mike Richards

Senior Meteorologist

Office of Aviation Safety

Operational Factors Division (AS-30)

National Transportation Safety Board

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 mountain standard time for 7 February 2024 (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: 39.26625° north latitude; 109.05652° west longitude at an elevation of about 4,825 feet.

This report provides information on icing and instrument meteorological conditions applicable to the accident flight.

D. WEATHER INFORMATION

1.0 Weather Radar

WSR-88D² Level-II base reflectivity weather radar imagery from the Grand Junction, Colorado, site (KGJX) are presented in Figures 1-2. KGJX was located approximately 41 miles east-southeast of the accident location with an antenna elevation of about 10,100 feet. Assuming standard refraction and considering the 0.95° beam width³ for

¹ UTC - abbreviation for Coordinated Universal Time

² Weather Surveillance Radar 88 Doppler (WSR-88D)

³ 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.

the WSR-88D radar beam, the KGJX -0.041° and 1.750° tilts would have “seen” altitudes above the accident location of between about 11,000 and 13,100 feet, and between about 18,800 and 20,900 feet, respectively.

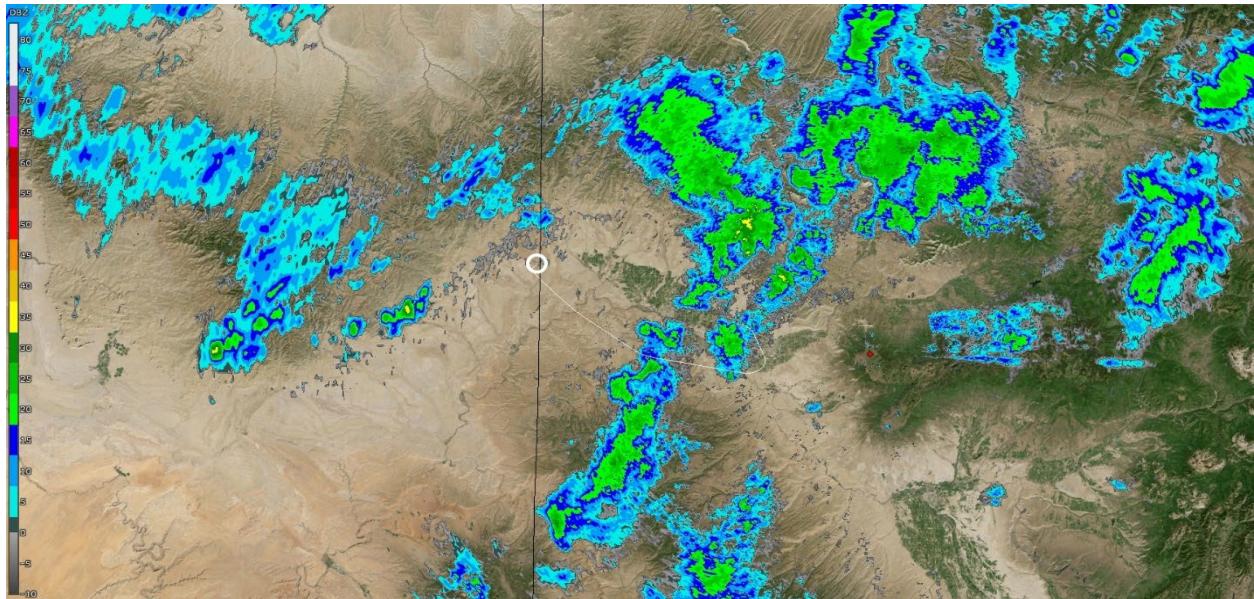


Figure 1 - KGJX -0.041° Level-II base reflectivity product from a sweep initiated at 1049:43. The accident aircraft's flight track is marked by the thin white line and the accident location is denoted by the white circle.

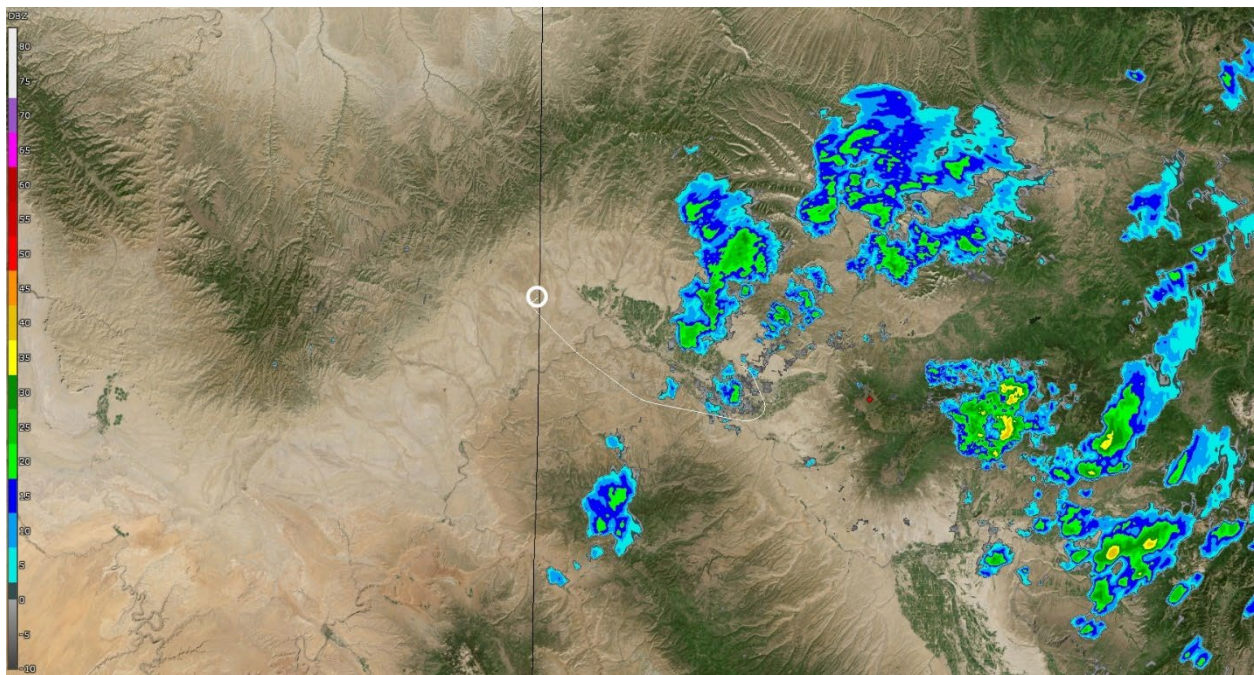


Figure 2 - KGJX 1.750° Level-II base reflectivity product from a sweep initiated at 1047:42. The accident aircraft's flight track is marked by the thin white line and the accident location is denoted by the white circle.

2.0 HRRR Model Sounding

A High-Resolution Rapid Refresh (HRRR) model⁴ sounding (Figure 3) for near the accident site⁵ at 1100 with an elevation of 4,825 feet was retrieved from the National Oceanic and Atmospheric Administration's (NOAA) Air Resources Laboratory and analyzed by the RAwinsonde OBservation (RAOB) program. Broken or overcast clouds were identified by RAOB between about 8,200 to 15,000 feet. The freezing level was at about 6,500 feet, and RAOB identified the potential for light or moderate clear, rime or mixed icing between about 7,800 and 15,300 feet. The wind between the surface and 20,000 feet was generally from the southwest at magnitudes between 17 and 32 knots.

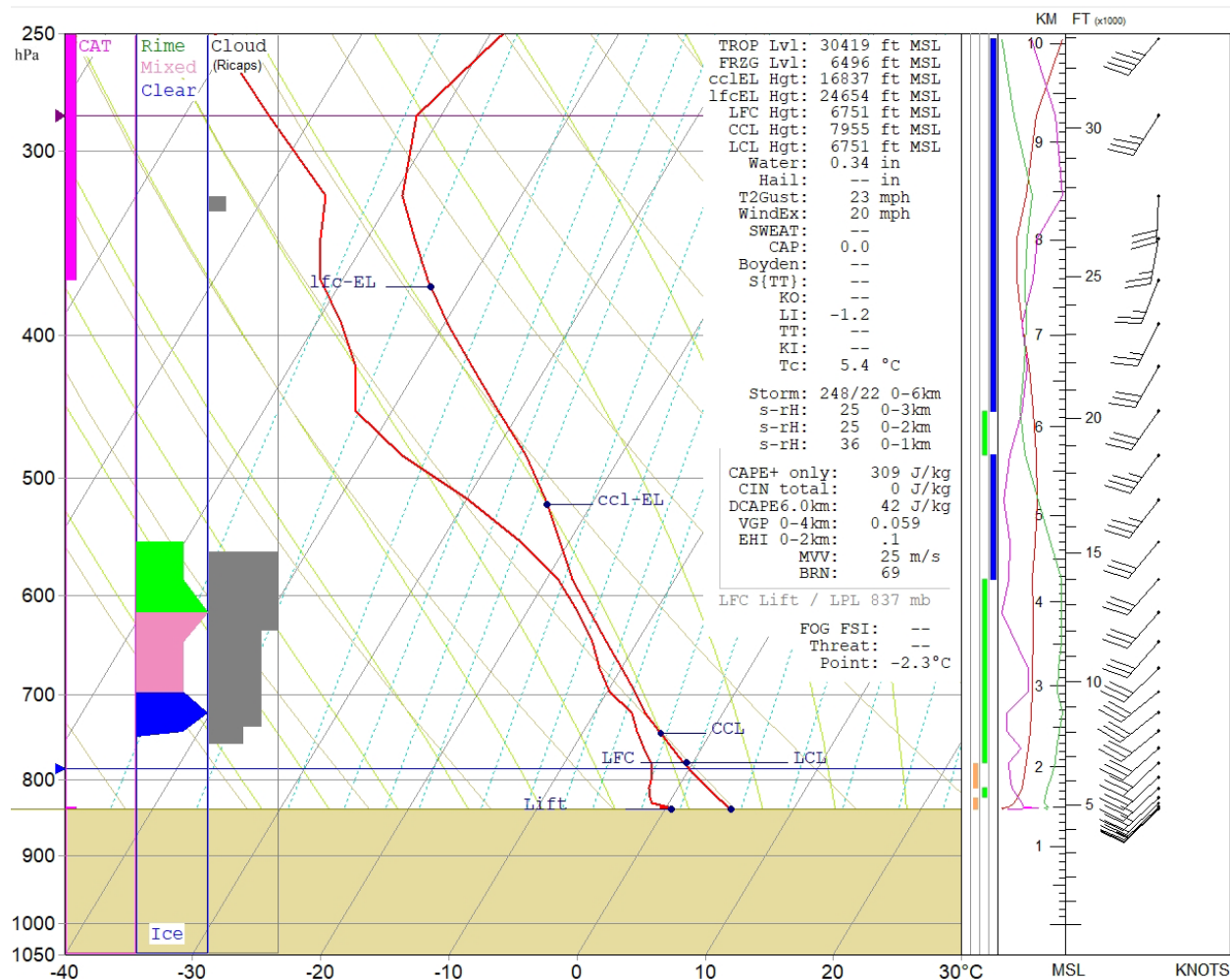


Figure 3 - HRRR model sounding data in SkewT/LogP format for 1100 near the accident site, surface to 250 hectopascals (hPa).

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

⁵ Coordinates used for the model were latitude: 39.27; longitude: -109.06.

3.0 Satellite Imagery

Advanced Very-High-Resolution Radiometer (AVHRR) visible (0.63 μ m) and infrared (10.8 μ m) data from the METOP-C platform were obtained from NOAA. Imagery from about 1043 are presented in Figures 4 and 5. Minimum infrared cloud-top temperatures near the accident site were about -25°C, which, when considering the 1100 HRRR sounding, corresponded to cloud top heights of about 17,500 feet.

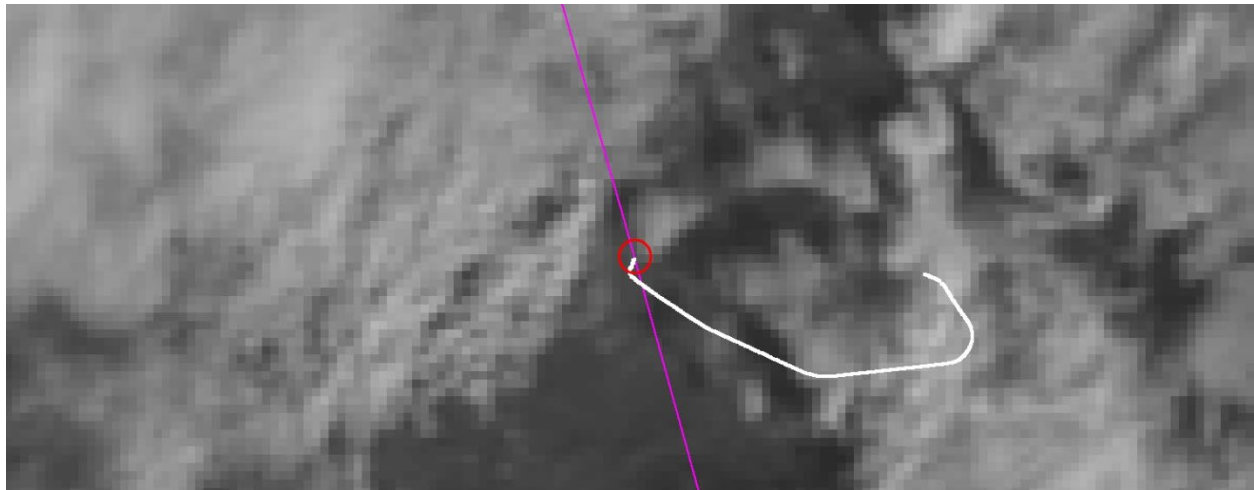


Figure 4 - METOP-C visible imagery from about 1043. Accident location denoted by the red dot. The accident aircraft's flight track is marked by the white line and the accident location is denoted by the red circle. Image is not corrected for any parallax error.

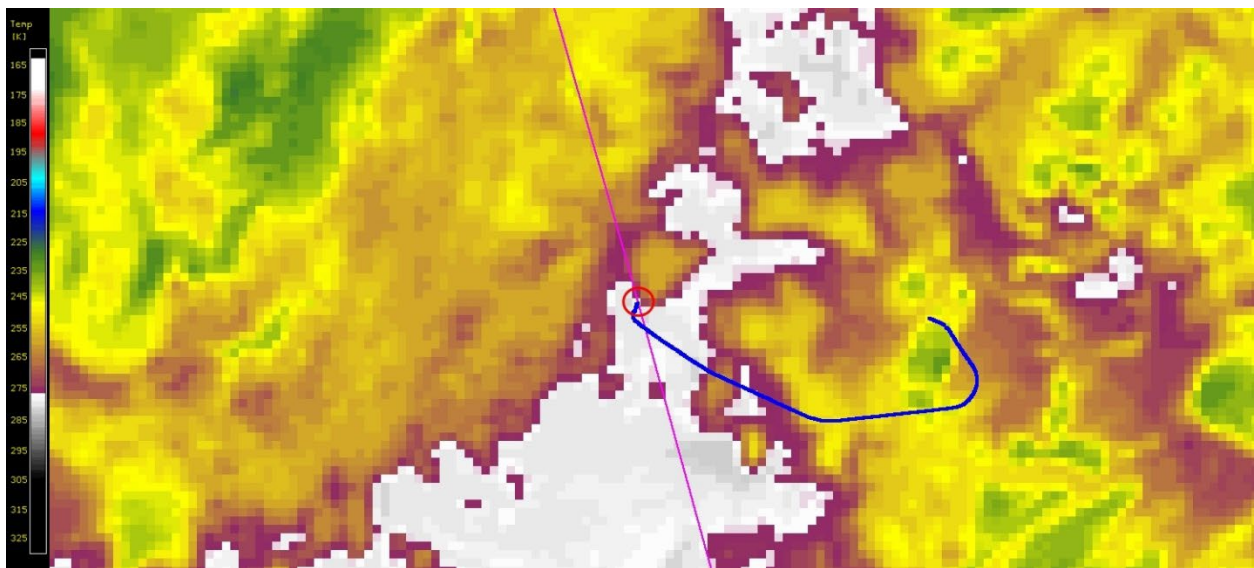


Figure 5 - METOP-C infrared imagery from about 1043. The accident aircraft's flight track is marked by the blue line and the accident location is denoted by the red circle. Image is not corrected for any parallax error.

4.0 Pilot Reports

There were no longline-disseminated pilot reports⁶ (PIREPs) reported within 90 minutes or 50 miles of the accident location.

5.0 Area Forecast Discussion

The National Weather Service's (NWS) Grand Junction, Colorado, Weather Forecast Office issued the following Aviation section of an Area Forecast Discussion at 1038, applicable for a region that included the accident location.

FXUS65 KGJT 071738

AFDGJT

Area Forecast Discussion

National Weather Service Grand Junction CO

1038 AM MST Wed Feb 7 2024

.AVIATION /18Z TAFS THROUGH 18Z THURSDAY/...

Issued at 1038 AM MST Wed Feb 7 2024

The precipitation mode has turned more convective meaning more hit or miss showers in some places. These showers however could contain brief moderate to heavy precip rates and be accompanied by thunder and gusty winds this afternoon. So another tough TAF forecast to represent exact scenario and expect plenty of amendments as critical flight categories are exceeded. This storm cycle is long from over so a mix of VFR to LIFR can be expected at many places over the next 24 hours. Winds will also remain gusty from the South-Southwest with mountain wave turbulence and LLWS possible in some areas.

6.0 Current Icing Potential and Forecast Icing Potential

The Current Icing Potential (CIP) and Forecast Icing Potential (FIP) imagery provides information on expected icing severity as five categories: none, trace, light, moderate, and heavy. The severity estimates are roughly based on the accretion rate of ice on an airplane, and the levels are determined by the time it would take for an airfoil to accrete 1/4 of an inch of ice: trace = 1 hour; light = 15 minutes to 1 hour; moderate = 5 to 15 minutes; severe = less than 5 minutes.⁷

⁶ These do not include pilot reports only broadcast via radio.

⁷ These are general values. Users should always consider the icing susceptibility of their airframe and availability of icing protection provided by their aircraft. Different aircraft and different flight configurations (airspeed, angle of attack, etc.) will experience variations in accretion rate.

The images presented in this report show data from the National Center for Atmospheric Research's (NCAR) prototype CIP and FIP algorithms and were generated using NCAR's visualization software. These algorithms differ in various ways from the operational CIP and FIP that provided data used to generate the publicly available images accessible through the NWS Aviation Weather Center (AWC) on the accident day. NCAR's prototype CIP and FIP represent the latest research and development conducted by their team of in-flight icing scientists and have passed internal validation exercises using voice PIREPs of icing conditions and scientific airborne research observations of in-flight icing (when available).

Images presenting output from the CIP valid for 1000 and 1100 for altitudes from 4,000 feet to FL210⁸ for the accident region are presented in Attachment 1. CIP output at 1000 identified moderate icing in the accident region at and below 16,000 feet through 8,000 feet. By 1100, icing potential was not noted close to the accident site at or above 14,000 feet; however, moderate icing potential was still observed in the greater region at and below 16,000 through 8,000 feet.

Figure 6 presents cross-sections of CIP icing probability, CIP icing severity and liquid water content from the CIP's underlying HRRR model along the accident aircraft's flight path during its accident flight below 16,700 feet. According to NCAR, "calculations of ice accretion based on the model forecast were between 0.16 and 0.38 mm and we can say confidently the true value is less than 1 mm after also accounting for model uncertainty and bias."⁹

⁸ Flight Level (FL) - a standard nominal altitude of an aircraft, in hundreds of feet. This altitude is calculated from the international standard pressure datum of 1013.25 hPa (29.92 inches of mercury), the average sea-level pressure, and therefore is not necessarily the same as the aircraft's true altitude either above msl or agl.

⁹ According to NCAR, calculations were made using the accident aircraft's airspeed (provided by the NTSB) linearly interpolated to the time steps of the accident aircraft's track data, an ice density of 850 kg/m³, collection efficiencies of 0.3, 0.5, and 0.7, and a time-lag ensemble for the model liquid water content (which was the average from 10 different model runs--5 valid at 17z and 5 at 18, with lead times of 1hr, 2hr, 3hr, 6hr, and 9hr).

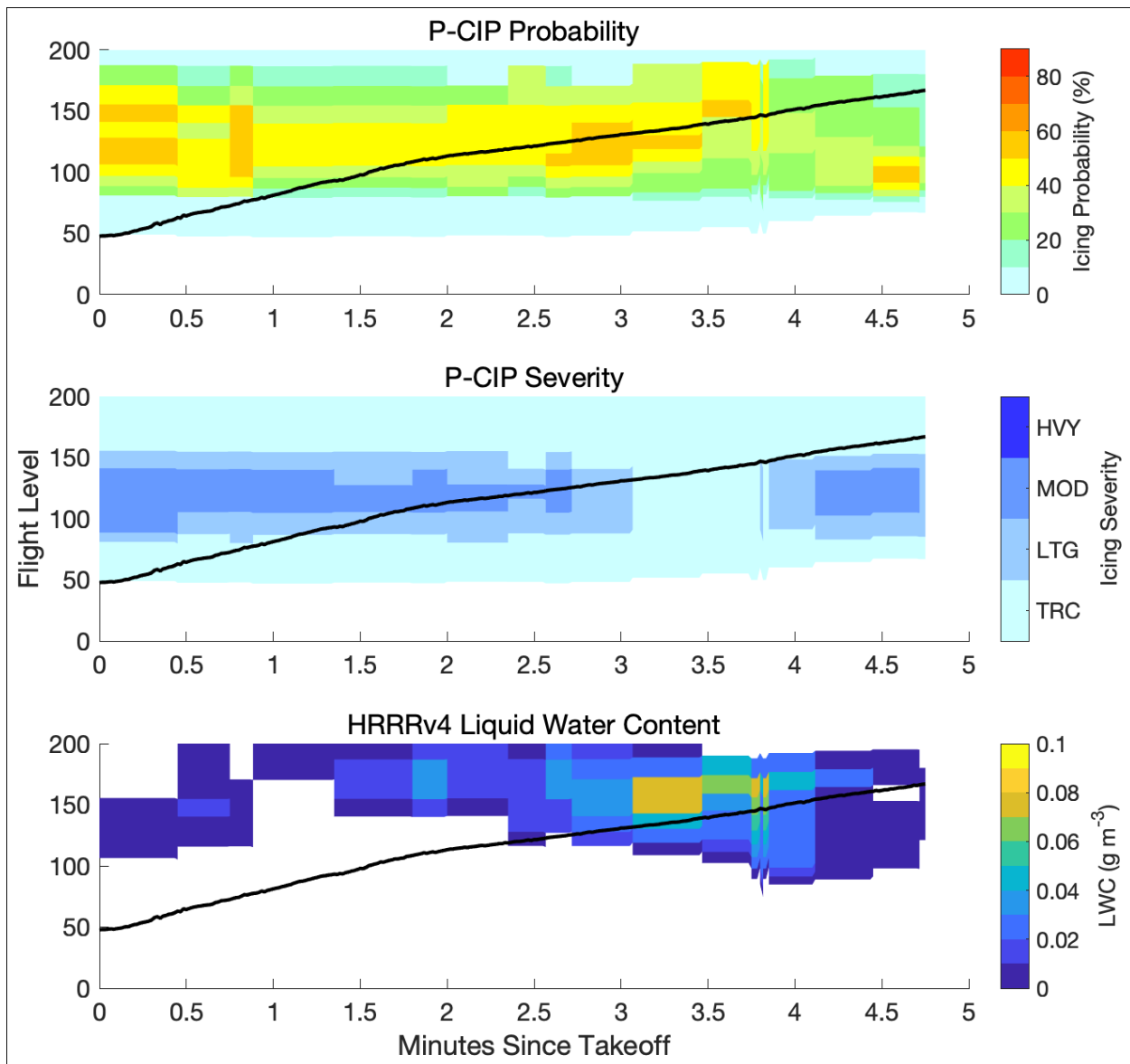


Figure 6 - Cross-sections of CIP icing probability, CIP icing severity and liquid water content from the CIP's underlying HRRR model along the accident aircraft's flight path during its accident flight below 16,700 feet.

7.0 SIGMETs

There were no non-convective or Convective Significant Meteorological Information (SIGMET) advisories active for the accident flight.

8.0 CWSU Products

There were no Center Weather Advisories or Meteorological Impact Statements issued by the Center Weather Service Unit (CWSU) at the Denver Air Route Traffic Control Centers that were active for the accident flight.

9.0 G-AIRMETs for Icing

A Graphical-Airmen's Meteorological Information (G-AIRMET) is a graphical advisory of weather that may be hazardous to aircraft but are less severe than SIGMETs. They are only valid at specific time "snapshots". G-AIRMETs are issued at discrete times three hours apart for a period of up to 12 hours into the future (i.e., 00-, 03-, 06-, 09- and 12-hour forecasts). They are issued at 0300 UTC, 0900 UTC, 1500 UTC and 2100 UTC (with updates issued as necessary).

At about 0800, a G-AIRMET was issued for moderate icing between the freezing level and FL220 and was valid at 0800 for a region that included the accident location. Also at about 0800, a G-AIRMET was issued for moderate icing between the freezing level and FL200 and was valid at 1100 for a region that included the accident location.

10.0 Graphical Forecasts for Aviation

The Graphical Forecasts for Aviation (GFA) are intended to provide the necessary aviation weather information to give users a complete picture of the weather that might impact flight in the continental United States. The GFAs are available through the AWC website and provide hourly analyses and forecasts, including information on clouds, flight category, precipitation, icing, turbulence, wind, and other output from the NWS. The following information was retrieved from the AWC's GFA archive.

Figure 7 presents the GFA icing probability analysis for FL180 at 1045. It depicted a zero percent probability of icing. Figure 8 presents the GFA cloud cover analysis for 1045. It depicted broken clouds at 8,000 feet with cloud tops to FL280.

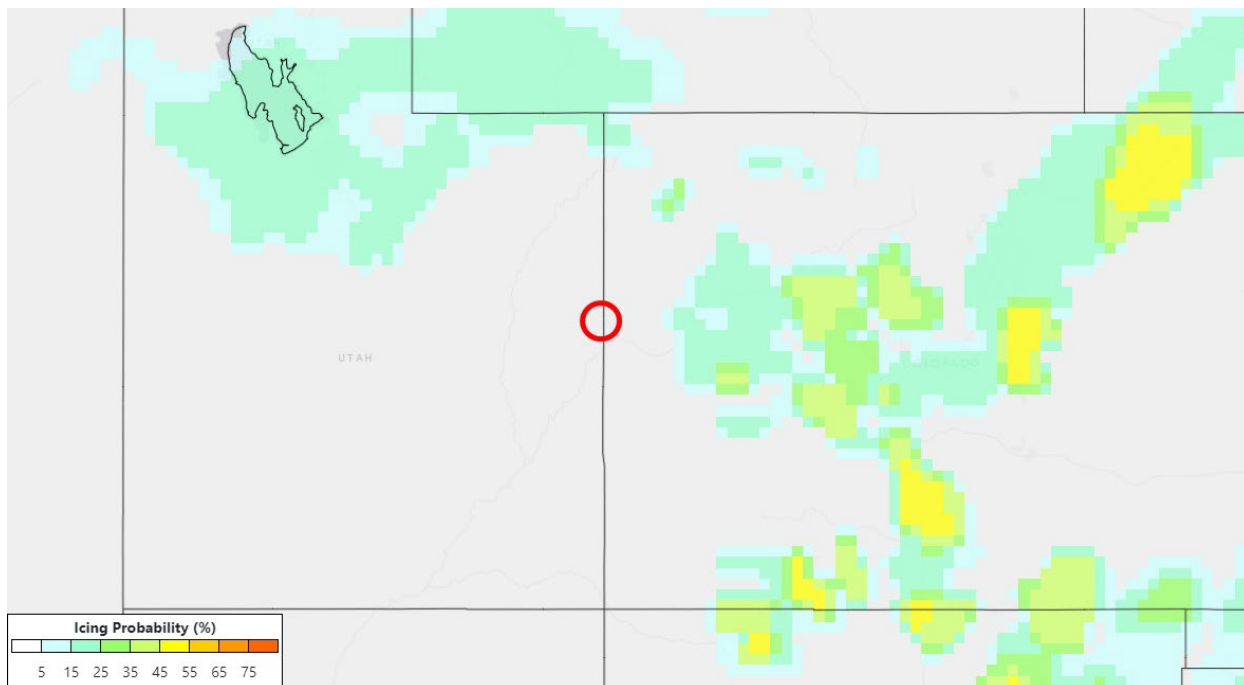


Figure 7 - GFA icing probability analysis for FL180 at 1045. The accident location is in the red circle.

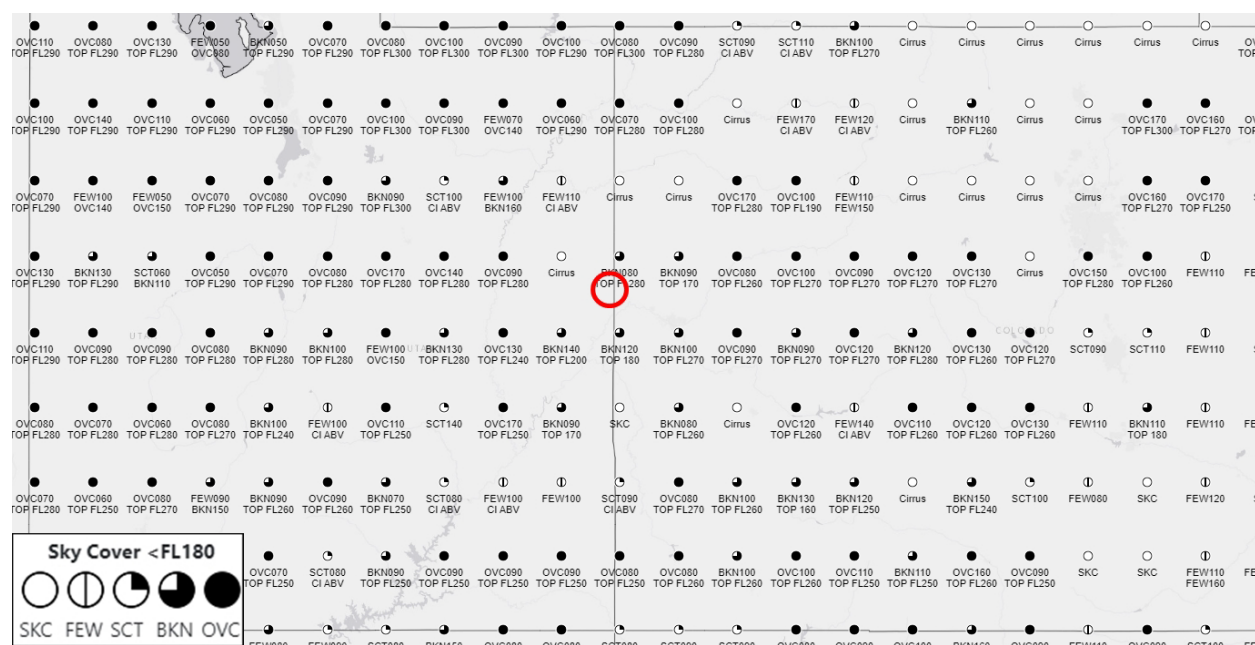


Figure 8 - GFA cloud cover analysis for 1045. The accident location is in the red circle.

E. LIST OF ATTACHMENTS

Attachment 1 - Images presenting output from the CIP valid for 1000 and 1100 for altitudes from 4,000 feet to FL210 for the accident region.

Submitted by:

Mike Richards
Senior Meteorologist