National Transportation Safety Board

Office of Aviation Safety
Washington, D.C. 20594-2000
July 14, 2016

WEATHER STUDY

ANC16FA023

A. Accident

Location: Skagway, Alaska
Date: May 6, 2016
Time: about 1855 Alaska daylight time (0255 UTC[1] on May 7, 2016)
Aircraft: Airbus AS350B2; N94TH

B. Meteorological Specialist

Mike Richards
Senior Meteorologist
National Transportation Safety Board
Operational Factors Division, AS-30
Washington, DC 20594-2000

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 Alaska daylight time (AKDT) for May 6, 2016 (based upon the 24-hour clock), directions are referenced to true north, distances are in nautical miles and heights are above mean sea level (msl).

Coordinates used for the accident location: 59.450278° north latitude, 135.205556° west longitude, elevation of about 4,175 feet.

[1] UTC – abbreviation for Coordinated Universal Time

Synoptic Conditions

The National Weather Service (NWS) Surface Analysis Chart for 1900 AKDT is presented in figure 1. The surface analysis chart identified a low pressure center west of the accident site over the Gulf of Alaska. A cold front stretched from near the accident site southward, then southwestward, over the Pacific Ocean.

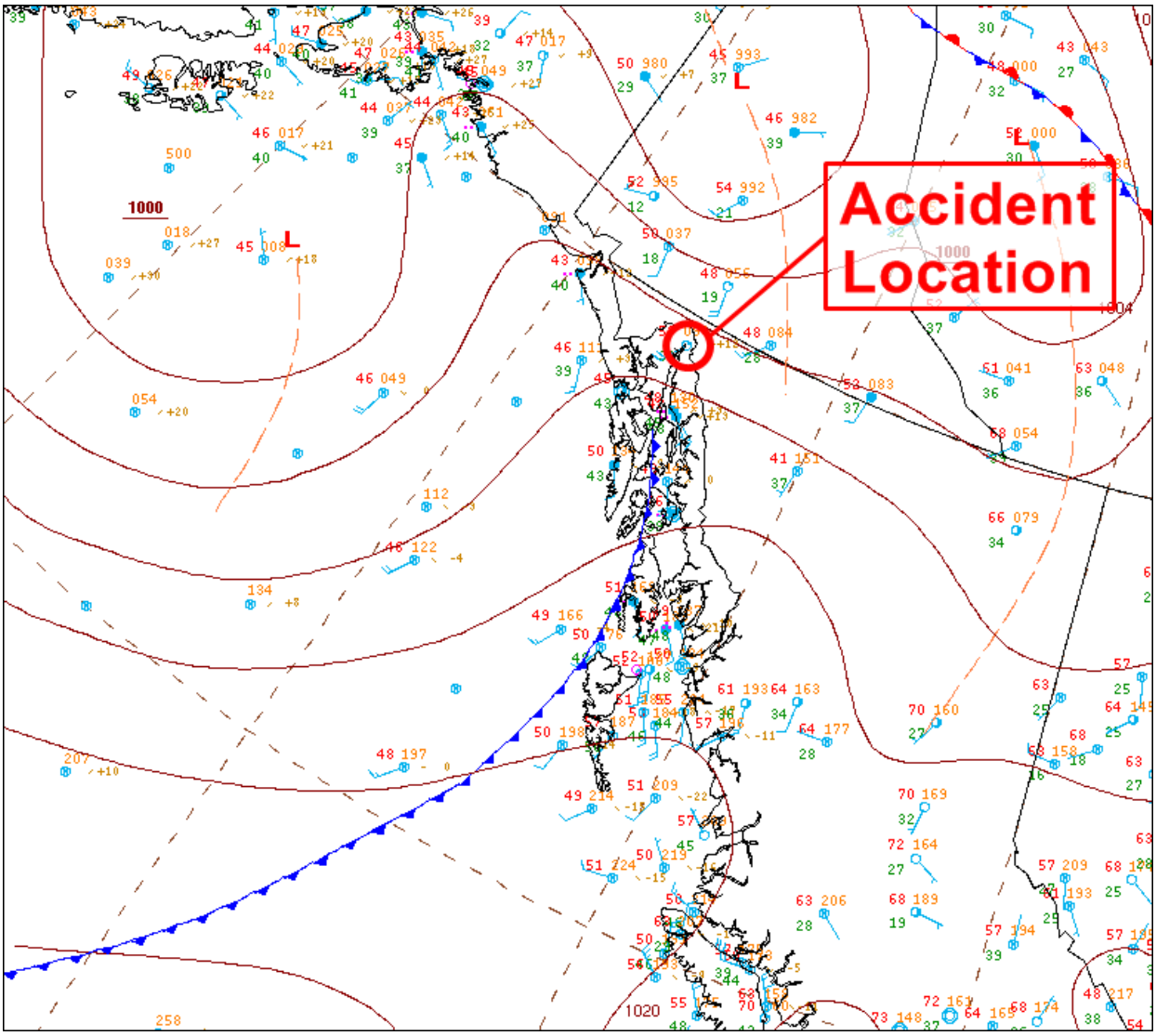

Figure 1 - NWS Surface Analysis Chart for 1900 AKDT.

Surface Observations

An Automated Surface Observing System was located at Skagway Airport (PAGY) in Skagway, Alaska, about three miles west of the accident location at an elevation of 44 feet. Automated reports from PAGY during the times surrounding the accident time are presented here:

[1653 AKDT] METAR PAGY 070053Z AUTO 21013KT 10SM CLR 12/05 A2980
RMK AO2 PK WND 22031/0004 SLP091 T01220050 TSNO=

[1753 AKDT] METAR PAGY 070153Z AUTO 21021G31KT 10SM CLR 12/04 A2980 RMK AO2 PK WND 21031/0147 SLP091 T01170039 TSNO=

[1853 AKDT] METAR PAGY 070253Z AUTO 21019G28KT 10SM FEW080 12/03 A2980 RMK AO2 PK WND 22030/0228 SLP093 T01170033 51012 TSNO=

[1953 AKDT] METAR PAGY 070353Z AUTO 21017G26KT 10SM SCT070 11/03 A2982 RMK AO2 PK WND 22033/0305 SLP098 T01110033 TSNO=

At 1853 AKDT, PAGY reported a wind from 210° at 19 knots with gusts to 28 knots, visibility of 10 statute miles or greater, few clouds at 8,000 feet above ground level (agl), temperature of 12° Celsius (C) and a dew point temperature of 3°C, altimeter setting of 29.80 inches of mercury; remarks included: station with a precipitation discriminator, peak wind from 220° at 30 knots at 1828 AKDT.

Unofficial meteorological reporting station KLNA2 was located about 11 miles north of the accident site at an altitude of 3,287 feet. Calibration, maintenance and siting standards of this instrument are not known. Reports[2] from KLNA2 during the times surrounding the accident time are presented here.

Time	Temp	D_Temp	RH	W_Mag	W_Dir	G_Mag
1725	2.5°	-1.1°	77	18.9	195°	25.4
1755	2.4°	-1.4°	76	17.8	190°	23.7
1825	2.6°	-3.5°	64	21.0	190°	29.7
1855	1.9°	-0.7°	83	16.8	170°	30.8
1925	2.2°	-1.9°	74	19.4	185°	26.4
1955	2.4°	-2.7°	69	24.9	190°	35.1

Weather Radar

WSR-88D Level-II weather radar imagery from Sitka, Alaska (PACG), is presented in figure 2. PACG was located approximately 155 miles south of the accident site at an elevation of about 270 feet. Assuming standard refraction and considering the 0.95° beam width for the WSR-88D radar beam, the PACG 0.45° tilt would have "seen" altitudes between about 15,775 and 31,400 feet msl above the accident location. There were no areas of reflectivity near the accident location.

[2] Temp=temperature(C); D_Temp=dew point temperature (C); RH=relative humidity(%); W_Mag=average wind magnitude(kts); W_Dir=average wind direction(true); G_Mag=gust wind magnitude(kts)

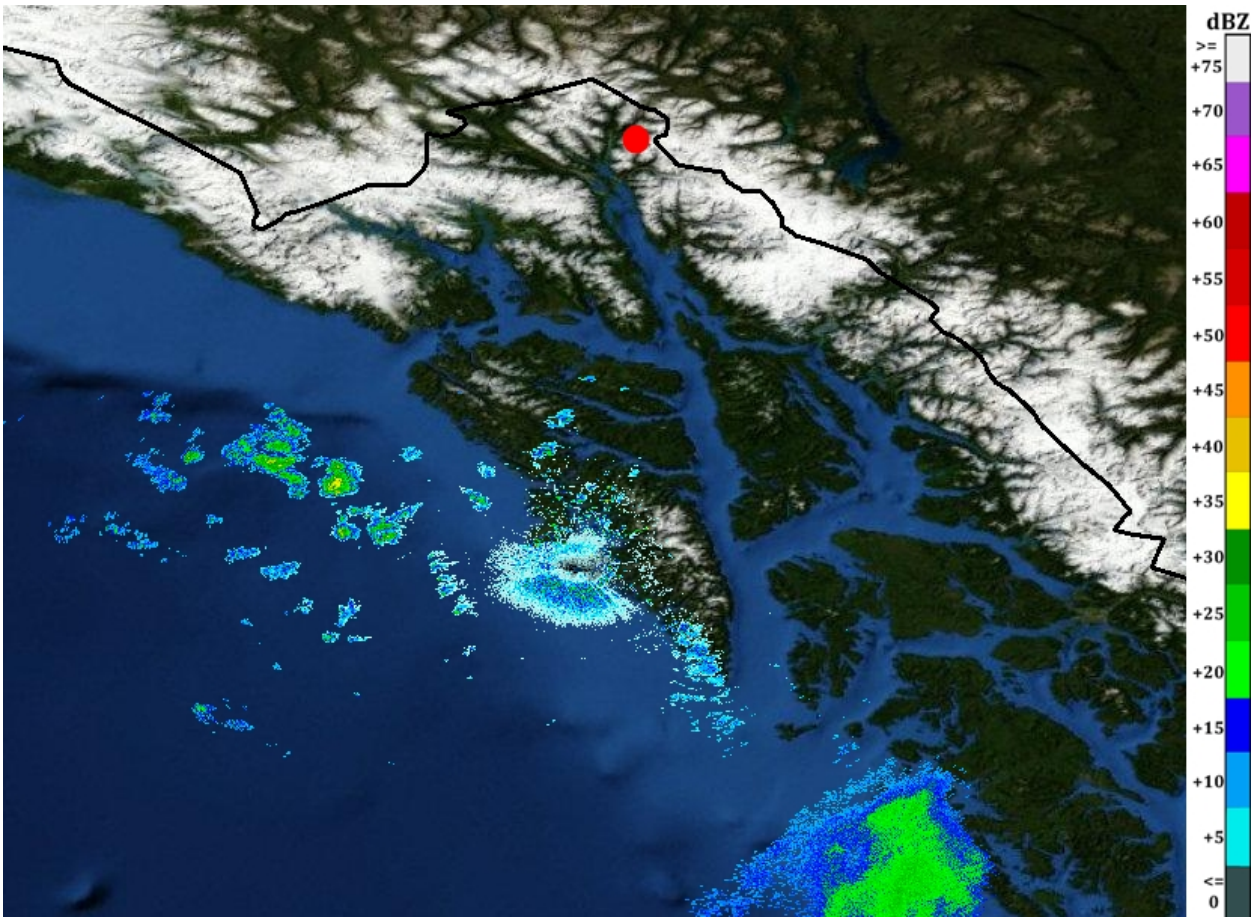

Figure 2 – PACG 0.45° Level-II reflectivity product from 1857 AKDT.

Terminal Aerodrome Forecasts

The Terminal Aerodrome Forecast (TAF) issued for PAGY prior to the accident time is presented here:

TAF PAGY 062325Z 0700/0724 **20022G35KT 5SM -RA SCT015 OVC050**
FM070300 21012G20KT P6SM VCSH SCT015 OVC050
FM071400 21009KT P6SM VCSH OVC060
AMD LTD TO CLD VIS AND WIND=

The PAGY TAF issued at 1525 AKDT forecasted for the accident time: a wind from 200° at 22 knots with gusts to 35 knots, visibility of 5 statute miles, light rain, scattered clouds at 1,500 feet agl, ceiling overcast at 5,000 feet agl.

Pilot Reports

There were no publicly disseminated pilot reports[3] made within two hours of the accident time and 100 miles of the accident location.

Model Data

The Weather Research and Forecasting Model (WRF) was run to simulate a rawinsonde launch from the accident site at the accident time. WRF ARW (Advanced Research WRF core) version 3.2.1.5 was run with 3 domains with horizontal grid spacing of 8 kilometers (km), 1.6 km, and 320 meters over the accident site. Other WRF simulation parameters included: 38 vertical levels, a Lin et al. microphysics scheme, a Yonsei University boundary layer scheme, Noah land surface physics, the Dudhia scheme for long and short wave radiation, and the Grell 3D ensemble scheme for cumulus parameterization was used on the outer domain. Figure 3 presents the rawinsonde launch, which identified a saturated or near-saturated layer immediately above the surface, where wind was about 35 knots from the south-southwest.

The WRF run also provided information pertaining to horizontal wind, relative humidity and vertical velocity for the accident location. Figures 4-9 present these data in graphical form. For all WRF images, the center of the horizontal axis is the accident location (59.450278°N, 135.20556°W). These data depict horizontal wind magnitudes greater than 30 knots, relative humidity greater than 90 percent, and maximum vertical velocities in the area around +/-800 feet per minute.

[3] Only pilot reports with the WMO header UBAK** were considered.

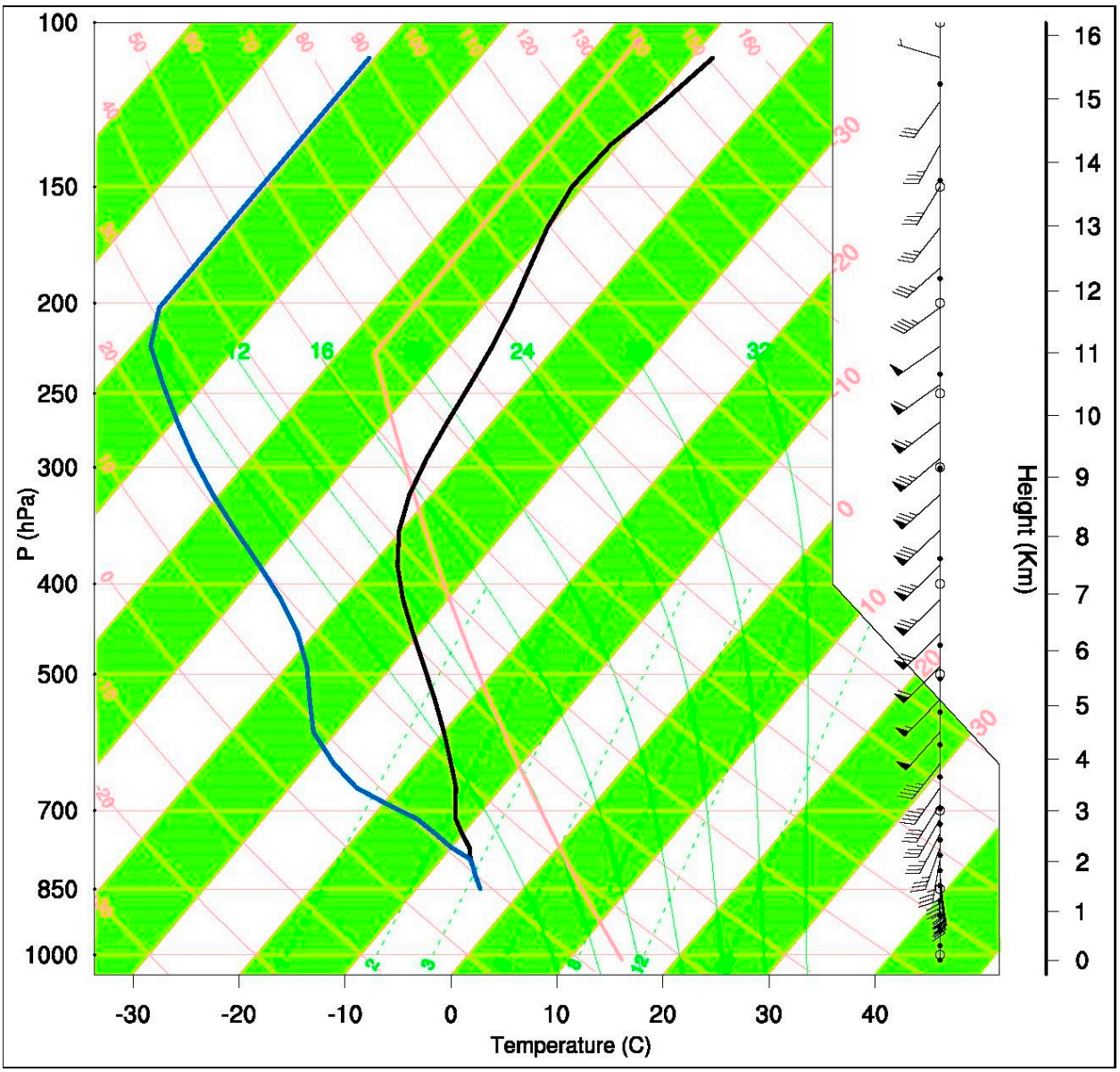

Figure 3 – WRF model rawinsonde data in SkewT/LogP format for 1855 AKDT at the accident site, surface to 100 hectopascals (hPa).

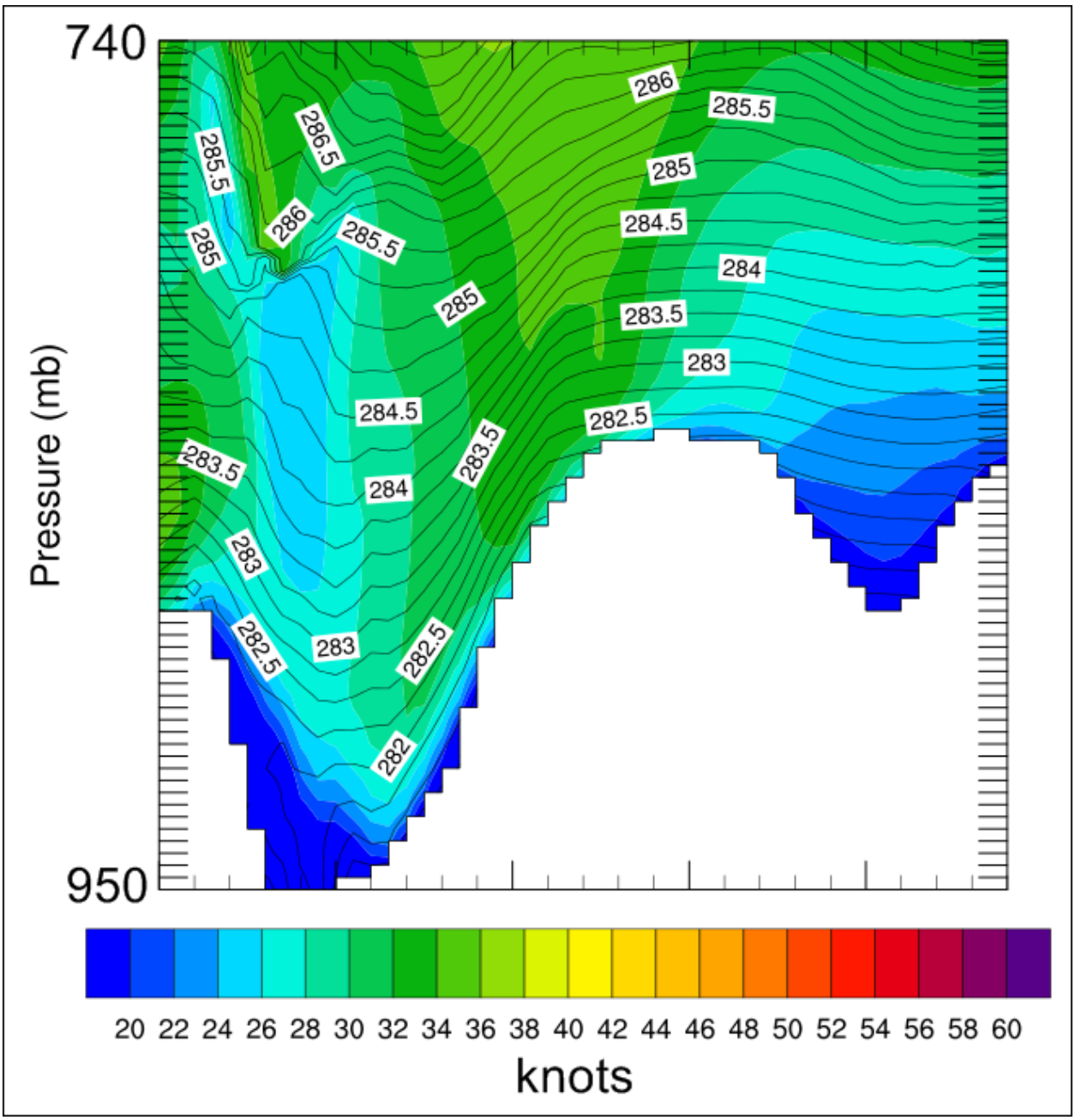

Figure 4 –WRF simulation of horizontal wind around the accident location (north-to-south cross-section along the longitude 135.20556°W). Black contours are lines of constant potential temperature (degrees Kelvin).

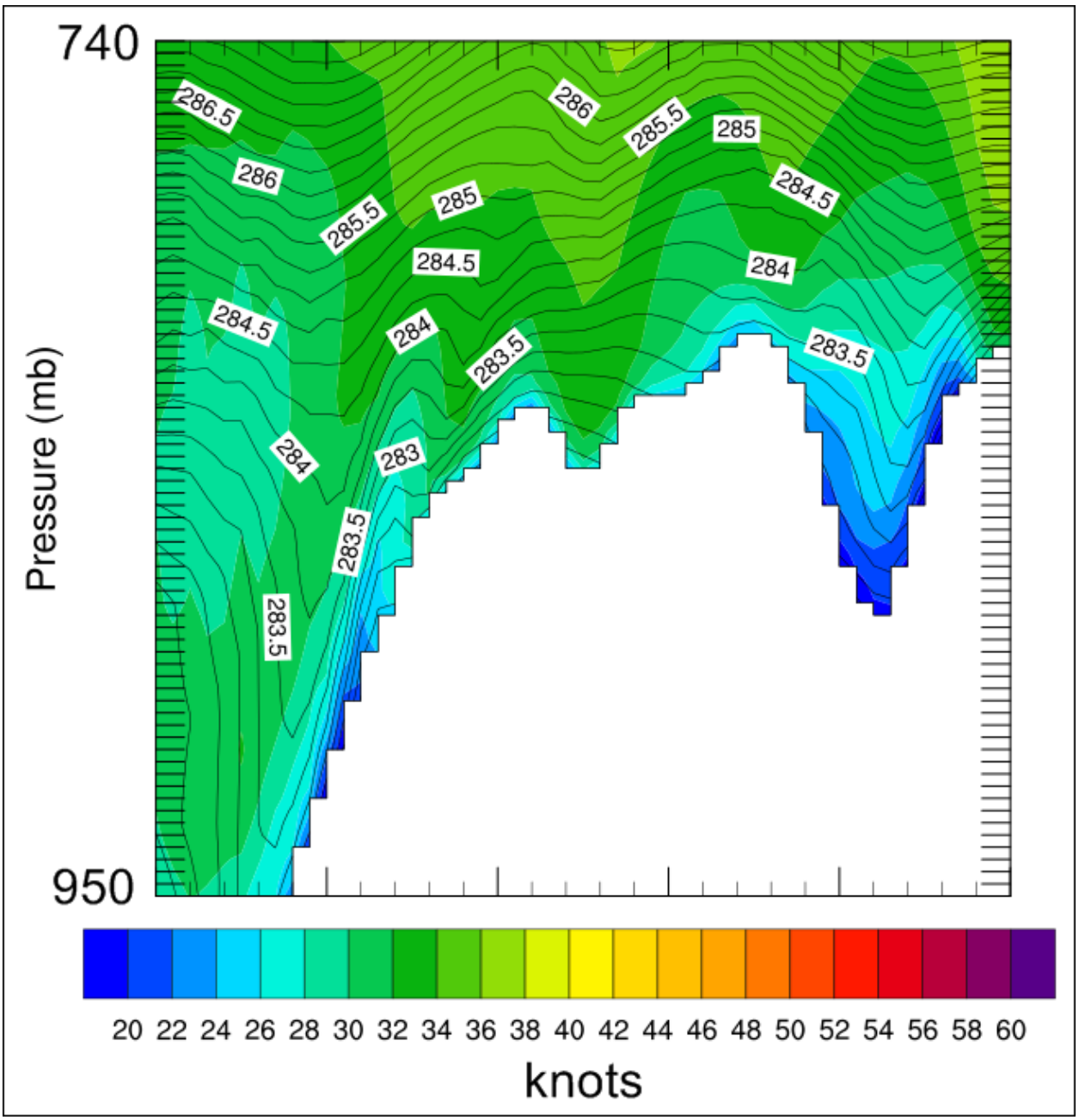

Figure 5 – WRF simulation of horizontal wind around the accident location (west-to-east cross-section along the latitude 59.450278°N). Black contours are lines of constant potential temperature (degrees Kelvin).

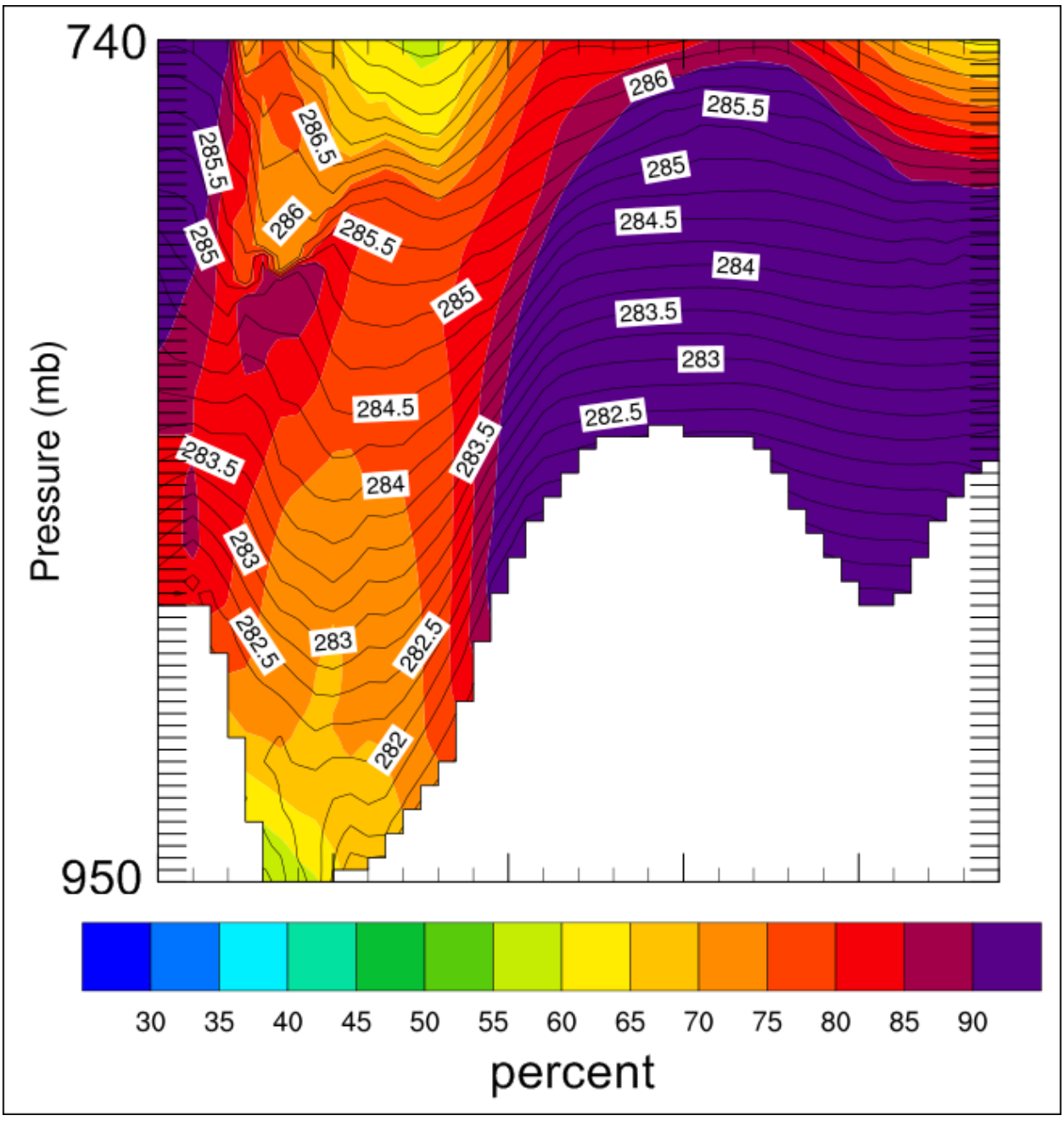

Figure 6 –WRF simulation of relative humidity around the accident location (north-to-south cross-section along the longitude 135.20556°W). Black contours are lines of constant potential temperature (degrees Kelvin).

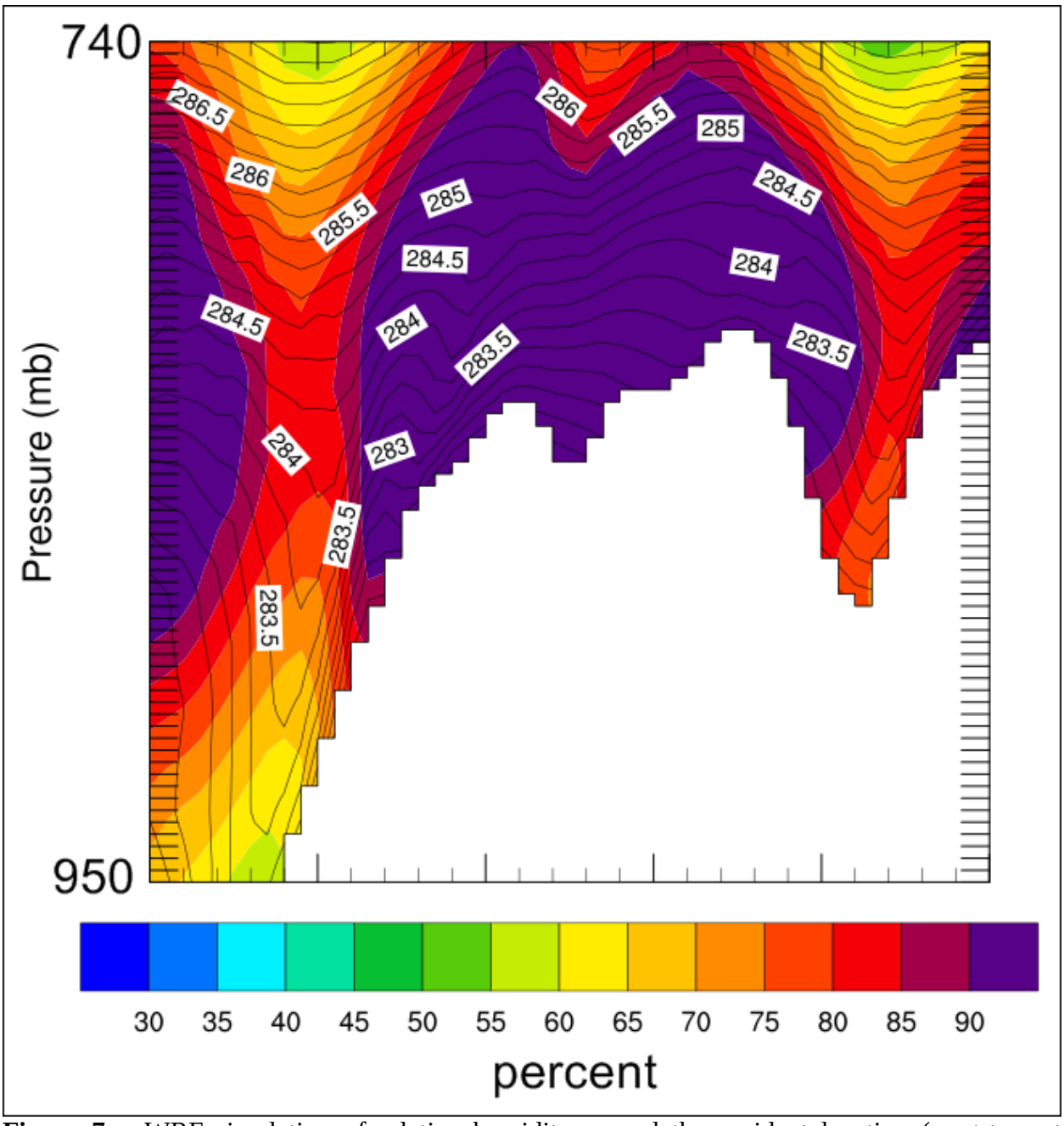

Figure 7 – WRF simulation of relative humidity around the accident location (west-to-east cross-section along the latitude 59.450278°N). Black contours are lines of constant potential temperature (degrees Kelvin)..

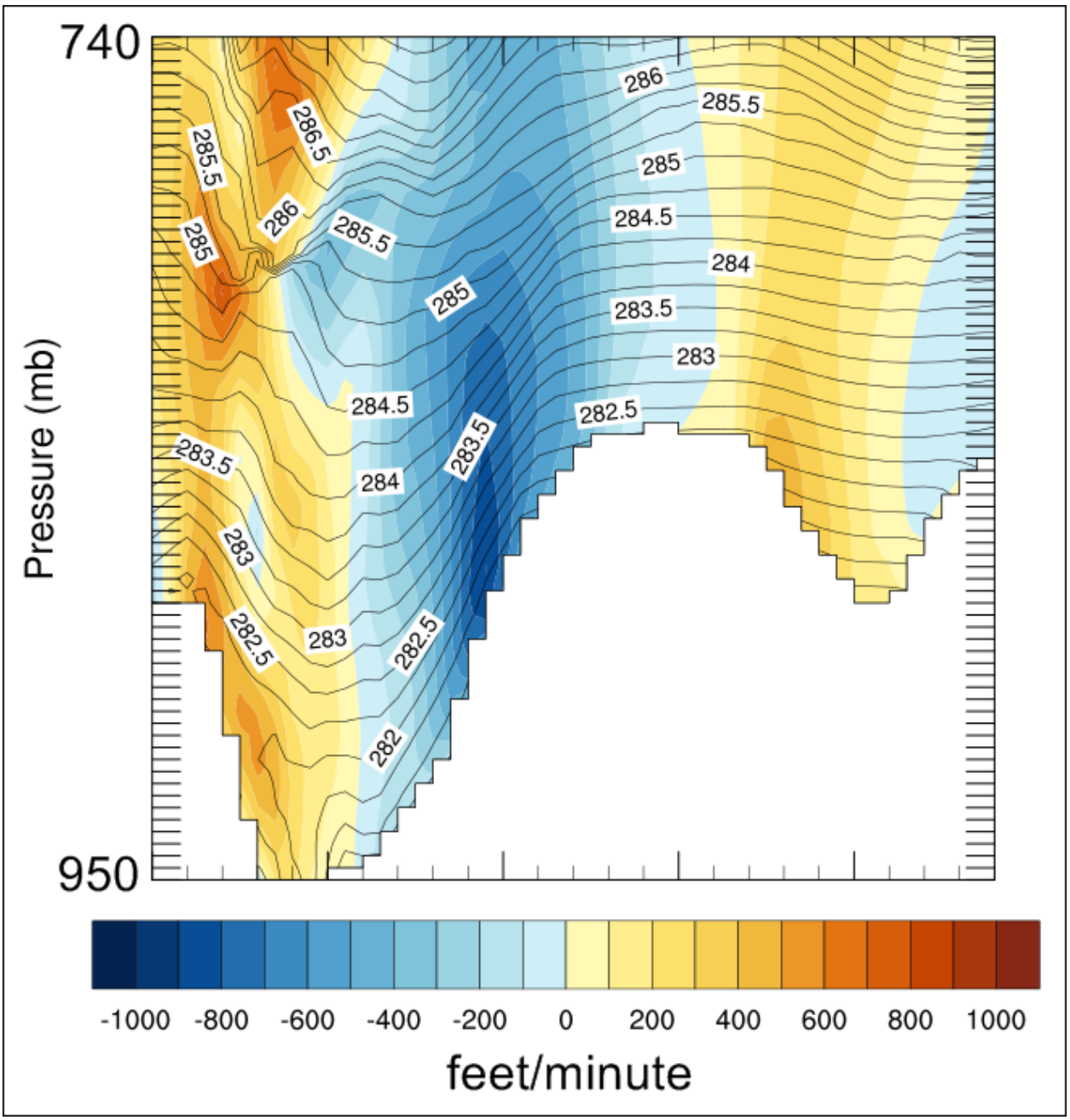

Figure 8 –WRF simulation of vertical velocities around the accident location (north-to-south cross-section along the longitude 135.20556°W). Black contours are lines of constant potential temperature (degrees Kelvin).

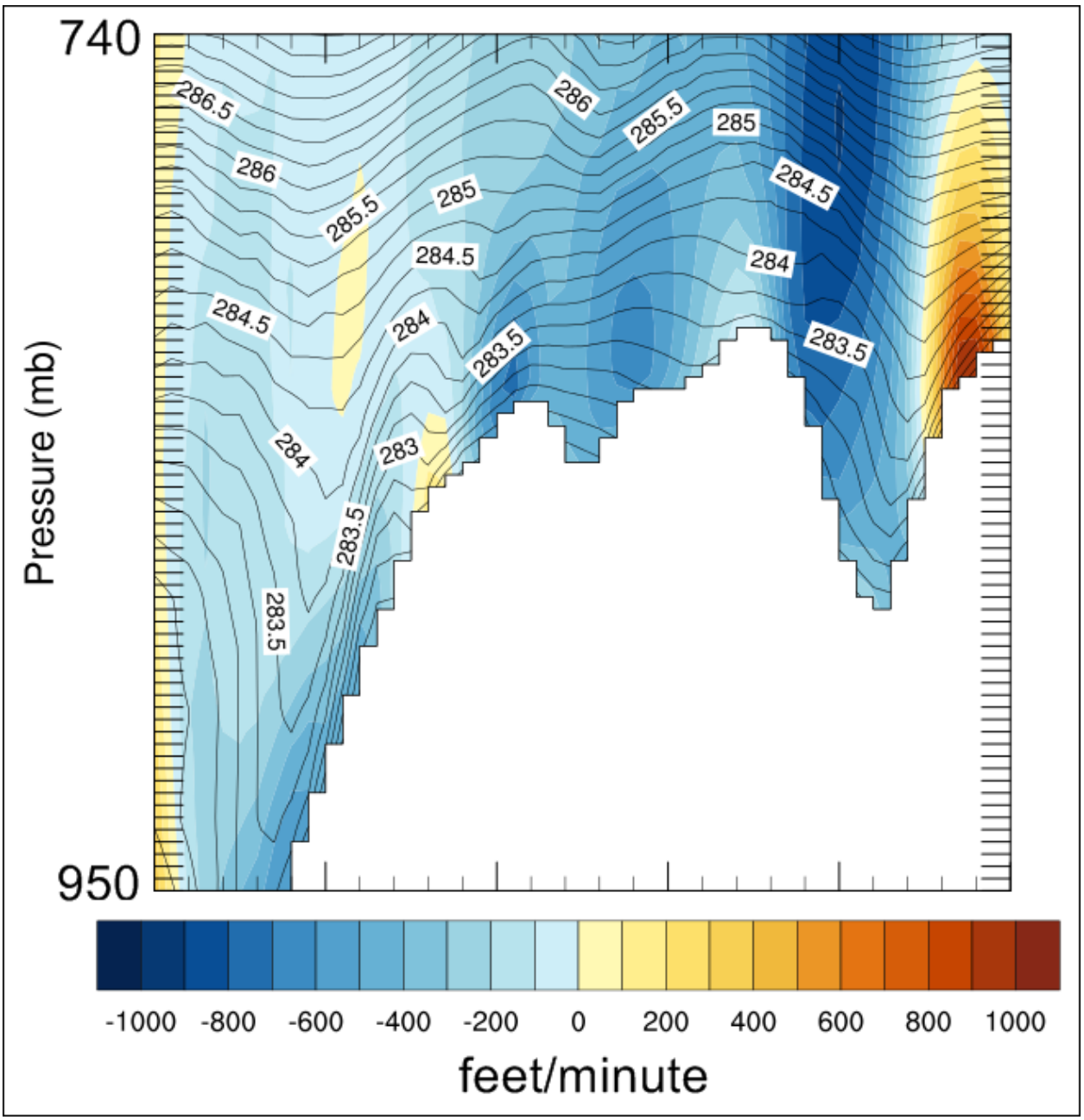

Figure 9 – WRF simulation of vertical velocities around the accident location (west-to-east cross-section along the latitude 59.450278°N). Black contours are lines of constant potential temperature (degrees Kelvin).

Satellite Imagery

Geostationary Operational Environmental Satellite (GOES)-15 visible (0.63µm) and infrared (10.7µm) data were obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison. Imagery from 1900 AKDT are presented in figures 10 and 11. The GOES-15 imagery identified cloudy conditions over the accident location, with minimum infrared cloud-top temperatures over the accident site retrieved as -12°C. When considering the WRF model sounding, -12°C corresponded to cloud top heights of near 9,500 feet. It should be noted these figures have not been corrected for any parallax error.

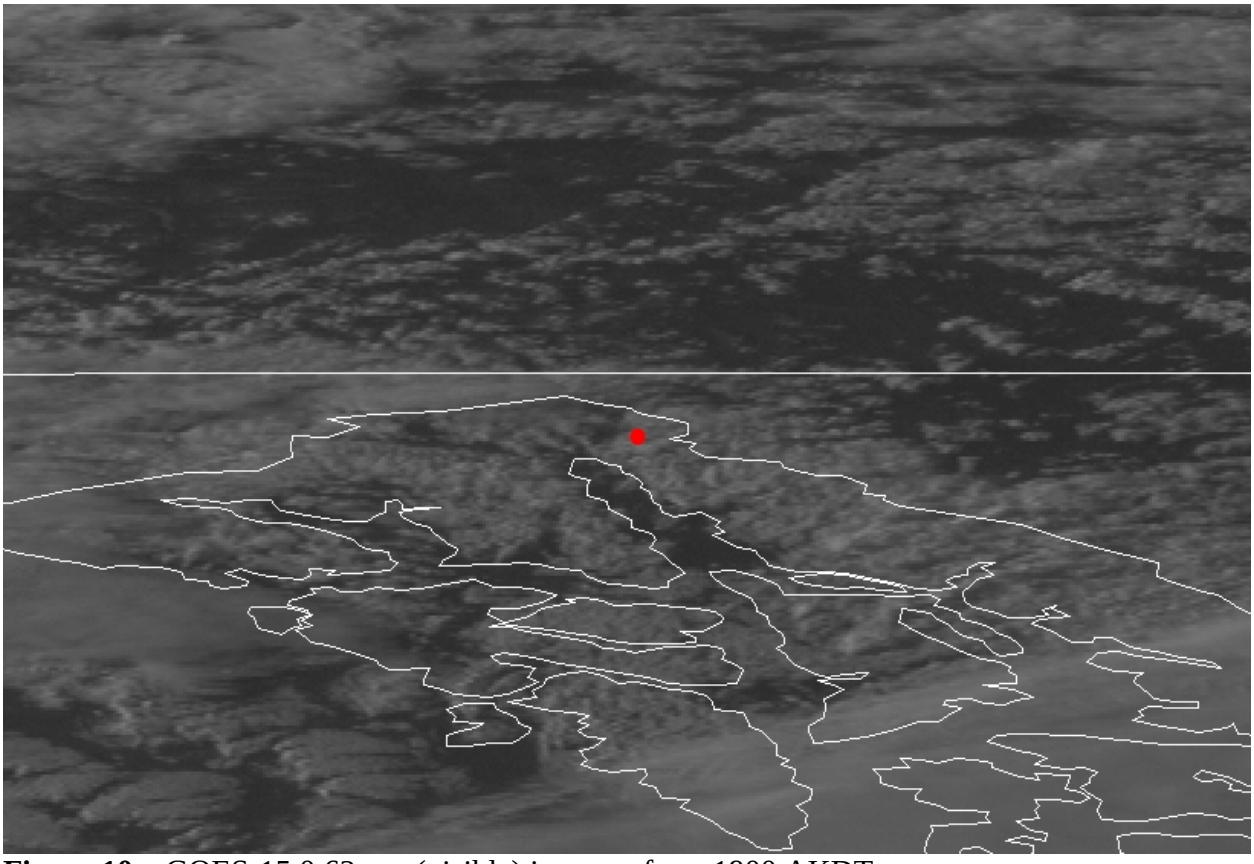

Figure 10 – GOES-15 0.62 µm (visible) imagery from 1900 AKDT.

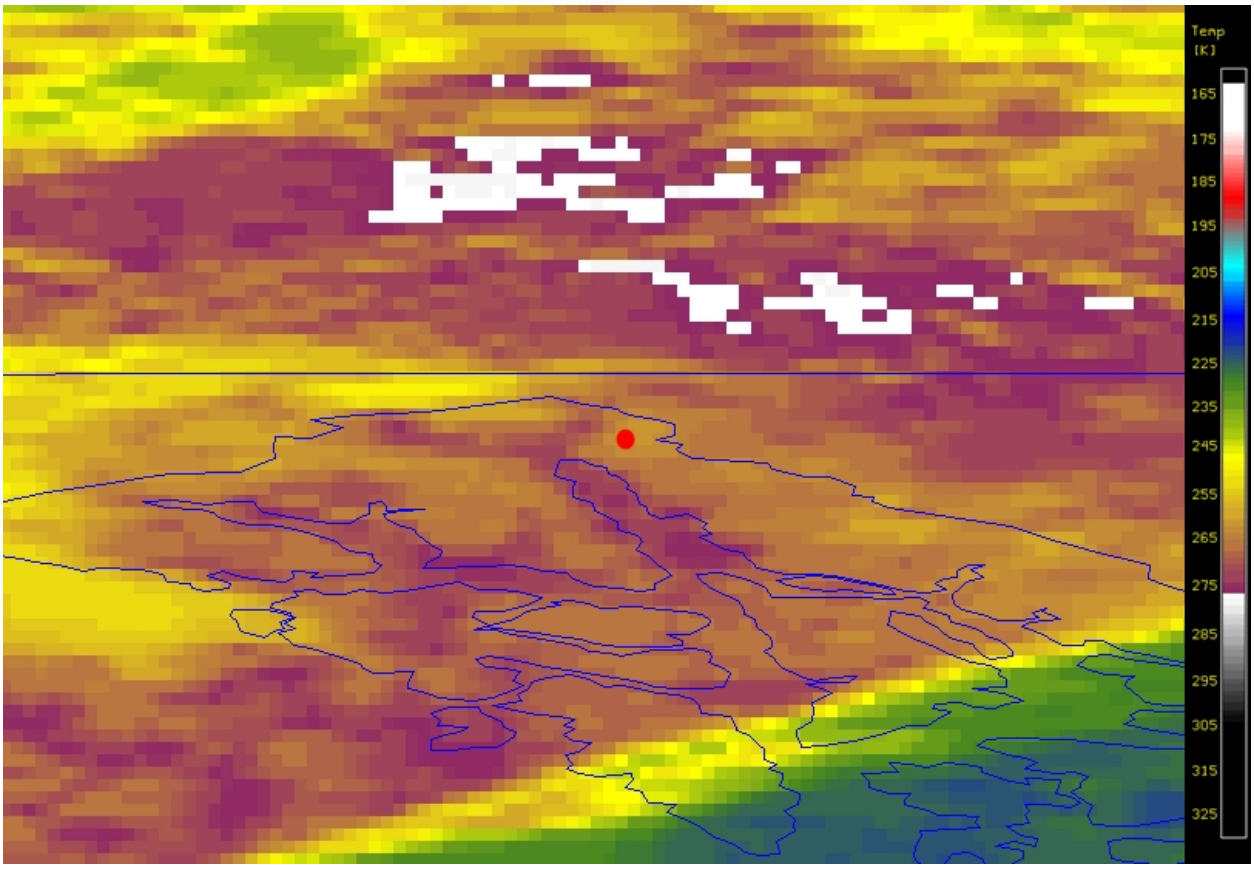

Figure 11 – GOES-15 10.7µm (infrared) color-enhanced imagery from 1900 AKDT.

Weather Cameras

Images from the Skagway and Haines FAA weather cameras were retrieved for times surrounding the accident time. The Skagway northeast-facing camera did not have a view in the direction of the accident location and captured imagery farther north. Figure 14 identifies cloudy conditions north of the accident location at about 1855 AKDT. The Haines north-facing camera did have a view in the direction of the accident location and between 1850 AKDT (figure 16) and 1900 AKDT (figure 17) identified cloudy conditions in that direction.

Figure 12 – Map of the FAA Haines and Skagway weather cameras. Accident location is denoted by red dot.

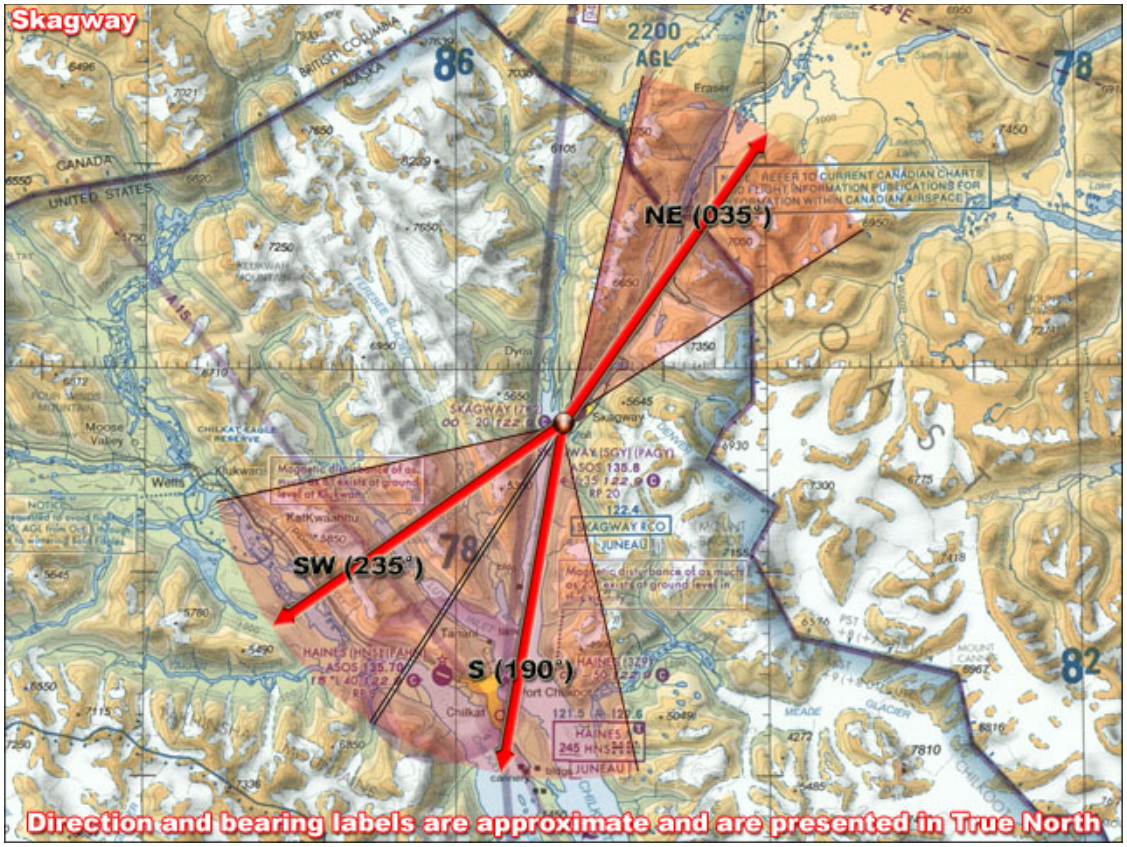

Figure 13 – Diagram depicting the view for the northeast-facing Skagway camera.

Figure 14 – Northeast-facing Skagway camera image at about 1855 AKDT.

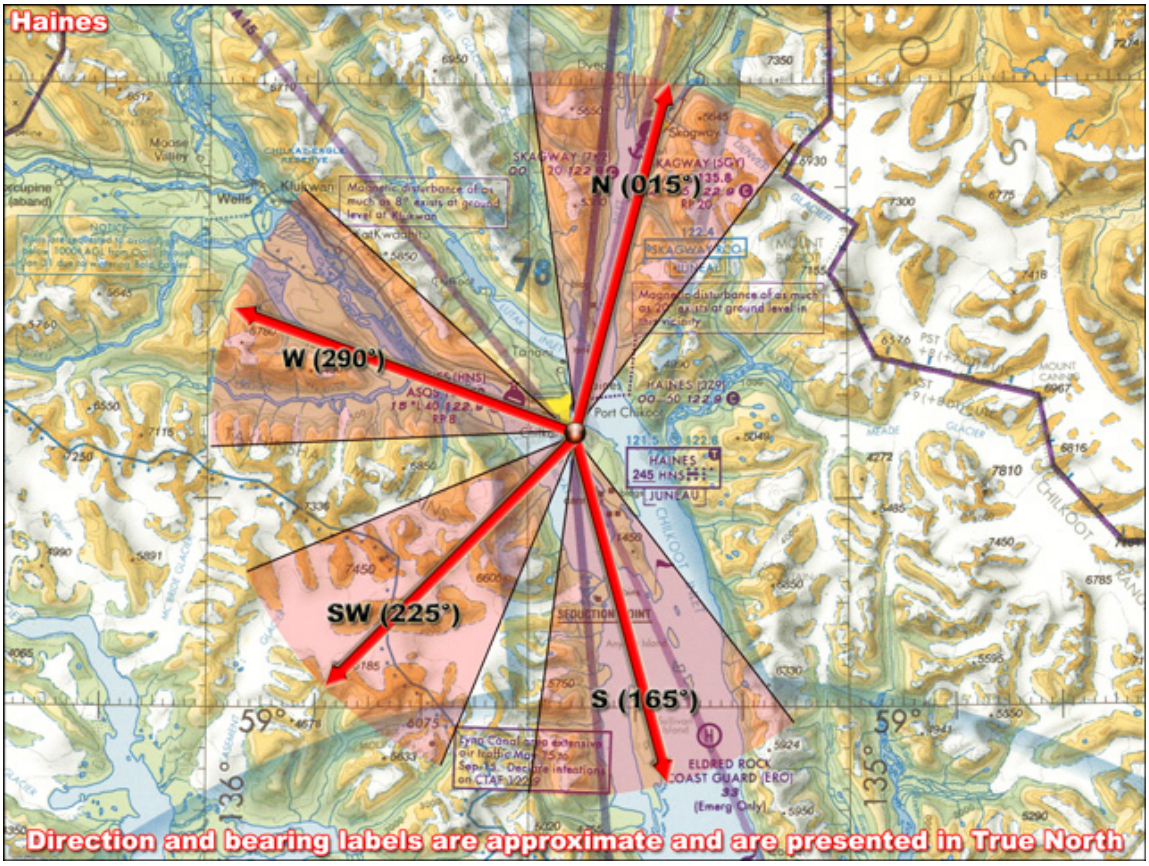

Figure 15 – Diagram depicting the view for the north-facing Haines camera.

Figure 16 – North-facing Haines camera image at about 1850 AKDT.

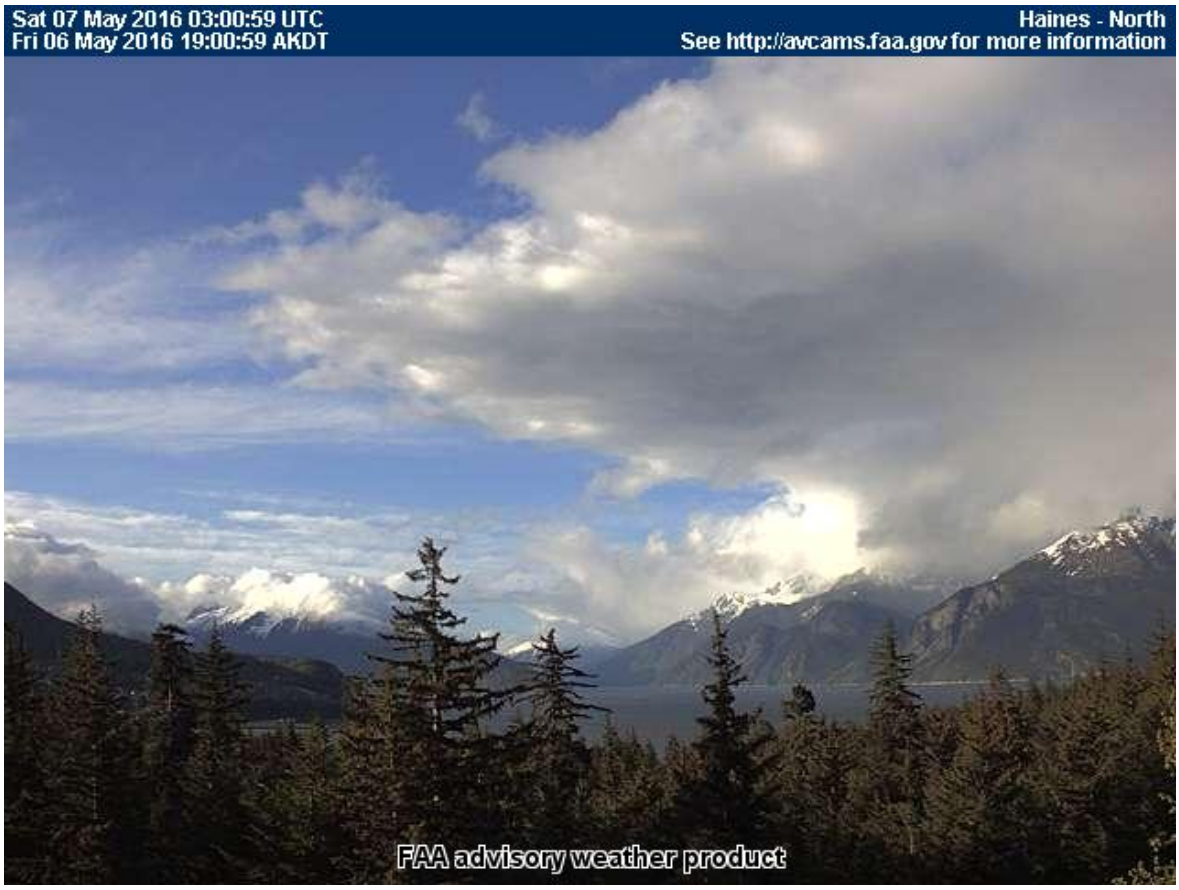

Figure 17 – North-facing Haines camera image at about 1900 AKDT.

AIRMETs

An Airmen's Meteorological Information (AIRMET) advisory for mountain obscuration was issued at 1204 AKDT and was active for the accident location at the accident time. AIRMETs for moderate turbulence below 6,000 feet and low level wind shear were issued in the same bulletin but were only valid until 1500 AKDT. There were no AIRMETs for icing active.

WAAK47 PAWU 062014
WA7O
JNUS WA 062015
AIRMET SIERRA FOR IFR AND MT OBSC VALID UNTIL 070415
.
LYNN CANAL AND GLACIER BAY JB
MTS OCNL OBSC IN CLDS/PCPN. NC.

=JNUT WA 062015
AIRMET TANGO FOR TURB/STG SFC WINDS VALID UNTIL 070415
.
LYNN CANAL AND GLACIER BAY JB
OCNL MOD TURB FL300-FL380. NC.

.
LYNN CANAL AND GLACIER BAY JB
TIL 23Z CST MTS OCNL MOD TURB BLW 060. WKN.
.
LYNN CANAL AND GLACIER BAY JB
TIL 23Z AREAS OF LLWS. WKN.

=JNUZ WA 062015
AIRMET ZULU FOR ICING VALID UNTIL 070415
.
NONE

SIGMETs

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

Zone Forecast

A Zone Forecast for the accident area was issued by the NWS Weather Forecast Office (WFO) in Juneau, Alaska, at 1539 AKDT and identified strong winds through the evening of the accident day.

FPAK57 PAJK 062339
ZFPAJK
ALASKA ZONE WEATHER FORECAST
NATIONAL WEATHER SERVICE JUNEAU ALASKA
400 PM AKDT FRI MAY 6 2016
CITY TEMPERATURES ARE FOR TONIGHT...SATURDAY...SATURDAY NIGHT...
AND SUNDAY.

AKZ018-071600-
TAIYA INLET AND KLONDIKE HIGHWAY-
INCLUDING...SKAGWAY
400 PM AKDT FRI MAY 6 2016
...STRONG WIND THROUGH THIS EVENING...
.TONIGHT...WINDY. RAIN EARLY IN THE EVENING... THEN SCATTERED SHOWERS. NEAR WHITE PASS...RAIN AND SNOW EARLY IN THE EVENING...THEN SCATTERED RAIN AND SNOW SHOWERS. LOWS AROUND 43. SOUTHWEST WIND 15 TO 25 MPH WITH GUSTS TO 45 MPH DECREASING TO 10 TO 15 MPH EARLY IN THE EVENING.

Area Forecast

An Area Forecast that included the forecast for the Lynn Canal and Glacier Bay area was issued by the Alaska Aviation Weather Unit at 1214 AKDT.

FAAK47 PAWU 062014
FA7H
JNUH FA 062015
EASTERN GULF COAST AND SE AK...
.
AIRMETS VALID UNTIL 070415
CB IMPLY POSSIBLE SEV OR GREATER TURB SEV ICE LLWS AND IFR CONDS.
NON MSL HEIGHTS NOTED BY AGL OR CIG.
.
SYNOPSIS VALID UNTIL 071400
994 MB LOW 120 NM SSE PAKH WILL MOV TO 150 NM SE PAMD WHILE WEAKENING TO 1003 MB BY 14Z. WEAKENING OCFNT JUST OFSHR SE AK WILL MOV INLAND AND DSIPT EARLY IN PD.
.
LYNN CANAL AND GLACIER BAY JB...VALID UNTIL 070800
...CLOUDS/WX...
*****AIRMET MT OBSC***MTS OCNL OBSC IN CLDS/PCPN. NC...**
SCT015 BKN-OVC025 TOP120 DCRG LYRS ABV TO FL200 -RA.
TIL 03Z OCNL BKN015 VIS 5SM -RA BR.
LYNN CANAL SFC WND S 20G30KT DMNSHG AND SHIFTING TO SW.
OTLK VALID 070800-071400...MVFR CIG SHRA.
PASSES...WHITE...CHILKOOT...IFR CIG RA/RASN.
...TURB...
*****AIRMET TURB***OCNL MOD TURB FL300-FL380. NC...**
*****AIRMET TURB***TIL 23Z CST MTS OCNL MOD TURB BLW 060. WKN...**
OTRW TIL 05Z ISOL MOD TURB BLW 060.
*****AIRMET LLWS***TIL 23Z AREAS OF LLWS. WKN...**
...ICE AND FZLVL...
TIL 23Z LYNN CANAL ISOL MOD ICEIC 070-170. FZLVL 040.

CWSU Products

There were no Center Weather Advisories or Meteorological Impact Statements issued by the Center Weather Service Unit (CWSU) at the Anchorage Air Route Traffic Control Center that were active within the accident region at the accident time.

Submitted by: Mike Richards
NTSB, AS-30