



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

April 21, 2020

Weather Study

METEOROLOGY

DCA20CA043

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A. ACCIDENT

Location: Disputanta, Virginia¹

Date: December 18, 2019

Time: 1110 eastern standard time (1610 UTC²)

Aircraft: Type - Embraer ERJ190; Registration - N959UW

B. METEOROLOGIST

Mike Richards

Senior Meteorologist

Operational Factors Division (AS-30)

National Transportation Safety Board

C. DETAILS OF THE INVESTIGATION

The NTSB Meteorologist traveled in support of this event to the Washington Air Route Traffic Control Center (ZDC) and also gathered data for this accident investigation remotely. Unless otherwise noted, all times are in eastern standard time (EST) for December 18, 2019 (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 in this report: 37.09833333° north latitude, 77.27500000° west longitude at FL180³.

D. WEATHER INFORMATION

1.0 Synoptic Conditions

An upper air map from the NWS Storm Prediction Center (SPC) at 0700 EST 500 hectopascals (hPa) depicted regional wind conditions for about FL180. The 500 hPa chart (figure 1) depicted a

¹ This location is often recorded as the nearest community with a US Post Office within the state where the accident/incident occurred. However, this location may not directly correlate to the coordinates of the accident site. Such situations include when the accident/incident occurred in a remote area, in international territories or aloft (where the aircraft landed safely at another location).

² UTC – abbreviation for Coordinated Universal Time

³ Flight Level - a standard nominal altitude of an aircraft, in hundreds of feet. This altitude is calculated from the International standard pressure datum of 1013.25 hectopascals (29.92 in Hg), the average sea-level pressure, and therefore is not necessarily the same as the aircraft's true altitude either above msl or above ground level (agl).

southwesterly wind of 115 knots to the northeast (downstream) of the accident location and a southwest wind of 95 knots southwest (upstream) of the accident location. To the west of the accident location over western Virginia the wind was depicted as southwesterly at 50 knots.

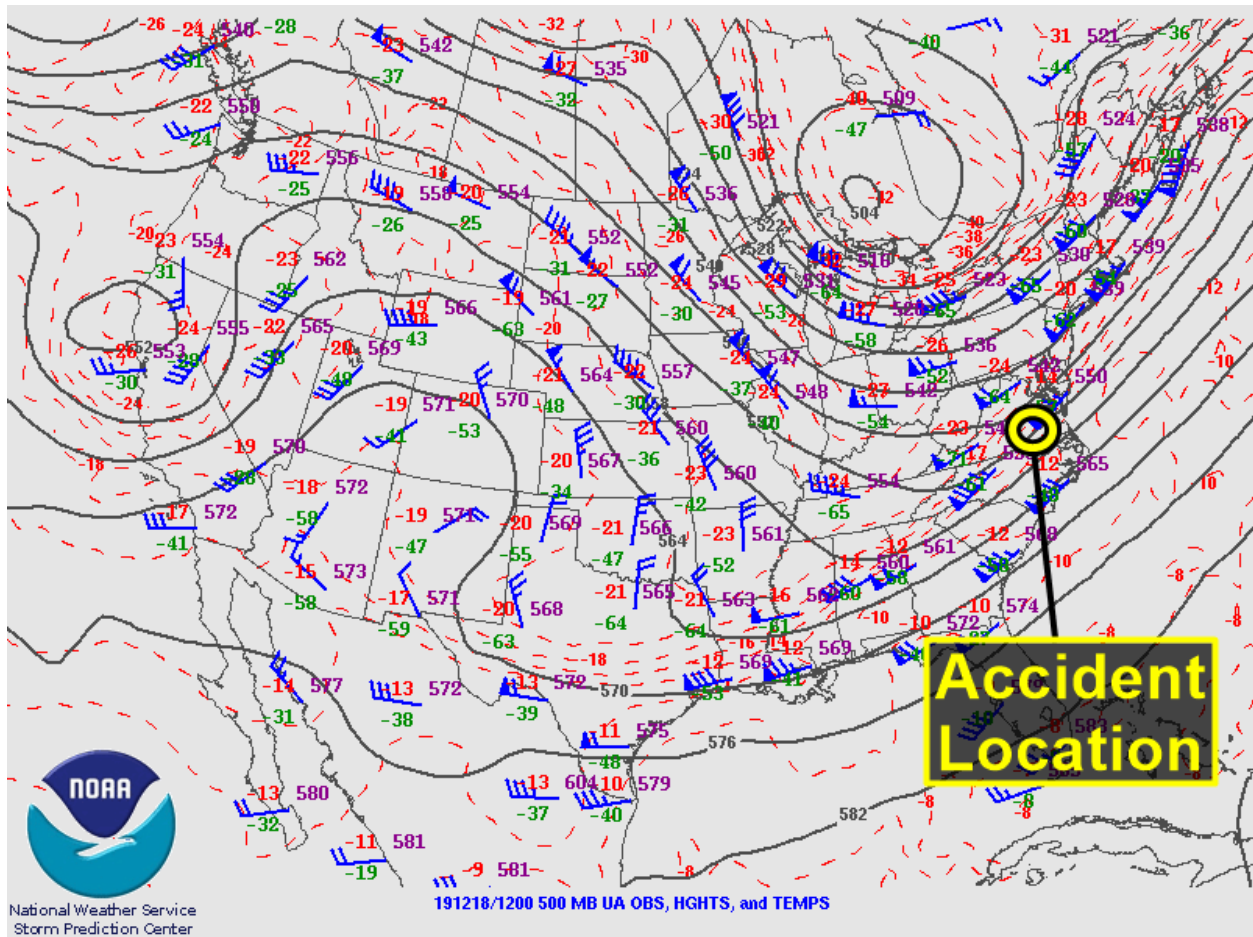


Figure 1 – SPC 500 hPa chart valid at 0700 EST.

A WSR-88D regional radar composite reflectivity mosaic obtained from the National Centers for Environmental Information (NCEI) for 1110 EST (figure 2) did not depict any meteorological targets within 50 miles of the accident location at the accident time.

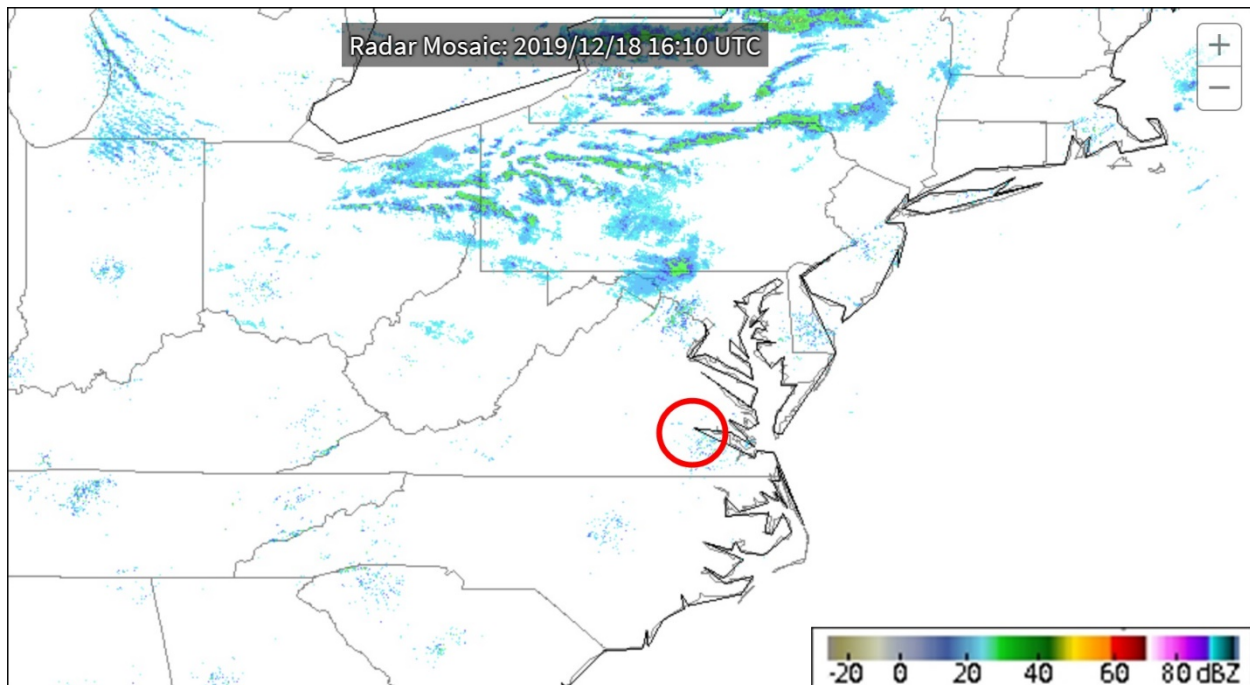


Figure 2 – NCEI WSR-88D mosaic from 1110 EST. Accident location is denoted by the red circle.

2.0 Upper Air Data

A High-Resolution Rapid Refresh (HRRR) model⁴ sounding (figure 3) for the accident site at 1100 EST was retrieved from the National Oceanic and Atmospheric Administration’s Air Resources Laboratory. At about 16,400 feet the wind was from 250° at 60 knots. Above this level the wind *backed*⁵ slightly to a wind from about 240° at 130 knots at 22,300 feet. Calculations made by the Rawinsonde OBservation Program indicated the potential for extreme turbulence conditions between about 18,500 feet and 20,400 feet.

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 A backing wind’s wind barbs turn counterclockwise with increasing height

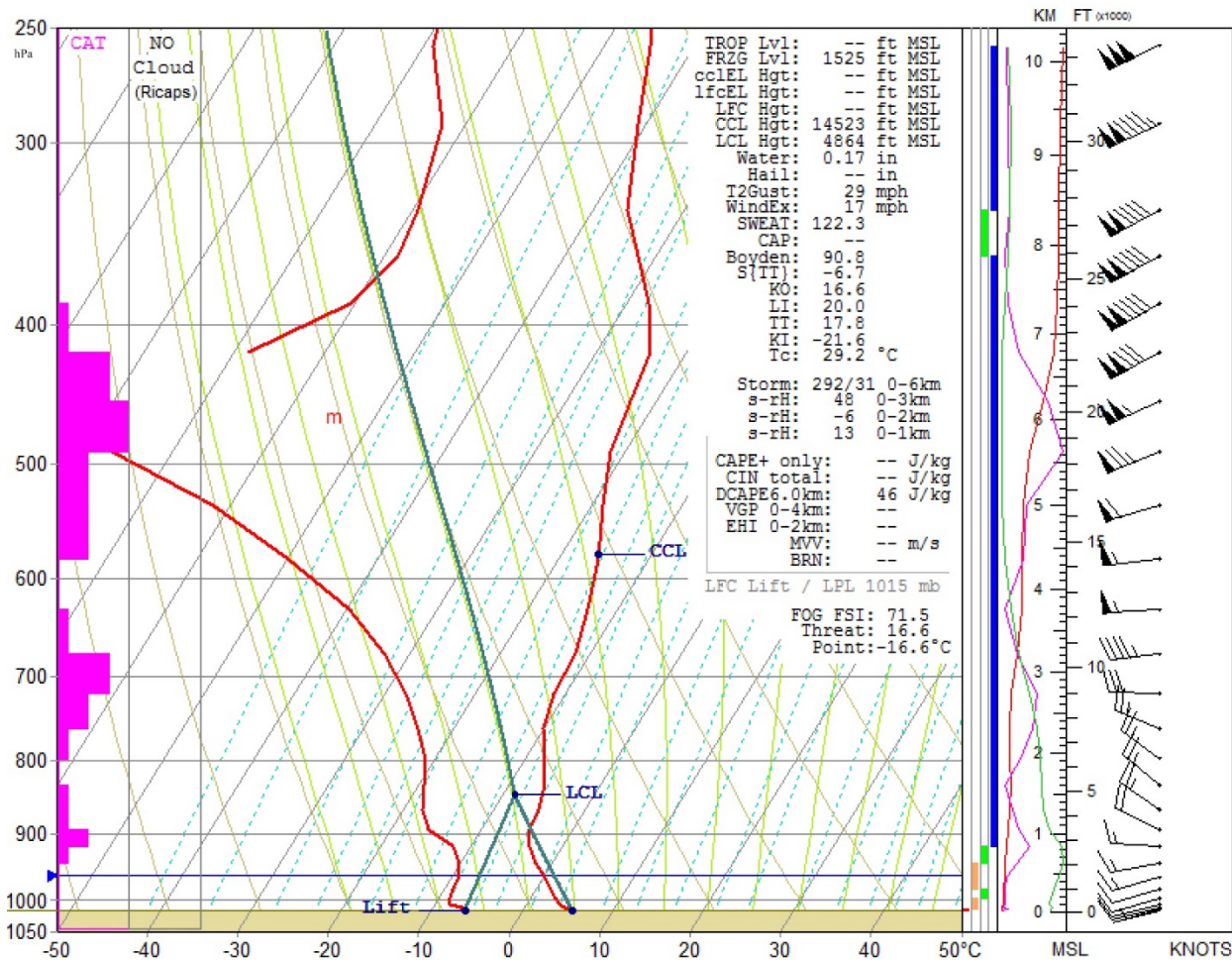


Figure 3 – HRRR model sounding data in SkewT/LogP format for 1100 EST at the accident site, surface to 250 hPa.

3.0 Satellite Imagery

Geostationary Operational Environmental Satellite (GOES)-16 visible ($0.64\mu\text{m}$) and low-level water vapor ($7.3\mu\text{m}$) data were obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison. Imagery from 1111 EST is presented in figures 4 and 5. The visible imagery depicted clear skies across the accident region at the accident time. The low-level water vapor imagery, which presents significant atmospheric contribution from below the altitude of the accident (the GOES-16 $7.3\mu\text{m}$ channel's weighting function peaks below 500hPa), identifies wave clouds over western and northwestern Virginia. However, applicable altitudes for

these clouds could not be determined using this and other images from additional GOES-16 water vapor-sensitive channels.

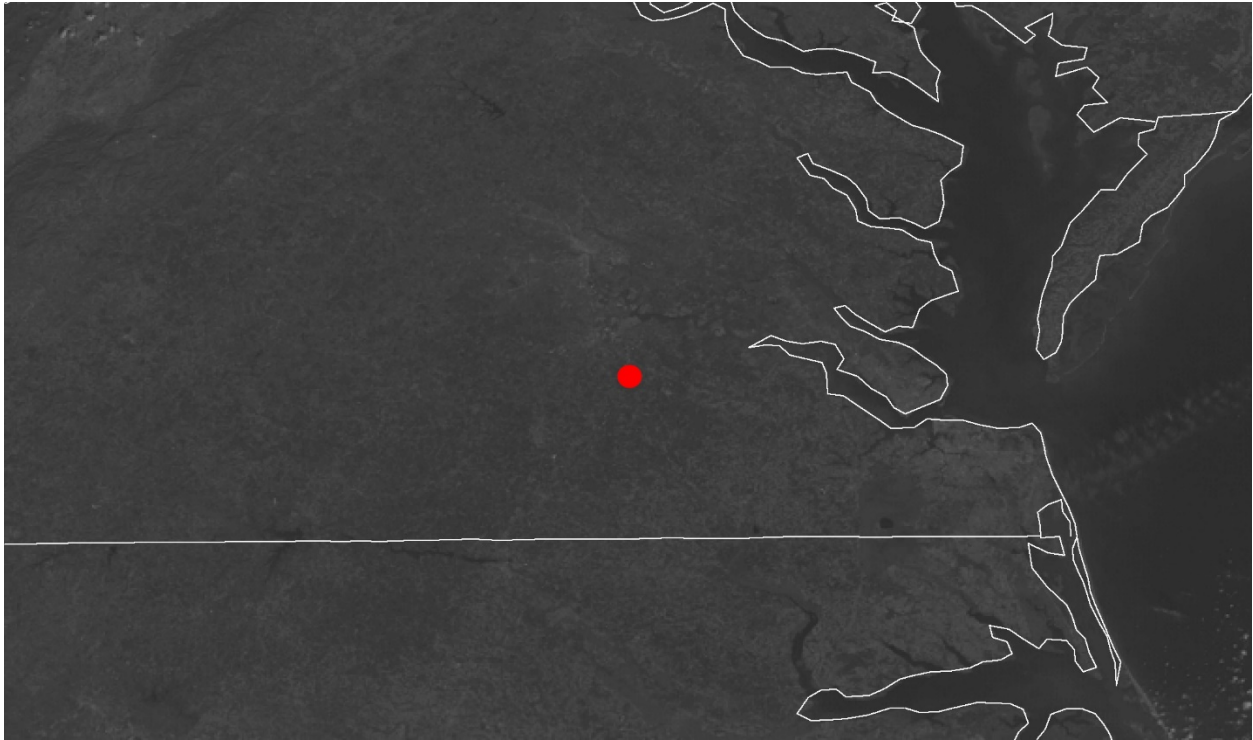


Figure 4 – GOES-16 visible imagery from 1111 EST. Accident location denoted by the red circle.

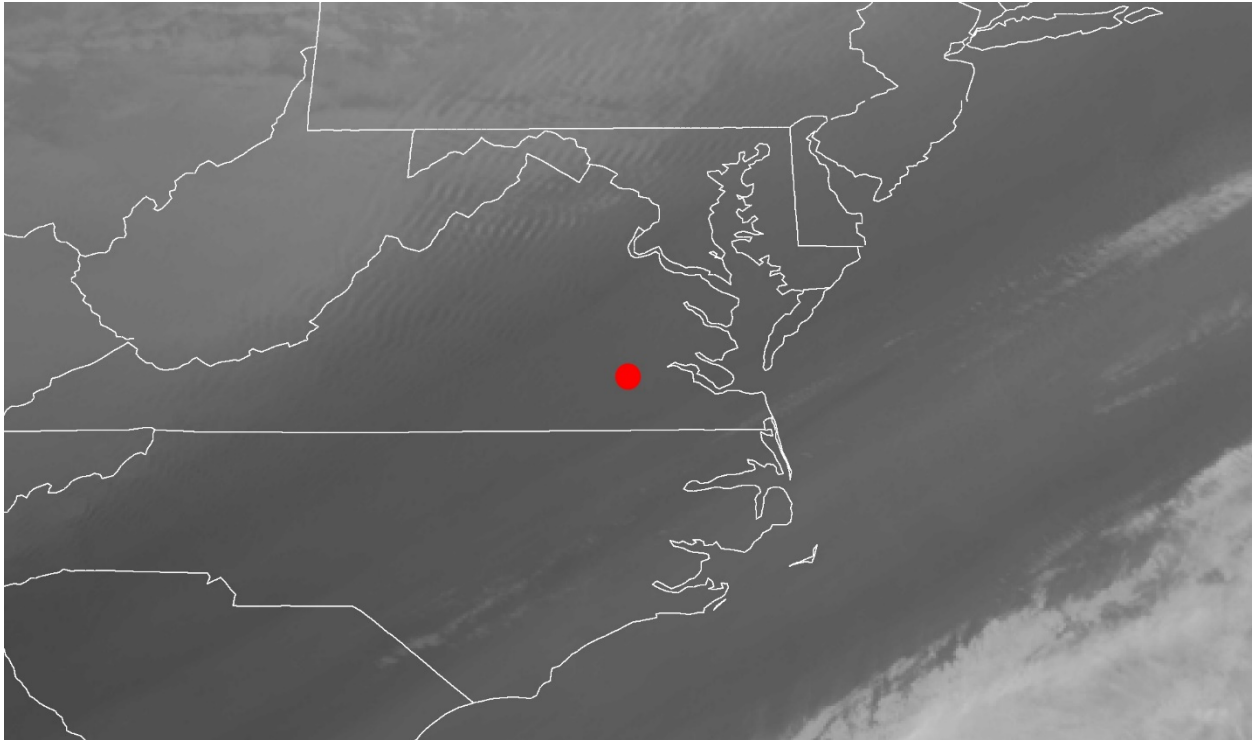


Figure 5 – GOES-16 low-level water vapor grayscale imagery from 1111 EST. Accident location denoted by the red circle.

4.0 Pilot Reports

The following pilot reports (PIREPs) were made within 30 minutes and 50 miles of the accident location and publicly-disseminated to the Federal Aviation Administration's public database.⁶

At 1058 EST, a Boeing 737 aircraft at FL220 7 miles away on the 315° radial from Richmond International Airport (RIC) in Richmond, Virginia, reported moderate turbulence and remarked that they were "out of it at FL190."

RIC UA /OV RIC315007/TM 1558/FL220/TP B737/TB MOD/RM OUT OF IT AT 190

At 1058 EST, an Airbus 321 aircraft at FL320 20 miles away on the 270° radial from Norfolk International Airport (ORF) Norfolk, Virginia, reported moderate chop.

ORF UA /OV ORF270020/TM 1627/FL320/TP A321/TB MOD CHOP

5.0 SIGMETs

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

6.0 CWSU Products

There were no Center Weather Advisories or Meteorological Impact Statements issued by the Center Weather Service Unit (CWSU) at ZDC that were active for the accident location at the accident time.

At about 0700 EST, the ZDC CWSU issued a weather briefing sheet (see Figure 6), which, regarding turbulence, advised of "AREAS MOD BLW FL430, PSBL SEV BLW 100 N ZDC; 150-FL300 MUCH OF ZDC" between 0700 and 1300 EST for all areas of ZDC.

The pre-duty video weather briefing issued by the ZDC CWSU at 0530 EST may be found in the docket for this accident. It should be noted that the first slide of the video presents the incorrect date (it indicates the video is valid for December 17, 2019, however, it is actually valid for the accident day).

⁶ These do not include PIREPs only broadcast via radio.
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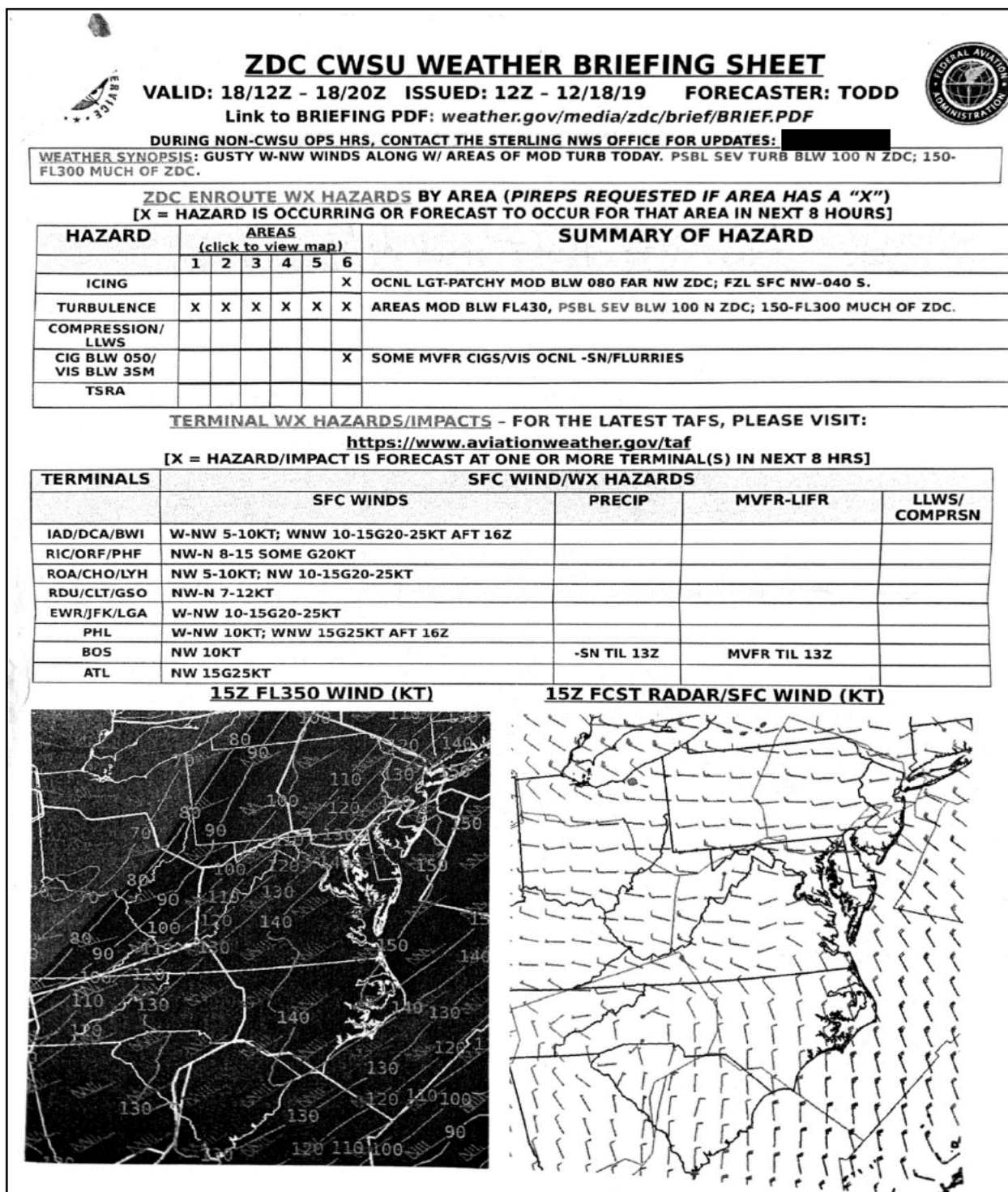


Figure 6 – ZDC CWSU weather briefing sheet issued at 0700 EST.

7.0 AIRMETs for Turbulence above FL180

An Airmen's Meteorological Information (AIRMET) Tango was active for moderate turbulence between FL180 and FL400 for a region that included the accident site.

WAUS41 KKCI 181445
WA1T
-BOST WA 181445
AIRMET TANGO UPDT 2 FOR TURB STG WNDS AND LLWS VALID UNTIL 182100
.
AIRMET TURB...ME NH VT MA RI CT NY LO NJ PA OH LE WV MD DC DE VA
AND CSTL WTRS
FROM 70NW PQI TO 60NE PQI TO 200SE ACK TO 160SE SIE TO 20NE ECG TO
HNV TO HNN TO BUF TO 20ESE YYZ TO 40NNW SYR TO MSS TO 40SE YSC TO
70NW PQI
MOD TURB BTN FL180 AND FL400. CONDS CONTG BYD 21Z THRU 03Z.

8.0 GTG

The Graphical Turbulence Guidance (GTG) turbulence product is generated operationally at the National Centers for Environmental Prediction and published for public use on the Aviation Weather Center's (AWC) website.⁷ The GTG yields computer-generated four-dimensional forecasts of information related to the expected intensity of clear-air or mountain wave turbulence. It is not intended to predict turbulence associated with convection and thunderstorm clouds but may provide some guidance in areas of properly predicted thunderstorms when the convection is widespread. Figure 7 presents the GTG clear-air turbulence analysis imagery for 1100 EST for FL180 using the eddy dissipation rate (EDR) scale applicable to "medium" aircraft.

The Graphical Turbulence Guidance Nowcast (GTGN) turbulence product is a rapidly updating nowcast (every 15 minutes) that provides a current snapshot of three-dimensional turbulence conditions of the continental United States.⁸ It blends in recent turbulence observations from sources including PIREPs, insitu EDR reports and the Nexrad Turbulence Detection Algorithm (NTDA). Attachment 1 presents GTGN data applicable to the accident time. It should be noted that there were no radar-detected clouds between 1100 and 1200 EST over Virginia and North Carolina (and thus no NTDA in-cloud turbulence).

⁷ <https://www.aviationweather.gov/adds/>

⁸ For further information, see: <https://ral.ucar.edu/projects/graphical-turbulence-guidance-nowcast-gtgn>

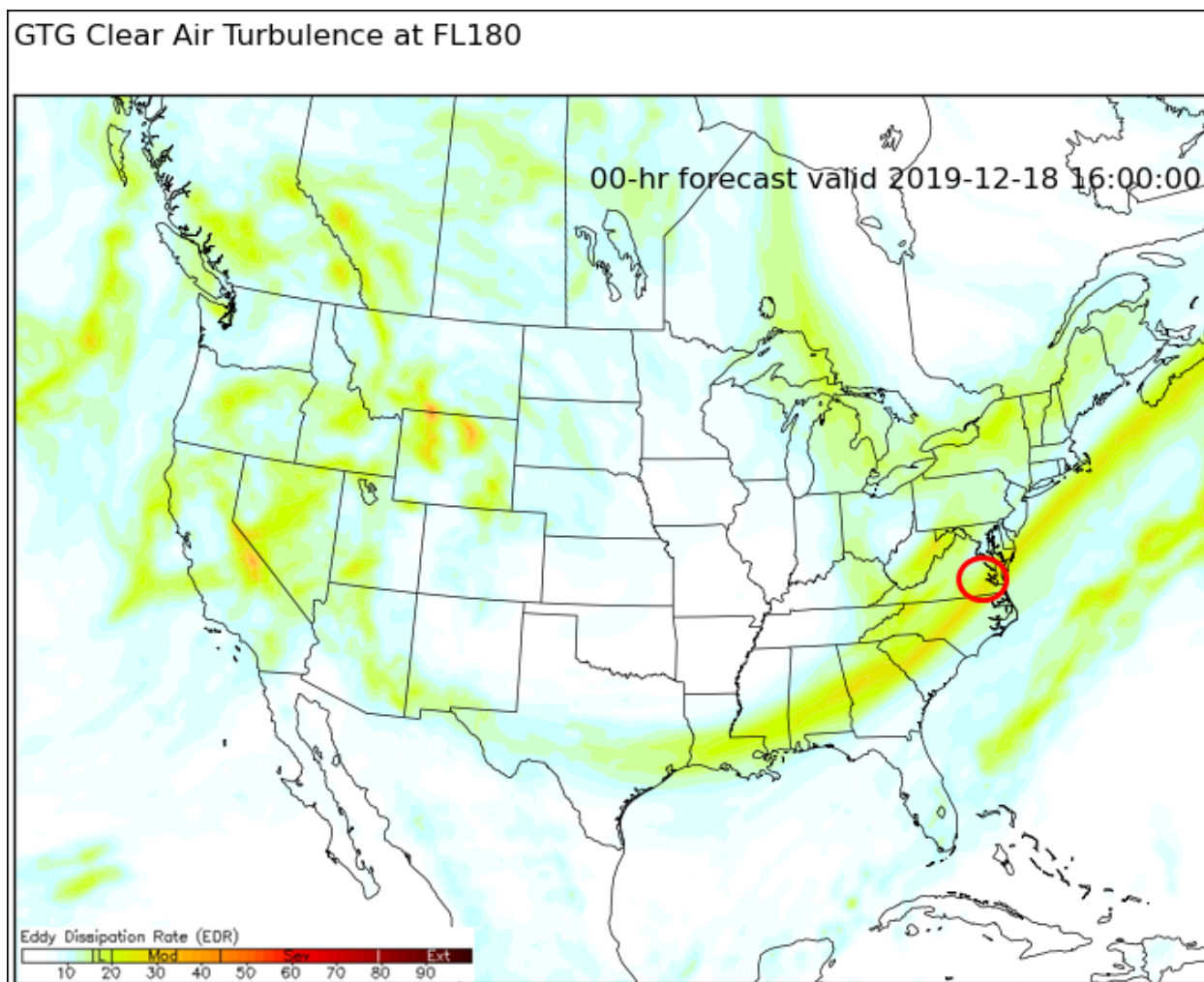


Figure 7 – GTG clear air turbulence 0-hour forecast imagery valid for FL180 feet at 1100 EST. EDR color scale is for a “medium” aircraft.

E. LIST OF ATTACHMENTS

Attachment 1 – Graphical Turbulence Guidance Nowcast data applicable to the accident site.

Submitted by:

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