

Data Requested

Synoptic conditions - The NWS Surface Analysis Chart for 1800 CST (0000Z on November 29, 2021) is included as figure 1 with the approximate accident site marked by a red star. The chart depicted a high pressure system at 1023-hectopascals immediately east of the accident site over Oklahoma with a ridge of high pressure extending northeast and southwest over the region with a weak pressure gradient. The station models surrounding the accident site depicted calm to light southerly winds of 5 knots or less, clear skies, with temperatures in the upper 40's degrees Fahrenheit (F), with dew point temperatures in the 30's °F. No significant weather was depicted over the state.

A review of the NWS Composite Radar Mosaic for the period indicated no significant meteorological echoes over Oklahoma at the time of the accident.

Observations - Perry Municipal Airport (F22), Perry, Oklahoma (OK), at an elevation of 1002 ft, did not have any weather reporting capability other than a lighted wind indicator. The approximate magnetic variation over the area was 3.5° east. The closest weather reporting station was from Stillwater Regional Airport (KSWO), Stillwater, OK, located 16 miles southwest of F22 at an elevation of 1,000 ft. The airport had an Automated Surface Observation System (ASOS) which was augmented by air traffic control personnel during normal operating hours. The following conditions were reported at the approximate time of the accident.

Routine weather observation for KSWO at 1653 CST, wind calm, visibility 10 statute miles or more, sky clear below 12,000 ft agl, temperature 14° Celsius (C) (57° F), dew point temperature -1° C (30° F), altimeter setting 30.21 inches of mercury. Remarks: automated station with a precipitation discriminator, sea-level pressure 1022.7-hPa, temperature 14.4° C, dew point -1.1° C.

The general flight conditions and raw METAR observations surrounding the period were as follows.

VFR METAR KSWO 282053Z 02004KT 10SM CLR 17/M01 A3021 RMK AO2 SLP227 T01671011 56025=

VFR METAR KSWO 282153Z VRB03KT 10SM CLR 16/M01 A3020 RMK AO2 SLP225 T01611011=

VFR METAR KSWO 282253Z 00000KT 10SM CLR 14/M01 A3021 RMK AO2 SLP227 T01441011=

Accident 2258Z

VFR METAR KSWO 282353Z 00000KT 10SM CLR 11/M01 A3020 RMK AO2 SLP225 T01111006 10167 20106 58004=

VFR METAR KSWO 290053Z 00000KT 10SM CLR 06/00 A3019 RMK AO2 SLP225 T00610000=

VFR METAR KSWO 290153Z 00000KT 10SM CLR 07/00 A3020 RMK AO2 SLP228 T00670000=

The NWS Aviation Weather Center's Helicopter (HEMS) METAR display for 1700 CST is included as figure 2 depicting the general flight conditions and weather over Oklahoma at the time of the accident.

Sounding - A High-Resolution Rapid Refresh (HRRR) numerical model over Perry Municipal Airport (F22) coordinates as obtained from the NOAA Air Resource Laboratory. The HRRR model data was then plotted on a standard skew T log P diagram using the RAOB Analysis software for 2300 CST and is included as figure 3. The HRRR 1700 CST sounding depicted an elevation of 978 ft over the grid point, with a near surface temperature of 12.2°C (54° F), with a dew point temperature of -1.1°C (30° F), a relative humidity of 40%, with a density altitude of 670 ft. A shallow isothermal layer was identified between 3,000 and 4,000 ft where temperature remained nearly constant with height, before decreasing again. The freezing level was identified at 9,270 ft msl (blue line across sounding). The lifted condensation level was identified at approximately 5,490 ft agl, with the convective condensation level at 17,230 ft agl. The RAOB Analysis program indicated conditions too dry for cloud

formation or any structural icing conditions. The precipitable water content of 0.42 inches.

The HRRR wind profile indicated light and variable surface wind at 3 knots with winds from the south through 3,000 ft before abruptly shifting to the northwest with wind speeds increasing above 6,000 ft to over 10 knots. The mean 0 to 6 kilometer (or 18,000 ft) wind was from 315° at 25 knots. The RAOB Analysis program supported moderate turbulence between 3,000 through 4,500 ft, with no significant turbulence or low-level wind shear (LLWS) below 2,000 ft agl.

A table of the HRRR parameters of height, pressure, temperature (T), dew point temperature (Td), relative humidity (RH), wind, and potential Clear Air Turbulence (CAT), Low-Level Wind Shear (LLWS), icing, and mountain wave activity below 8,000 ft is included below.

Height (ft-msl)	Pres (hPa)	T (C)	Td (C)	RH (%)	Wind (deg/kts)	CAT (FAA)	LLWS (FAA)	Icing (AFGWS)
0	986	12.2	-1.1	40	206/ 3			
28	985	13.4	-0.2	39	209/ 3			
84	983	13.2	-0.1	40	209/ 3			
225	978	12.8	-0.2	41	207/ 3			
508	968	12.0	-0.4	42	202/ 3			
907	954	10.8	-0.7	45	199/ 3			
1398	937	9.5	-2.1	44	191/ 3			
2014	916	8.7	-8.4	29	194/ 4			
2703	893	8.5	-12.1	22	214/ 2	LGT		
3440	869	7.7	-11.1	25	308/ 4	MDT		
4323	841	6.4	-7.1	37	311/ 12	MDT		
5331	810	4.9	-6.8	42	299/ 20	LGT		
6441	777	3.1	-8.4	43	301/ 25	LGT		
7661	742	0.8	-8.0	52	305/ 29	LGT		
9080	703	-1.0	-10.6	48	312/ 32			

Satellite Imagery - The Geostationary Operational Environmental Satellite number 16 (GOES-16) data were obtained from an archive at the Space Science Engineering Center (SSEC) at the University of Wisconsin-Madison in Madison, Wisconsin, and processed using the Man-computer Interactive Data Access System (McIDAS) software. The GOES-16 visible image at 1628 CST was retrieved with sufficient light from the setting sun and is included as figure . The image depicted some high cirriform clouds moving southward over the region. No low-level clouds or cumulonimbus clouds were identified to cause any low-level outflow winds over the regions during the period. The bright white area over northwest Oklahoma was associated with the Great Salt Plains Reservation, and not any meteorological feature.

Pilot Reports - a search of pilot reports or PIREPs between 1400 through 2000 CST below 18,000 ft within 120 miles of the accident site provided a single report. While several high altitude turbulence reports of light-to-moderate turbulence between 33,000 and 35,000 ft were noted.

MLC UA /OV MLC315021 /TM 2053 /FL062 /TP BE24 /SK SKC /WX FV10SM /TA 06 /WV 35538KT /TB NEG /IC NEG

NWS Forecasts - The NWS Norman (KOUN), OK Weather Forecast Office (WFO) was responsible for weather forecasts and warnings for the area over the accident site. In addition, the NWS Aviation Weather Center's (AWC) and Weather Prediction Center (WPC) issued the graphic aviation products.

Terminal Aerodrome Forecast (TAF) - issued for KSWO at 1124 CST and valid at the time of the accident was as follows.

*TAF KSWO 281724Z 2818/2918 VRB03KT P6SM SKC
FM290000 19004KT P6SM SKC=*

Area Forecast Discussion (AFD) issued by the NWS Norman office was as follows:

FXUS64 KOUN 281838

AFDOWN

Area Forecast Discussion
National Weather Service Norman OK
1238 PM CST Sun Nov 28 2021

...New LONG TERM...

.SHORT TERM...
(This evening through Monday)
Issued at 1201 PM CST Sun Nov 28 2021

Today's cooldown (that only brought us to near average temperatures) will be brief as we begin a stretch of unseasonably warm temperatures. An appreciable warmup is expected on Monday as a downslope-warmed air mass advects into the Southern Plains with rising mid-level heights. North (to occasionally variable) winds will shift to the south/south-southwest by this evening (northwest Oklahoma already shifted to the south-southwest) as a surface ridge moves to the east--providing a pattern favorable for the advection of the downsloped air mass.

850 mb temperatures are progged to range from 14 to 17 deg C (+2 to 2.5 sigma with respect to standardized anomaly) with abundant sunshine. High temperatures are generally expected to be in the 70s deg F, which is around 15 to 20 deg F above average for late November. Given the anomalously warm 850 mb temperatures, opted to trend higher than deterministic NBM (i.e., 75th percentile) for high temperatures (closer to MOS consensus).

Mahale

.AVIATION...
(18Z TAFS)
Issued at 1130 AM CST Sun Nov 28 2021

Unrestricted ceilings and visibilities are expected to continue.

North to occasionally variable winds will shift to the south /south-southwest by this evening (KWWR has already shifted to the south-southwest). Winds are expected veer to the west across the western terminals (KCSM/KWWR) toward the end of TAF period.

Mahale

.OUN WATCHES/WARNINGS/ADVISORIES...
OK...None.
TX...None.

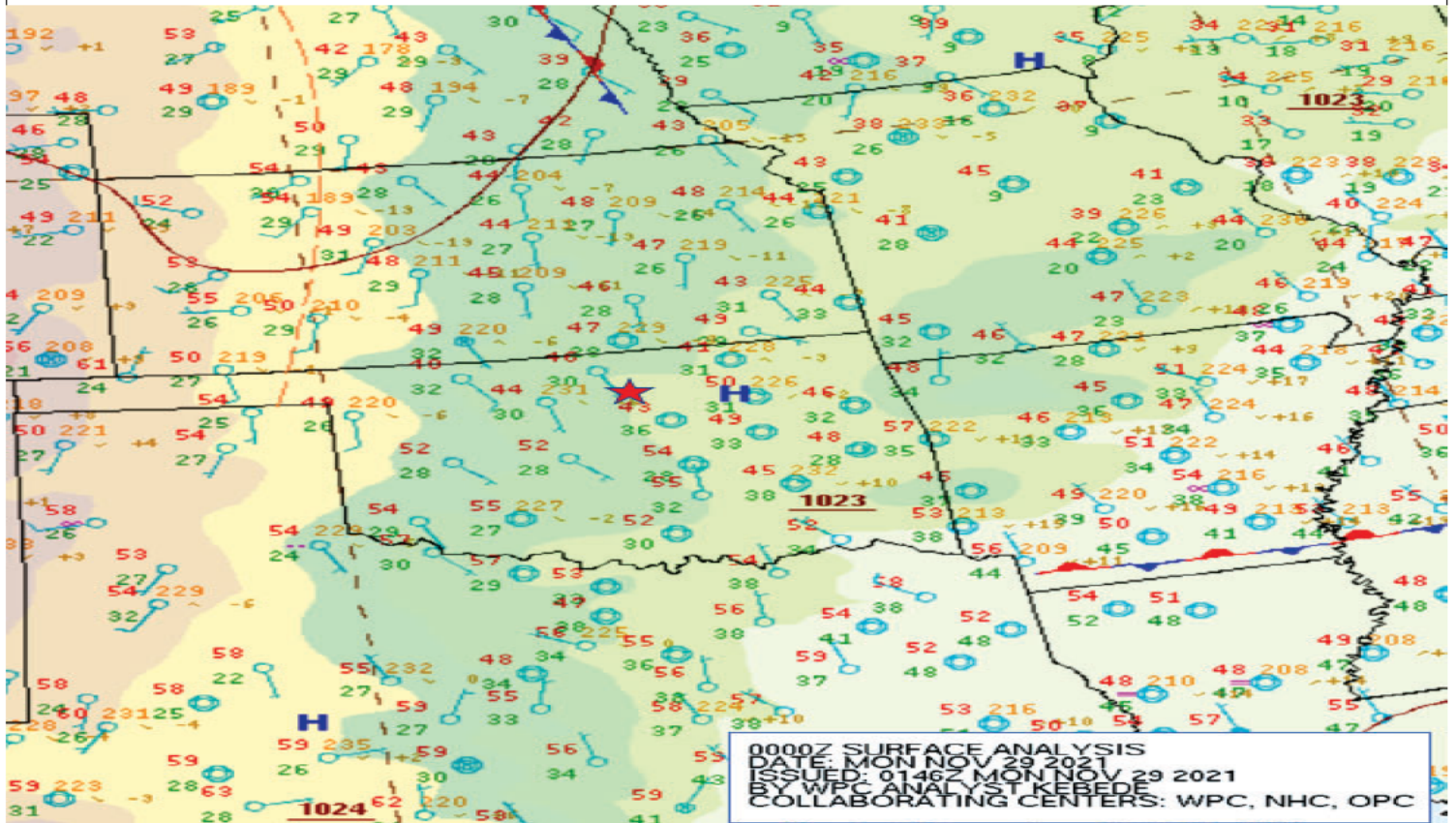
NWS Inflight Weather advisories - The NWS Aviation Weather Center had no SIGMETs, Convective SIGMETs, AIRMETs current over Oklahoma during the period, and the NWS Fort Worth (KZFW) and the Kansas City (Center Weather Service Unit (CWSU) had no Center Weather Advisories (CWA) or Meteorological Impact Statements (MIS) issued for the period for any hazardous weather impacting their airspace.

Astronomical Conditions - the United States Naval Observatory astronomical conditions over Perry, OK indicated the following conditions. The time of the accident has been included for reference in bold italic type.

Sun	Time
Begin civil twilight	0651 CST
Sunrise	0719 CST
Culminative	1217 CST
<i>Accident</i>	<i>1658 CST</i>
Sunset	1715 CST
End civil twilight	1742 CST

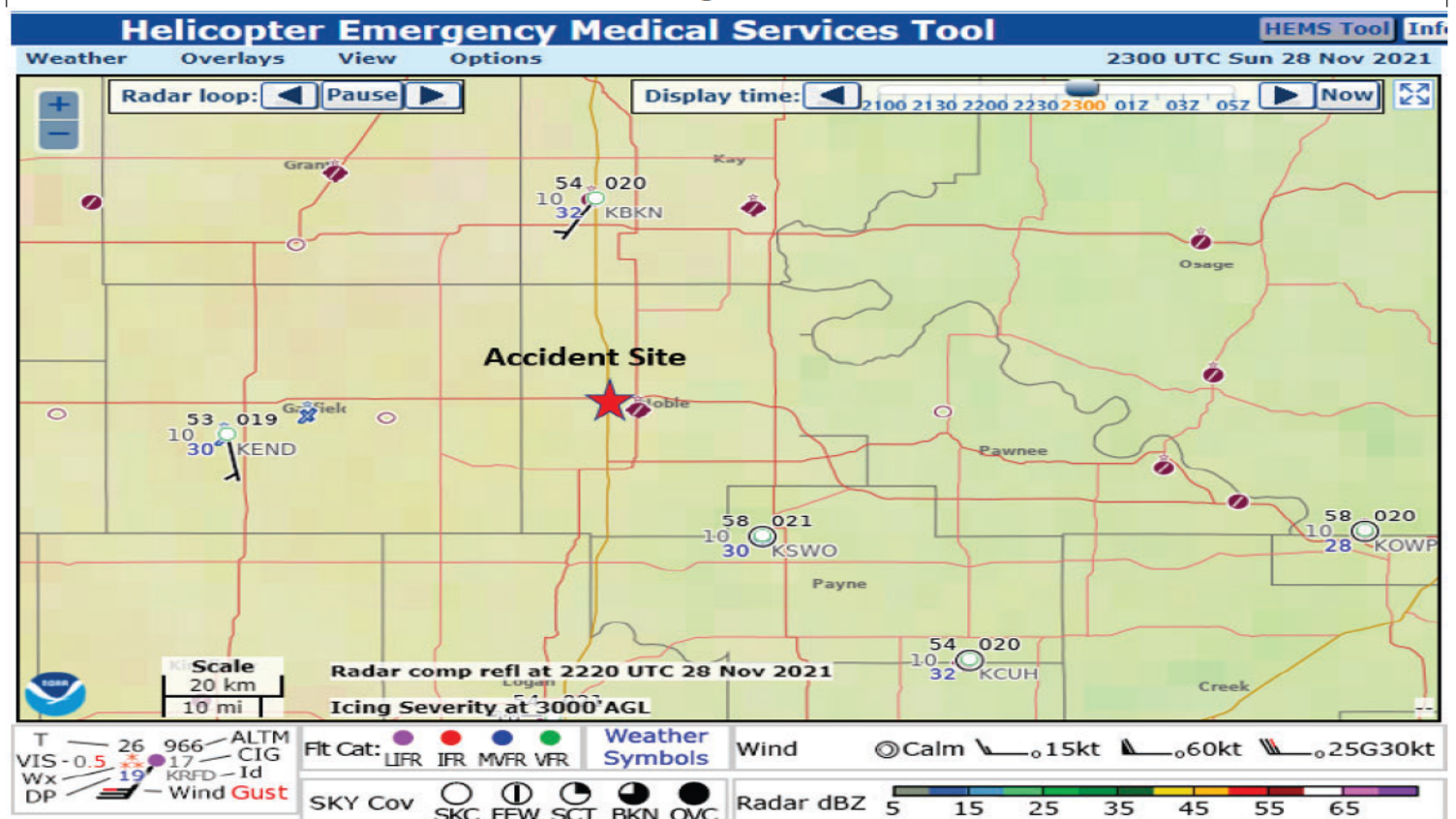
At the approximate time of the accident, the sun was 2.4° above the horizon at an azimuth of 241°.

Figure 1



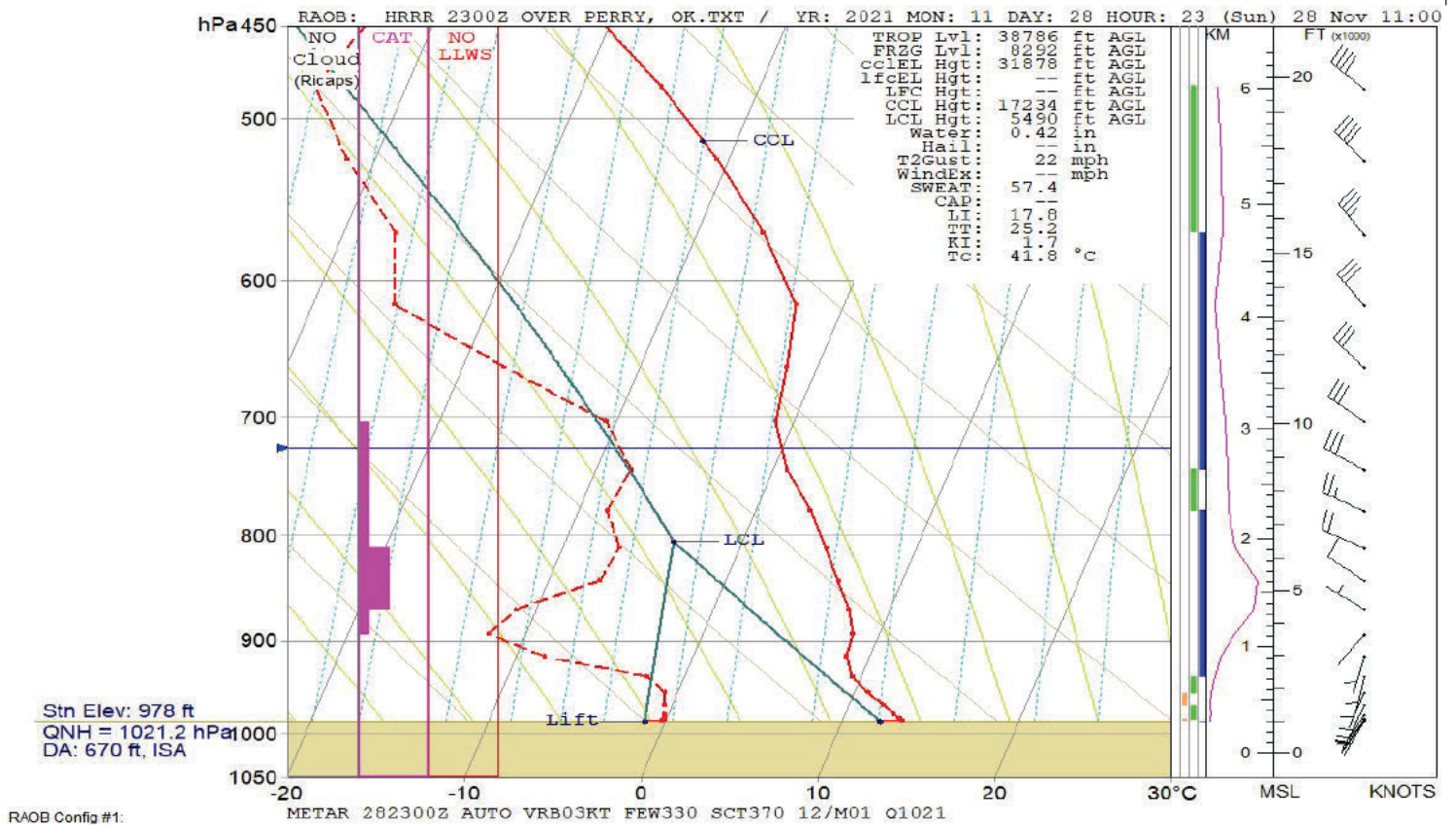
Caption NWS Surface Analysis for 1800 CST (0000Z November 29, 2021) with the approximate accident site marked by the red star.

Figure 2



Caption NWS Aviation Weather Center's Helicopter Emergency Medical Services (HEMS) Weather Tool display of conditions at 1700 CST with the approximate accident sit marked by red star.

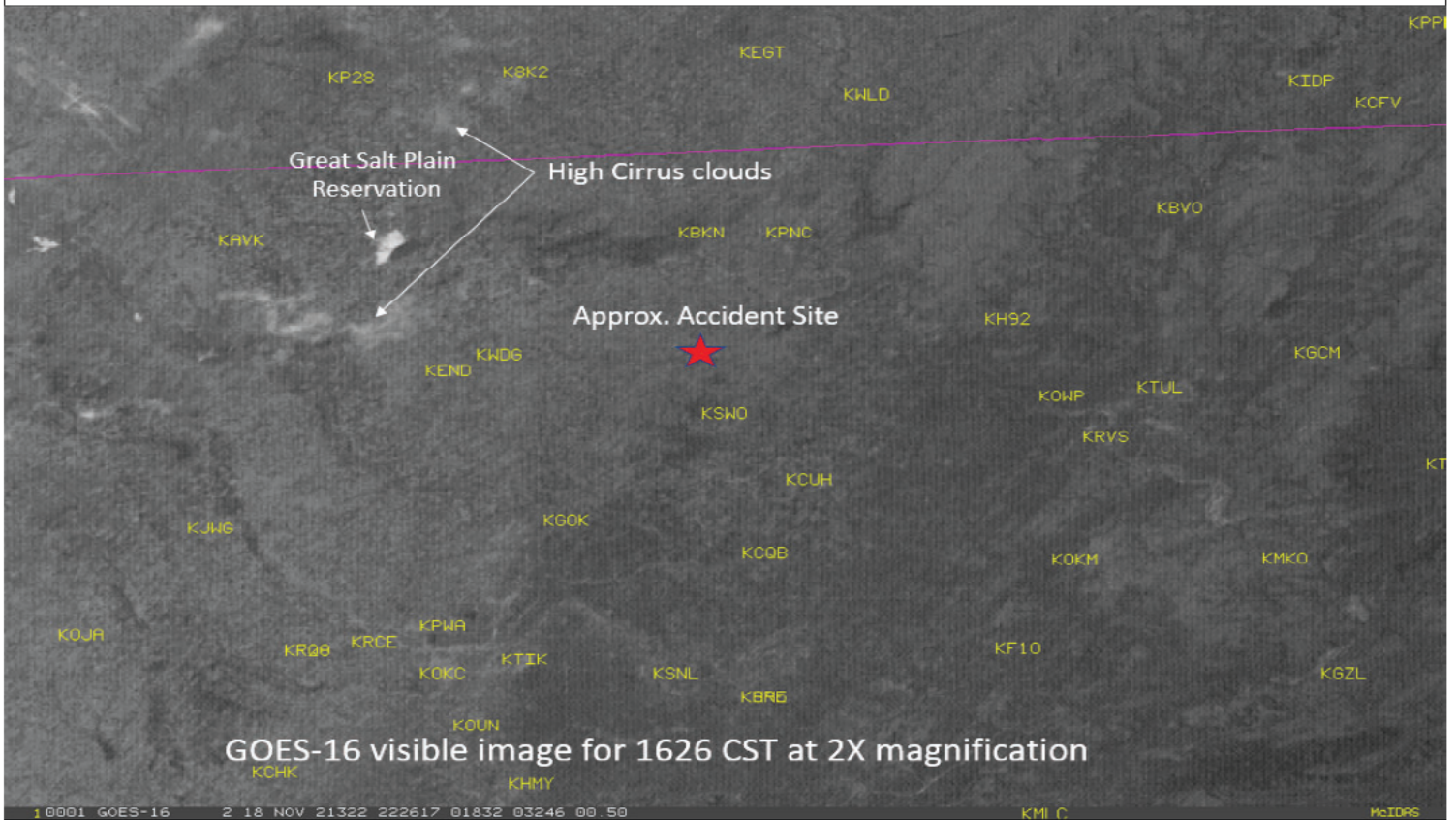
Figure 3



Caption

High-Resolution Rapid Refresh (HRRR) numerical model sounding over Perry at 1700 CST.

Figure 4



Caption

GOES-16 visible image at 1626 CST prior to the accident at 2X magnification.