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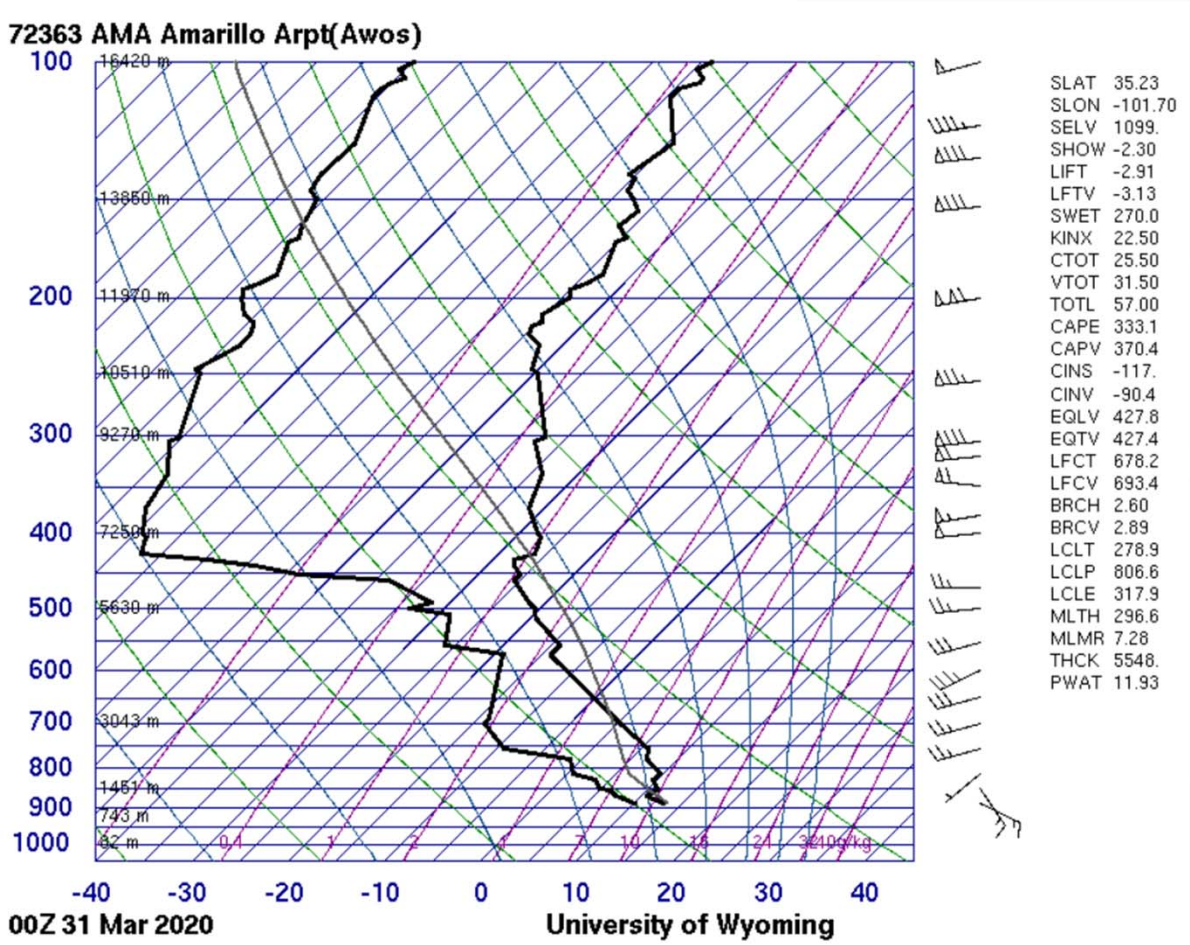
For NWSFO Amarillo
Late March 2020 Tornadic Thunderstorm

Steve Kersh
Meteorologist – Electromagnetics Group, Facility Engineering

August 20, 2020

Meteorological Setup for March 30, 2020



Meteorological Setup for March 30, 2020

72363 AMA Amarillo Arpt(Awos) Observations at 00Z 31 Mar 2020

PRES hPa	HGHT m	TEMP C	DWPT C	RELH %	MIXR g/kg	DRCT deg	SKNT knot	THTA K	THTE K	THTV K
1000.0	82									
925.0	743									
887.0	1099	13.0	10.2	83	8.88	115	16	296.1	322.1	297.7
869.0	1269	10.6	7.4	81	7.48	129	15	295.4	317.3	296.7
851.0	1441	11.0	6.0	71	6.94	144	13	297.6	318.1	298.8
850.0	1451	11.0	5.0	66	6.47	145	13	297.7	316.9	298.8
828.0	1669	9.6	3.6	66	6.02	194	8	298.4	316.4	299.5
813.0	1821	9.6	0.6	53	4.94	228	5	300.0	315.0	300.9
812.2	1829	9.5	0.6	54	4.93	230	5	300.0	315.0	300.9
782.8	2134	7.0	-1.0	56	4.55	270	12	300.5	314.4	301.3
780.0	2164	6.8	-1.2	57	4.51	269	13	300.6	314.4	301.4
756.0	2420	5.8	-9.2	33	2.53	256	24	302.2	310.2	302.6
754.3	2438	5.6	-9.3	33	2.51	255	25	302.2	310.2	302.6
726.4	2743	2.9	-11.6	34	2.18	255	27	302.4	309.4	302.8
700.0	3043	0.2	-13.8	34	1.89	255	27	302.7	308.8	303.0
689.0	3170	-0.9	-13.9	37	1.90	255	28	302.8	309.0	303.2
647.2	3658	-5.4	-15.6	44	1.76	255	31	303.2	308.9	303.5
598.5	4267	-11.0	-17.8	57	1.59	245	36	303.5	308.7	303.8
575.0	4580	-13.9	-18.9	66	1.50	250	33	303.7	308.6	303.9
571.0	4633	-14.1	-19.1	66	1.49	251	32	304.0	308.9	304.3
557.0	4821	-14.1	-26.1	36	0.82	254	31	306.2	309.0	306.4
552.9	4877	-14.6	-26.3	36	0.81	255	30	306.2	309.1	306.4
516.0	5396	-19.3	-28.3	45	0.72	262	26	306.7	309.2	306.8
508.0	5512	-19.9	-28.9	45	0.70	263	25	307.3	309.8	307.4
500.0	5630	-20.5	-33.5	30	0.46	265	24	308.0	309.6	308.1
490.0	5779	-21.9	-31.9	40	0.54	267	25	308.1	310.0	308.1
469.2	6096	-24.4	-36.4	32	0.36	270	26	308.8	310.1	308.8
459.0	6257	-25.7	-38.7	29	0.29	269	29	309.1	310.2	309.2
451.0	6384	-25.7	-48.7	10	0.10	269	32	310.7	311.1	310.7
441.0	6546	-27.1	-54.1	6	0.06	268	35	310.9	311.1	310.9
433.0	6678	-27.7	-59.7	3	0.03	267	38	311.8	311.9	311.8
426.0	6796	-26.1	-67.1	1	0.01	267	40	315.3	315.3	315.3
406.0	7143	-27.3	-68.3	1	0.01	265	47	318.1	318.1	318.1
400.0	7250	-28.1	-69.1	1	0.01	265	49	318.4	318.4	318.4
396.4	7315	-28.5	-69.4	1	0.01	260	53	318.7	318.7	318.7
379.8	7620	-30.5	-70.8	1	0.01	260	53	319.9	320.0	319.9
372.0	7767	-31.5	-71.5	1	0.01	264	54	320.5	320.6	320.6
348.3	8230	-32.9	-72.3	1	0.01	275	58	324.7	324.7	324.7
336.0	8484	-33.7	-72.7	1	0.01	271	59	327.0	327.0	327.0
319.2	8839	-36.0	-74.5	1	0.00	265	61	328.6	328.6	328.6
306.0	9133	-37.9	-75.9	1	0.00	265	78	330.0	330.0	330.0
305.5	9144	-37.8	-75.8	1	0.00	265	79	330.2	330.2	330.2

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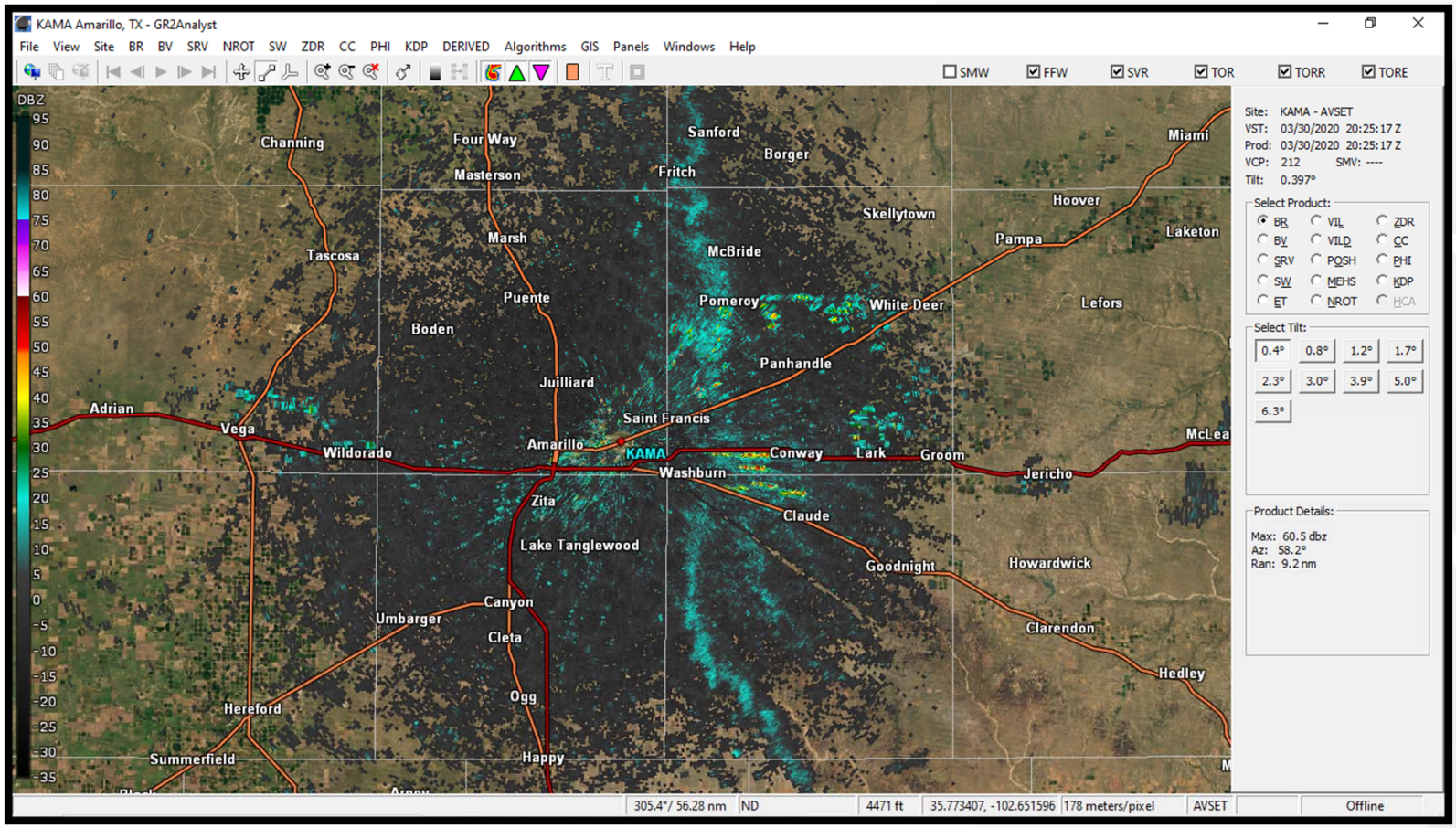
KAMA 88-D – BR Scan (0.5 Degree Tilt) – 15:25



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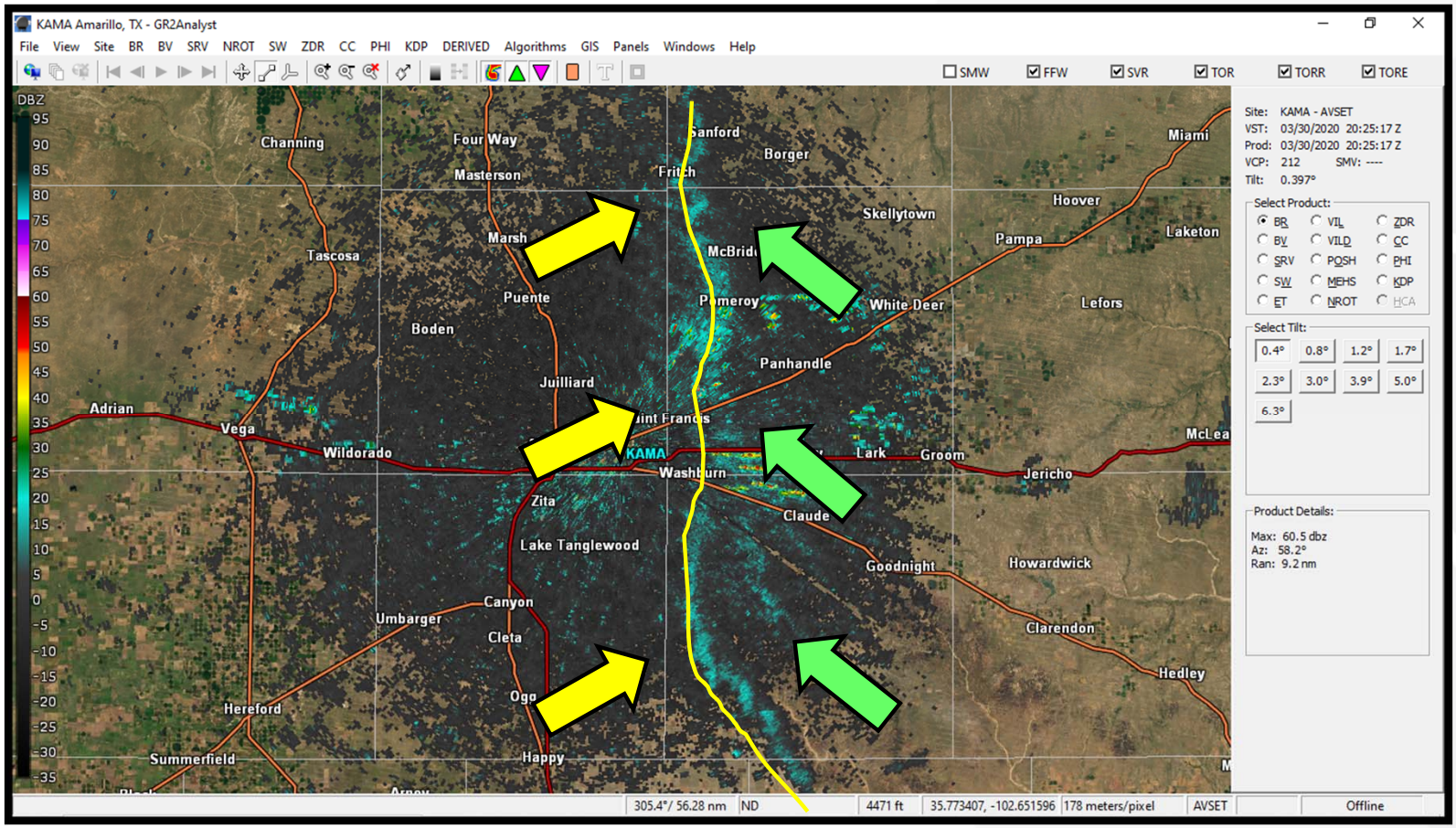
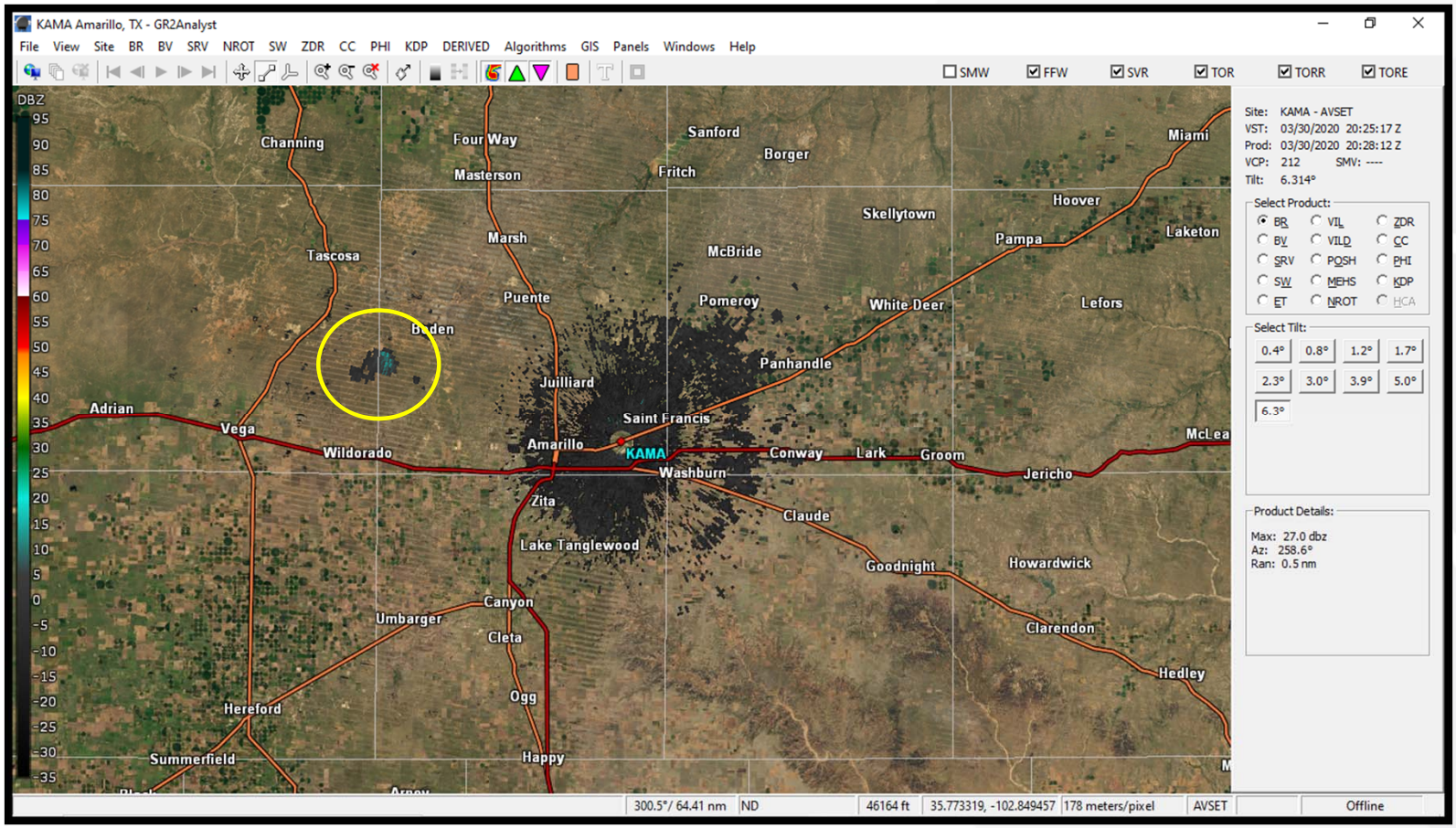
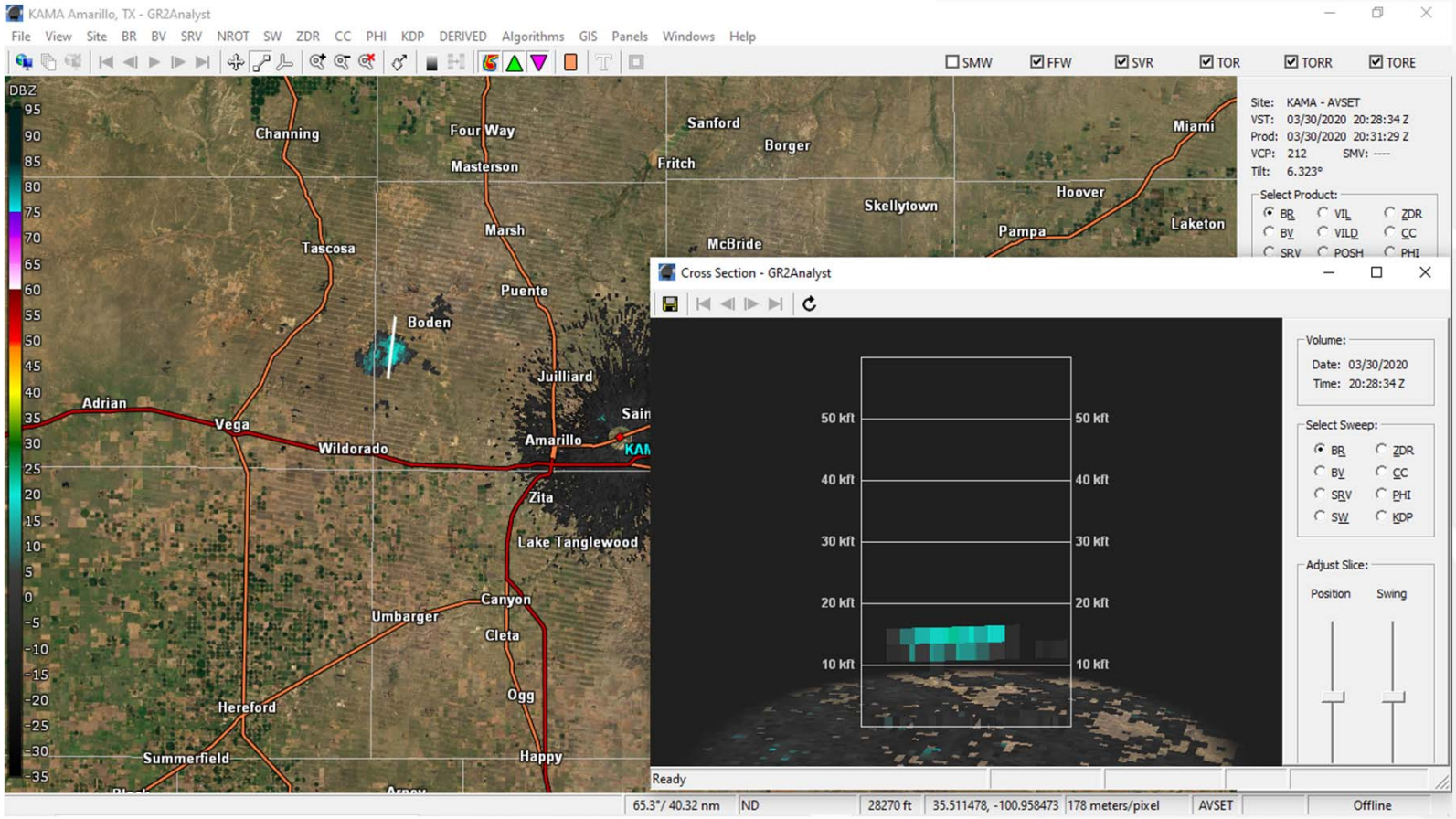


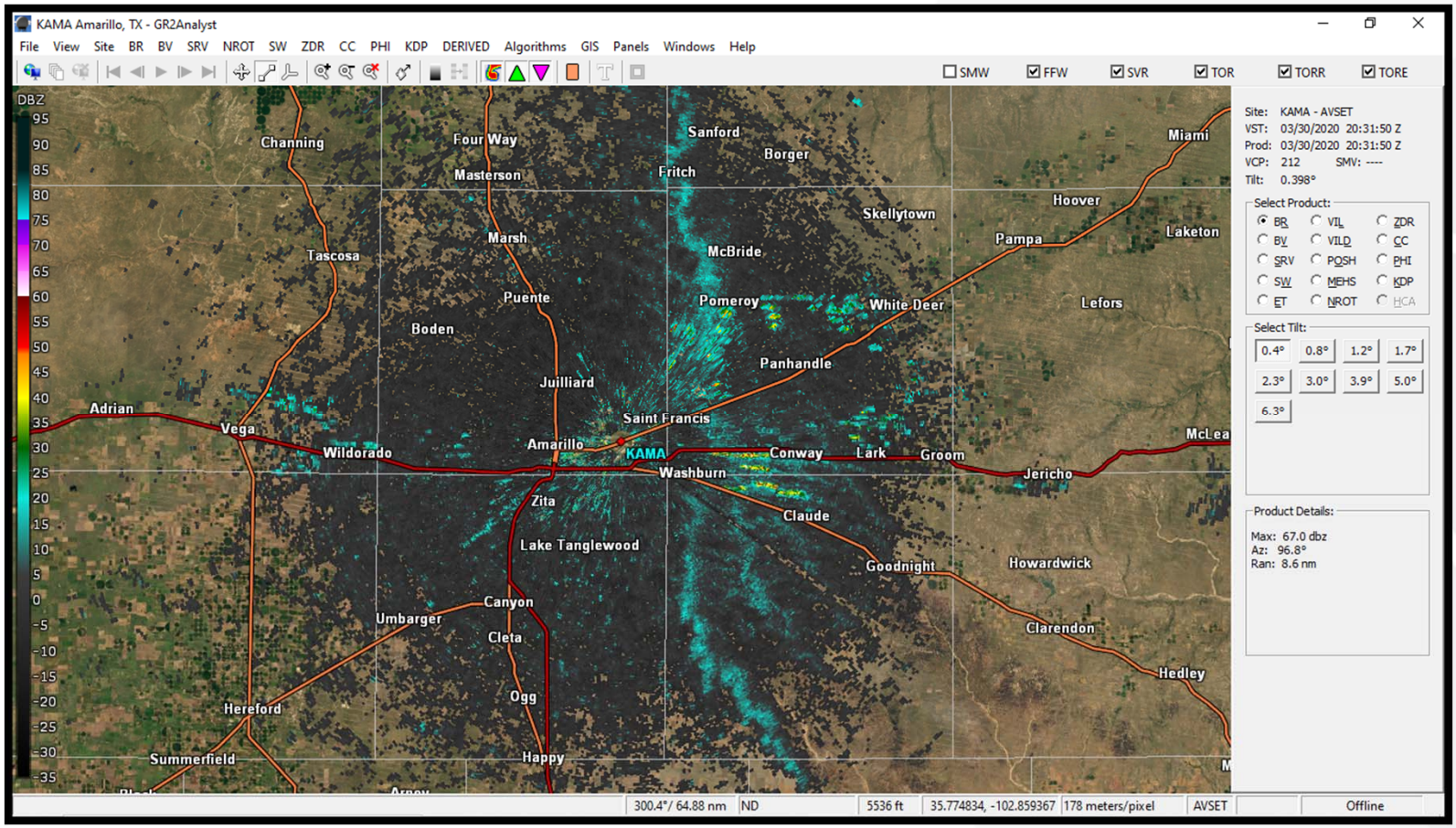
KAMA 88-D – BR Scan (6.3 Degree Tilt) – 15:25



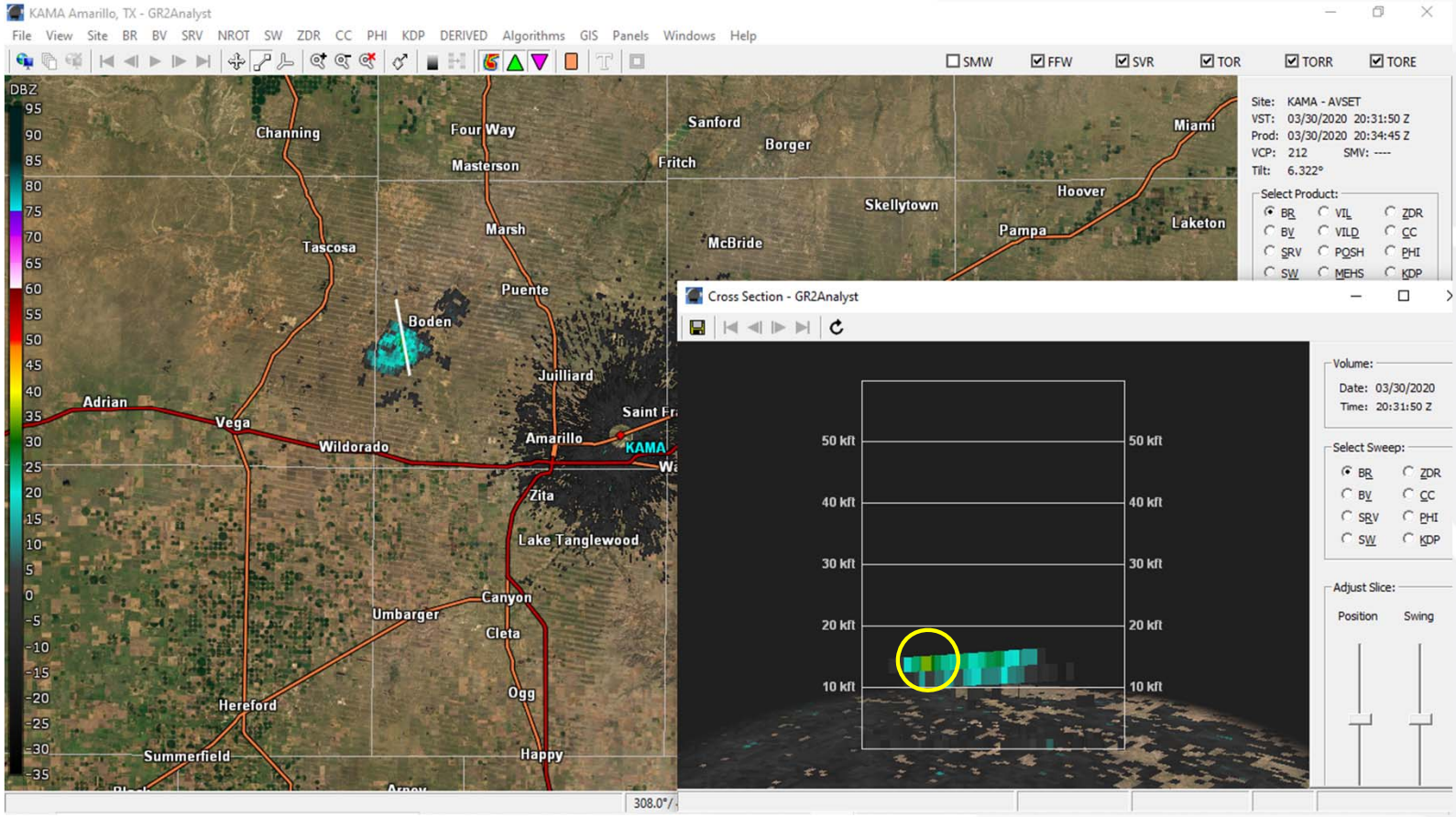
KAMA 88-D – Cross-Section Scan (6.3 Degree Tilt) – 15:28



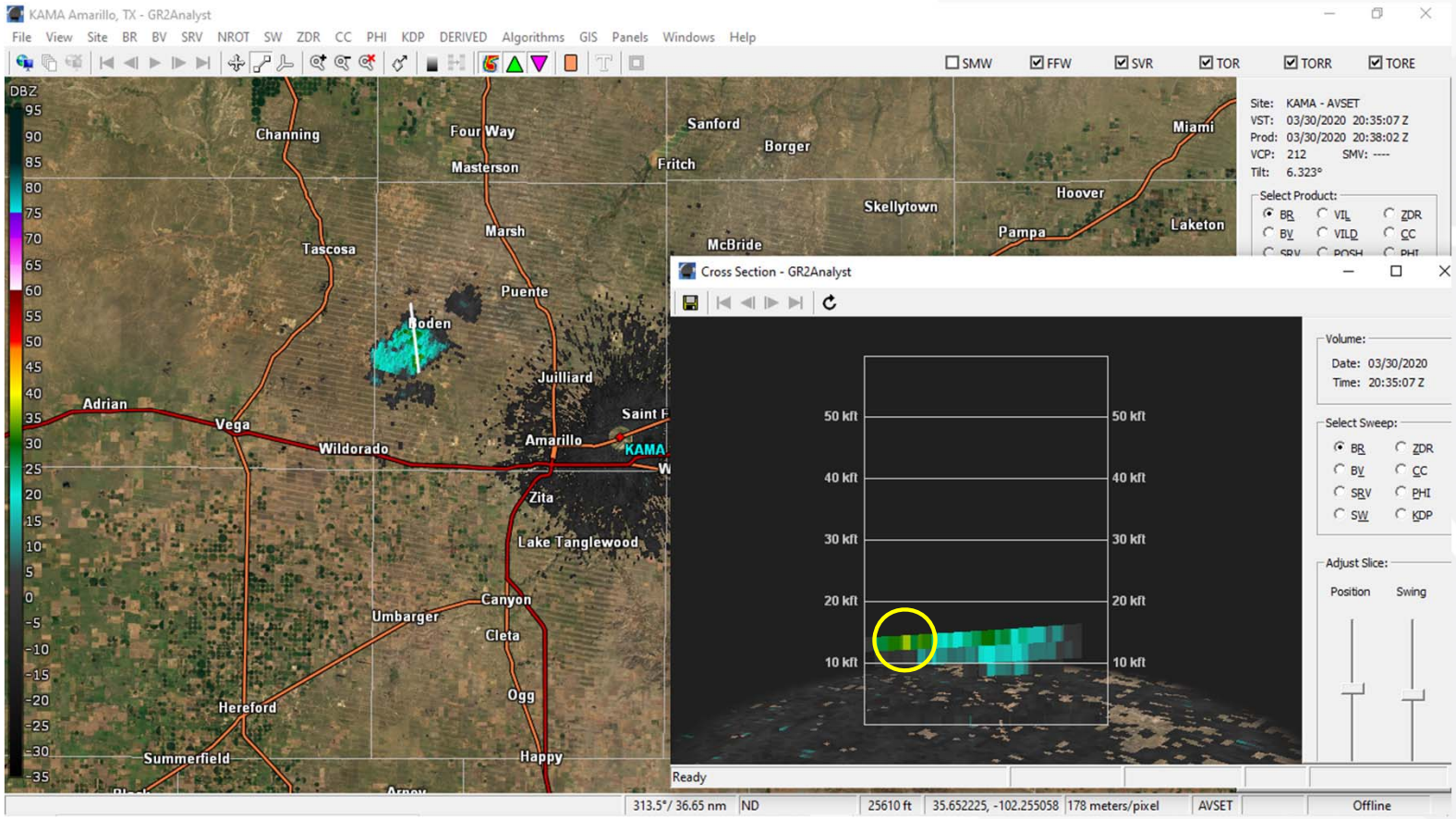
KAMA 88-D – BR Scan (0.4 Degree Tilt) – 15:31



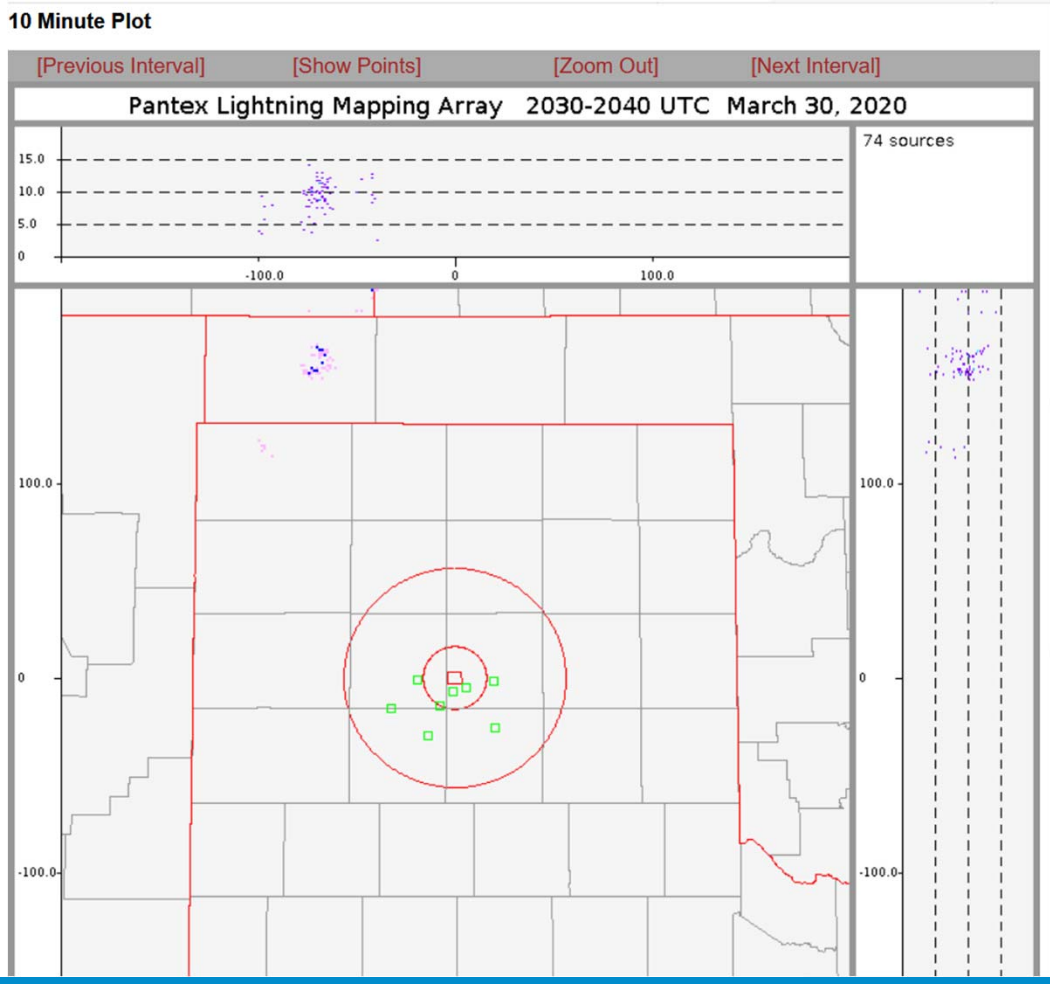
KAMA 88-D – Cross-Section Scan (6.3 Degree Tilt) – 15:31



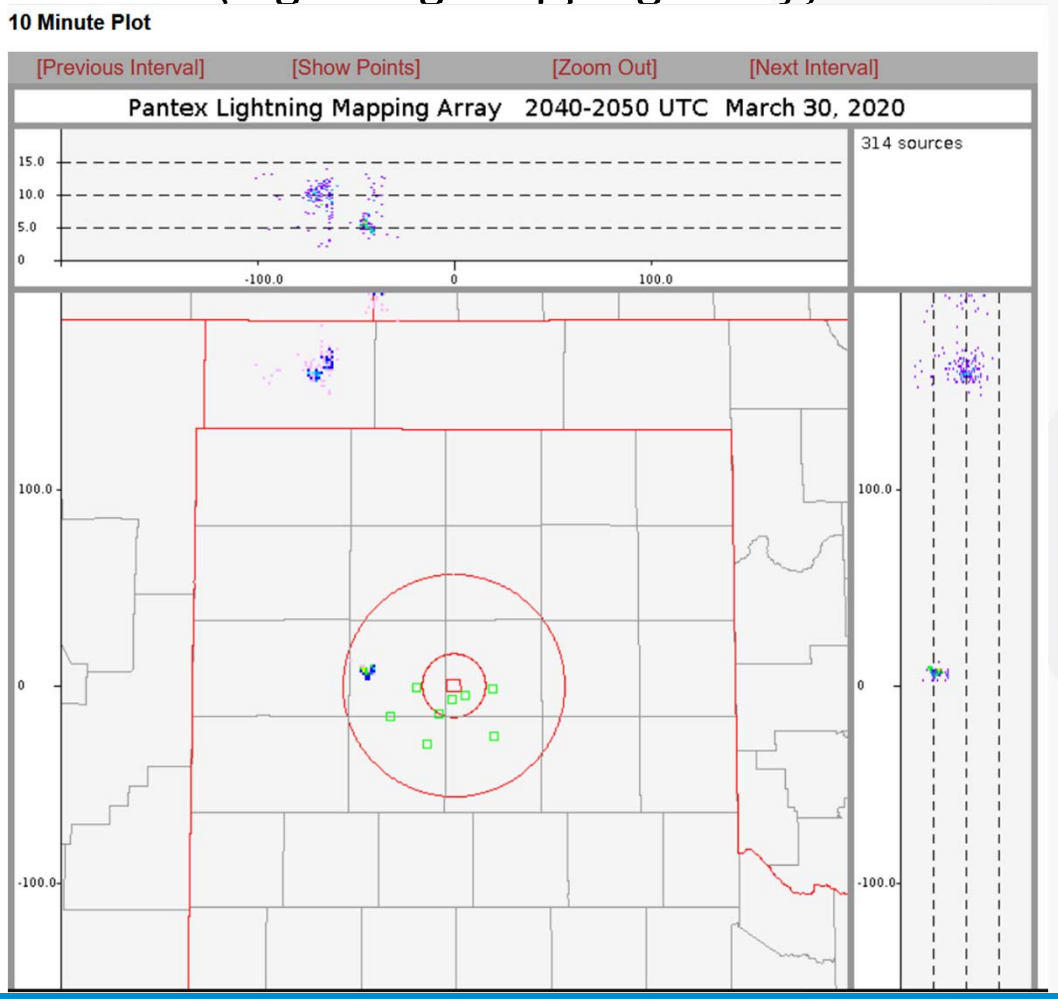
KAMA 88-D – BR Scan (6.3 Degree Tilt) – 15:35



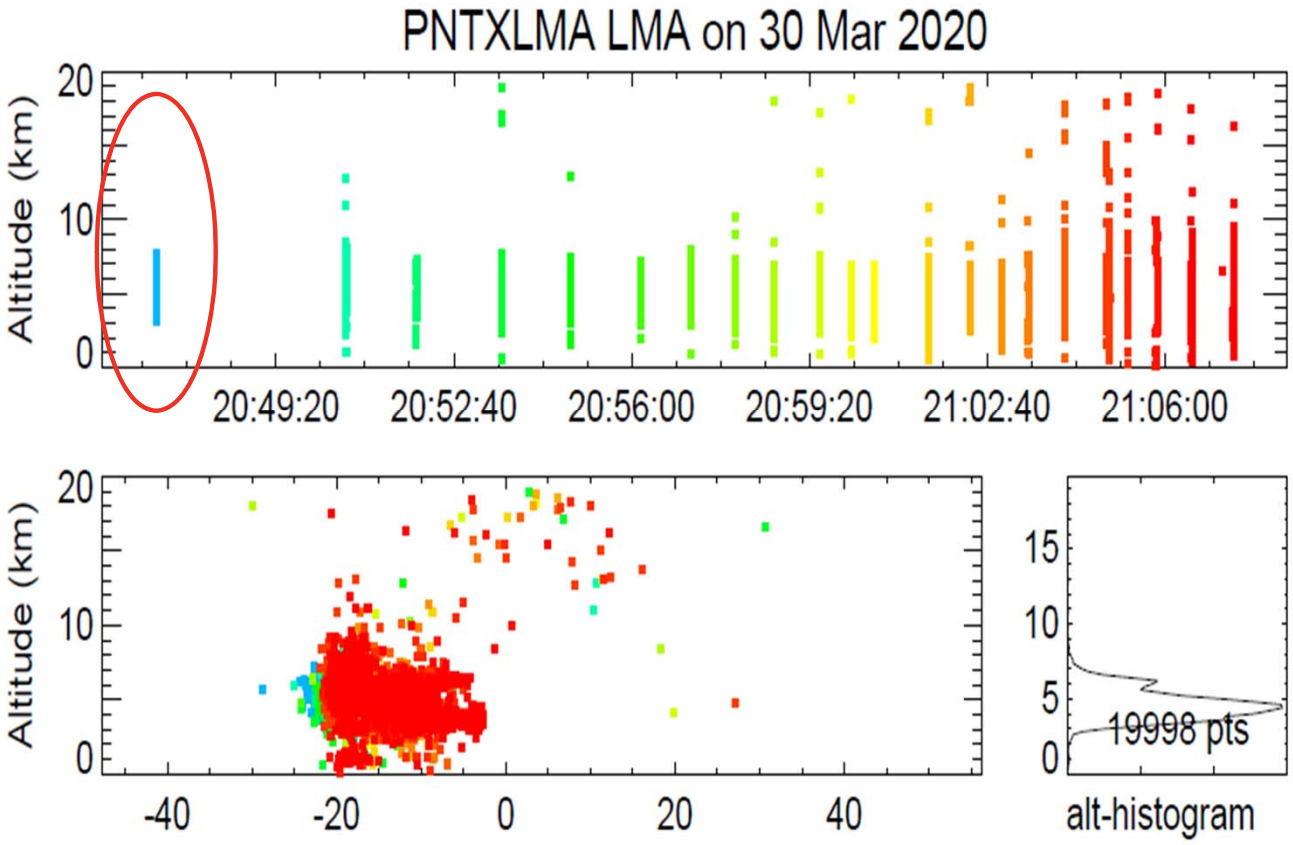
Pantex LMA (Lightning Mapping Array) – 1530-1540



Pantex LMA (Lightning Mapping Array) – 1540-1550



Pantex LMA (Lightning Mapping Array) – 1540-1550



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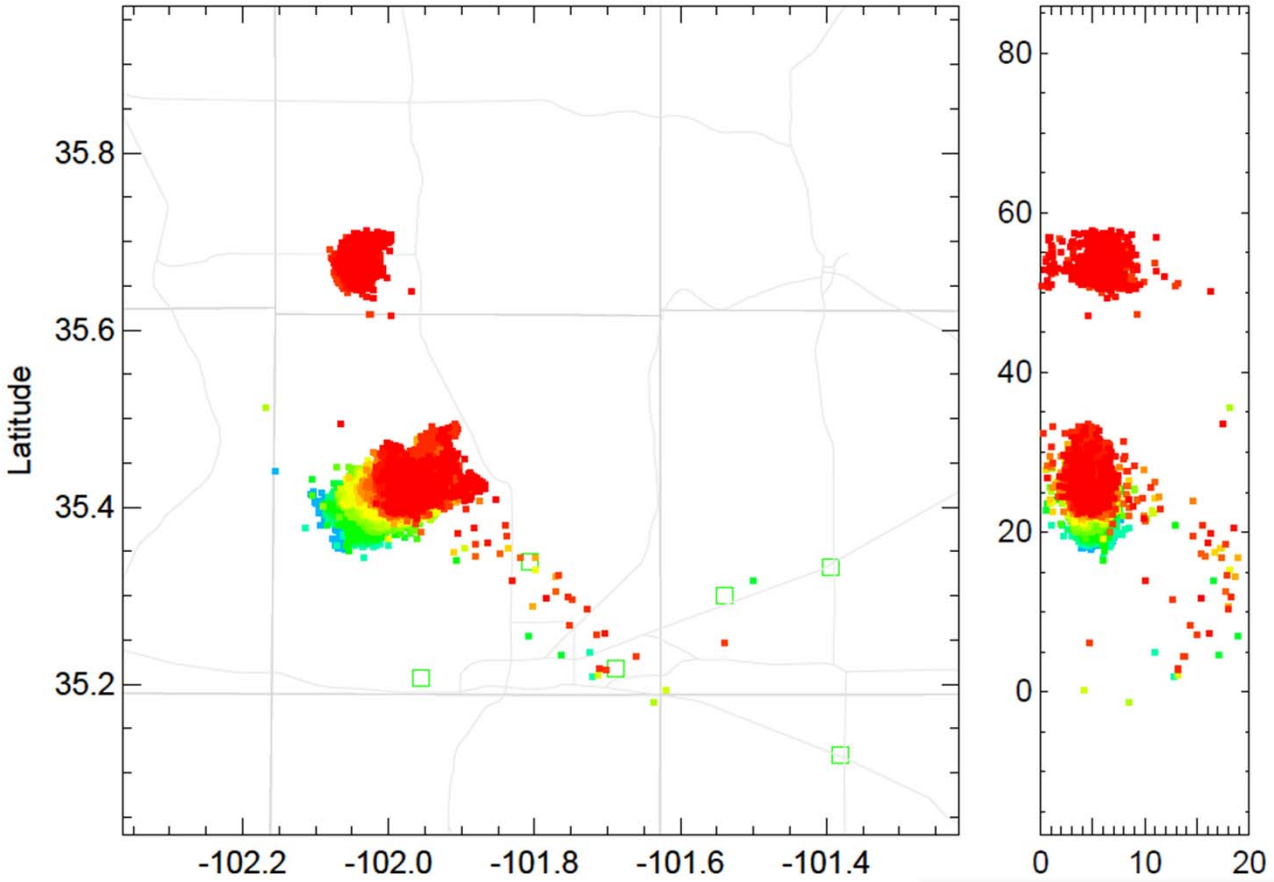
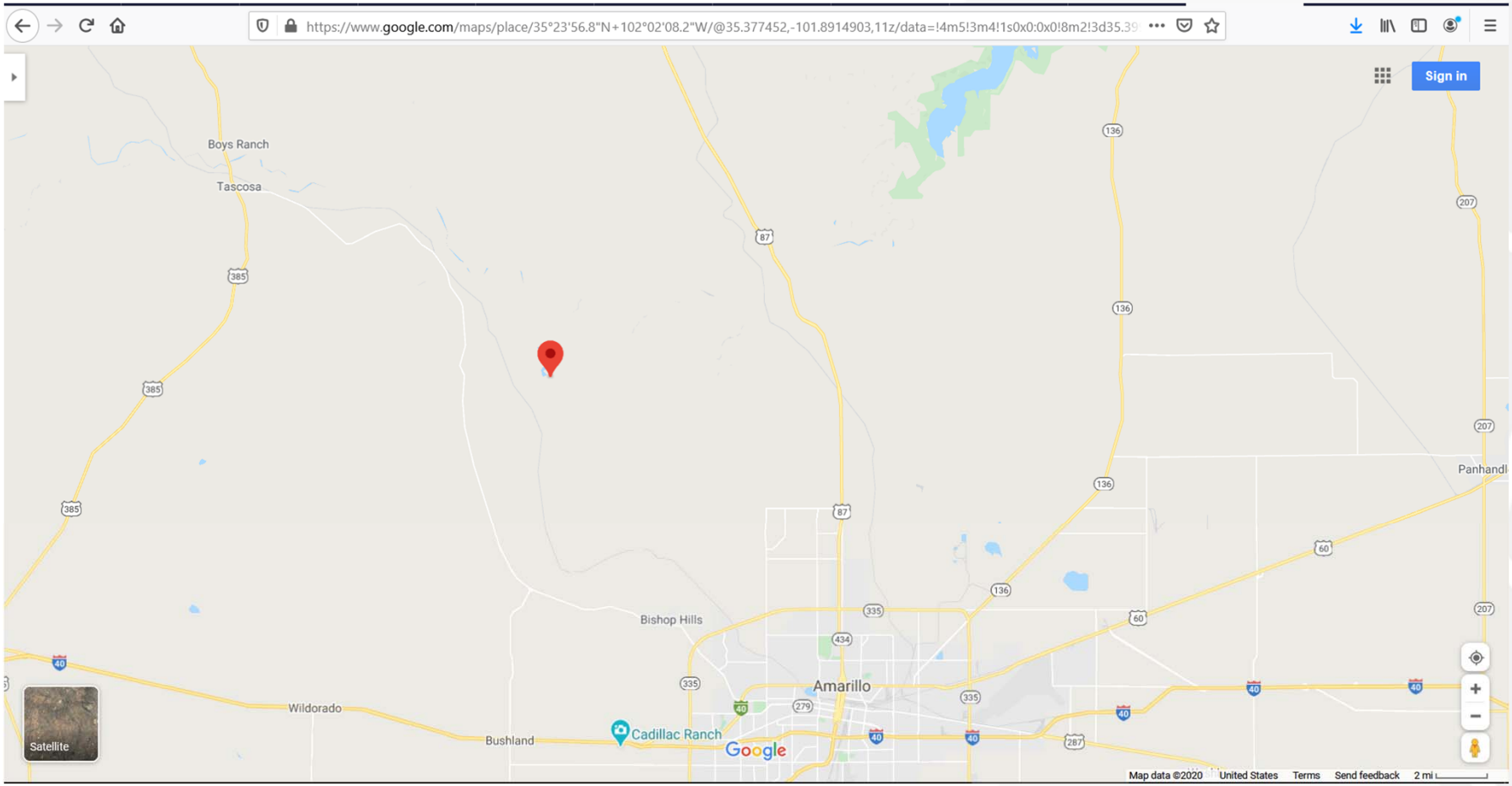


First Intra-Cloud (CC) Strike Occurs At 15:56

Lightning Event List

Date/Time	Latitude	Longitude	Amps	Distance	Bearing (°)
Mar 30, 2020 3:56:10 PM CDT	35.3991	-102.0356	-7363 amps	9.9838 miles	241.6924

Location of First “Intra-Cloud” or CC Strike at 15:56

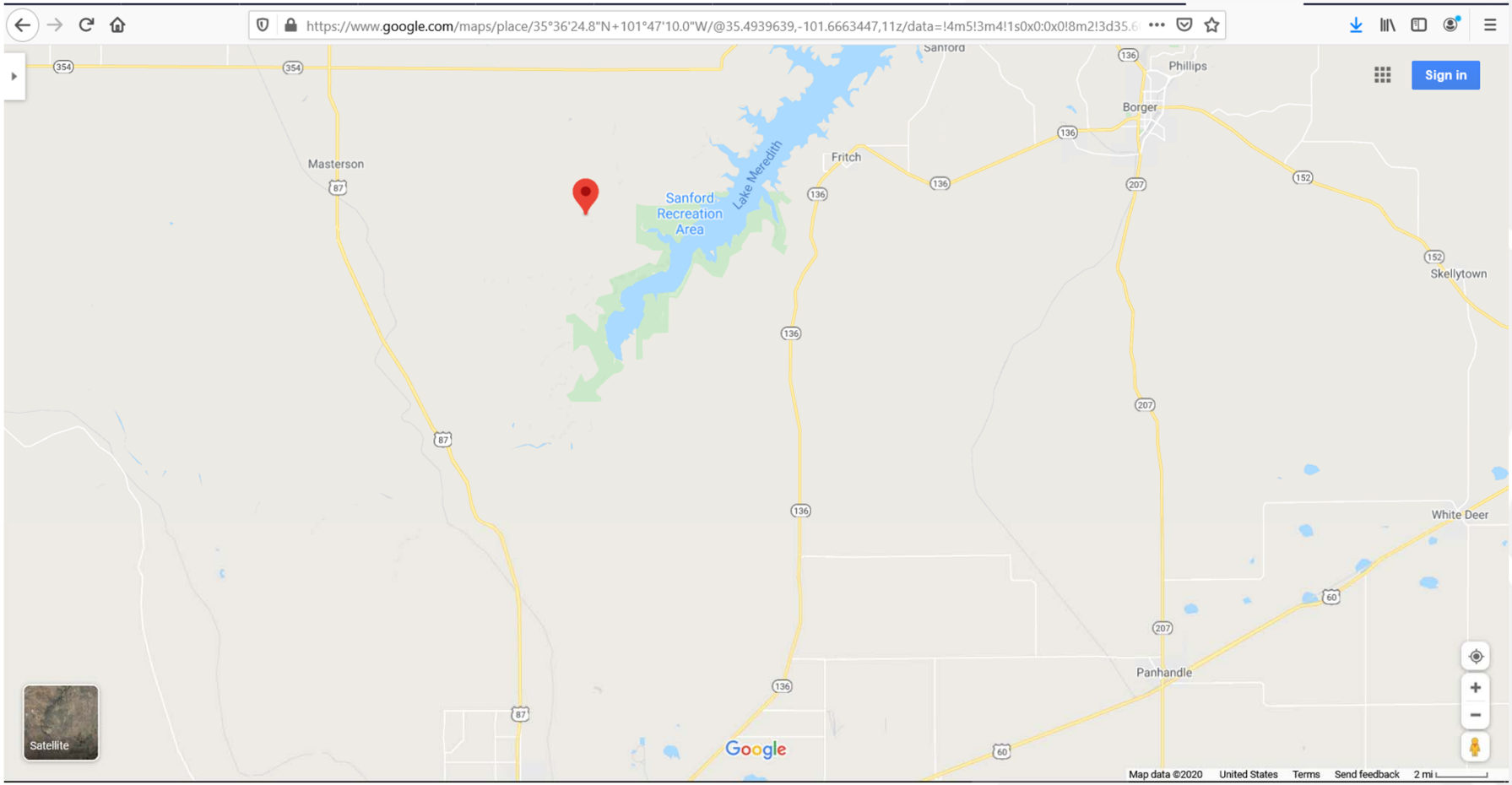


First Cloud-To-Ground (CG) Strike Occurs At 16:35

Lightning Event List

Date/Time	Latitude	Longitude	Amps	Distance	Bearing (°)
Mar 30, 2020 4:35:50 PM CDT	35.6069	-101.7861	-4255 amps	10.9551 miles	28.5997

Location of First CG Strike at 16:35



Lessons Learned / Lightning Summary Of The 3/30/20 Storm

1. The storm developed behind a “dry-line”, but was “elevated” in nature at first.

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1. The storm developed behind a “dry-line”, but was “elevated” in nature at first.
2. The storm reached a 35-40 dbz threshold at a temperature of -10 C around 15:31.
3. Pantex’s LMA detects “flash pulses” at 15:47, or 16 minutes later.
4. The first intra-cloud (CC) occurred at 15:56 , roughly 7 miles NW of Amarillo.

Lessons Learned / Lightning Summary Of The 3/30/20 Storm

5. The first CG lightning strike occurred at 16:35, just west of Lake Meredith.

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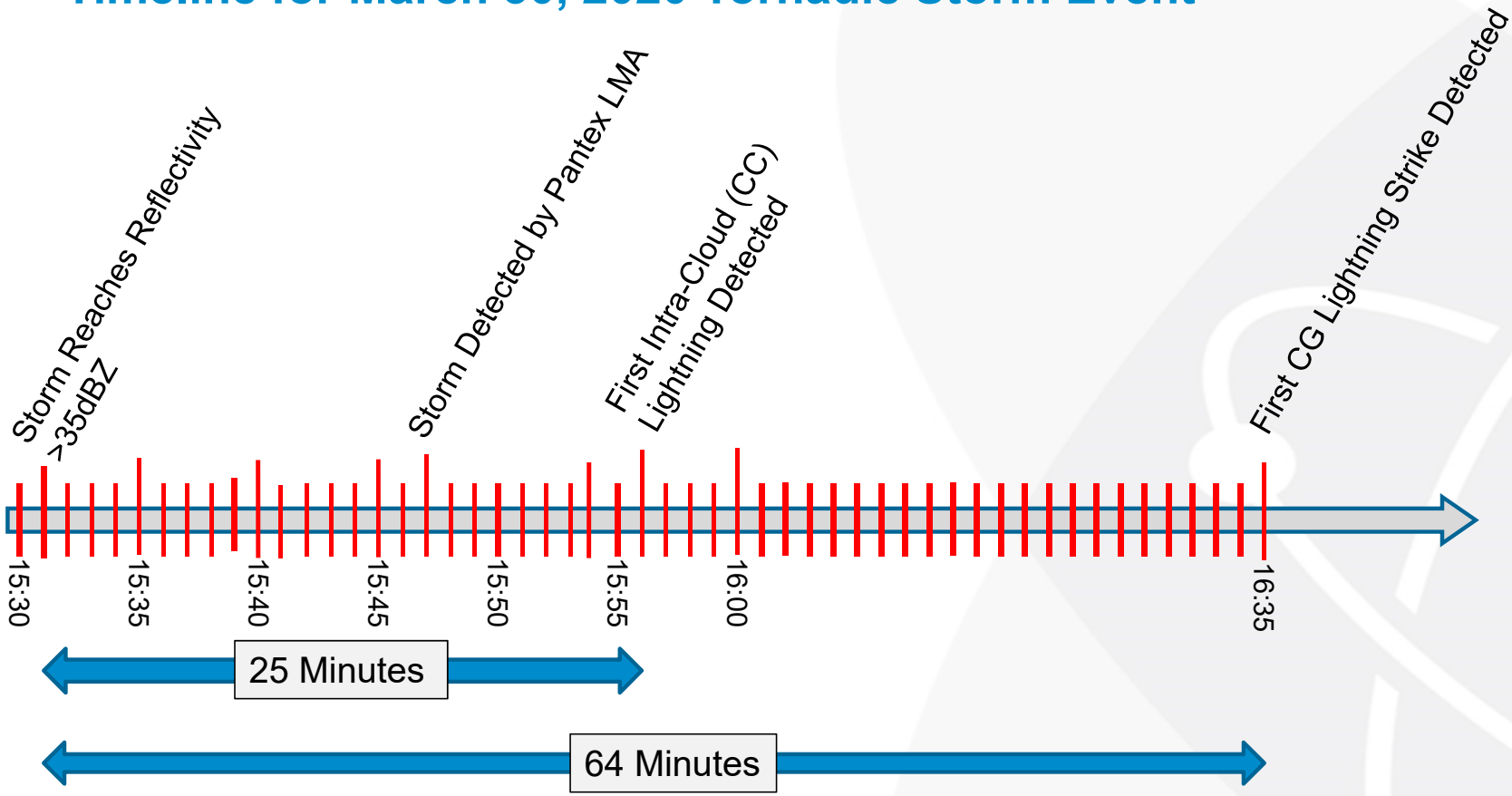
6. We had 64 minutes lead time between 35-40 dbz threshold being reached and the first CG lightning strike in this storm!

Timeline for March 30, 2020 Tornadic Storm Event



Tornado Near Pantex at 17:31 on 3/30/20 – Pic Courtesy – Wes Luginbyhl

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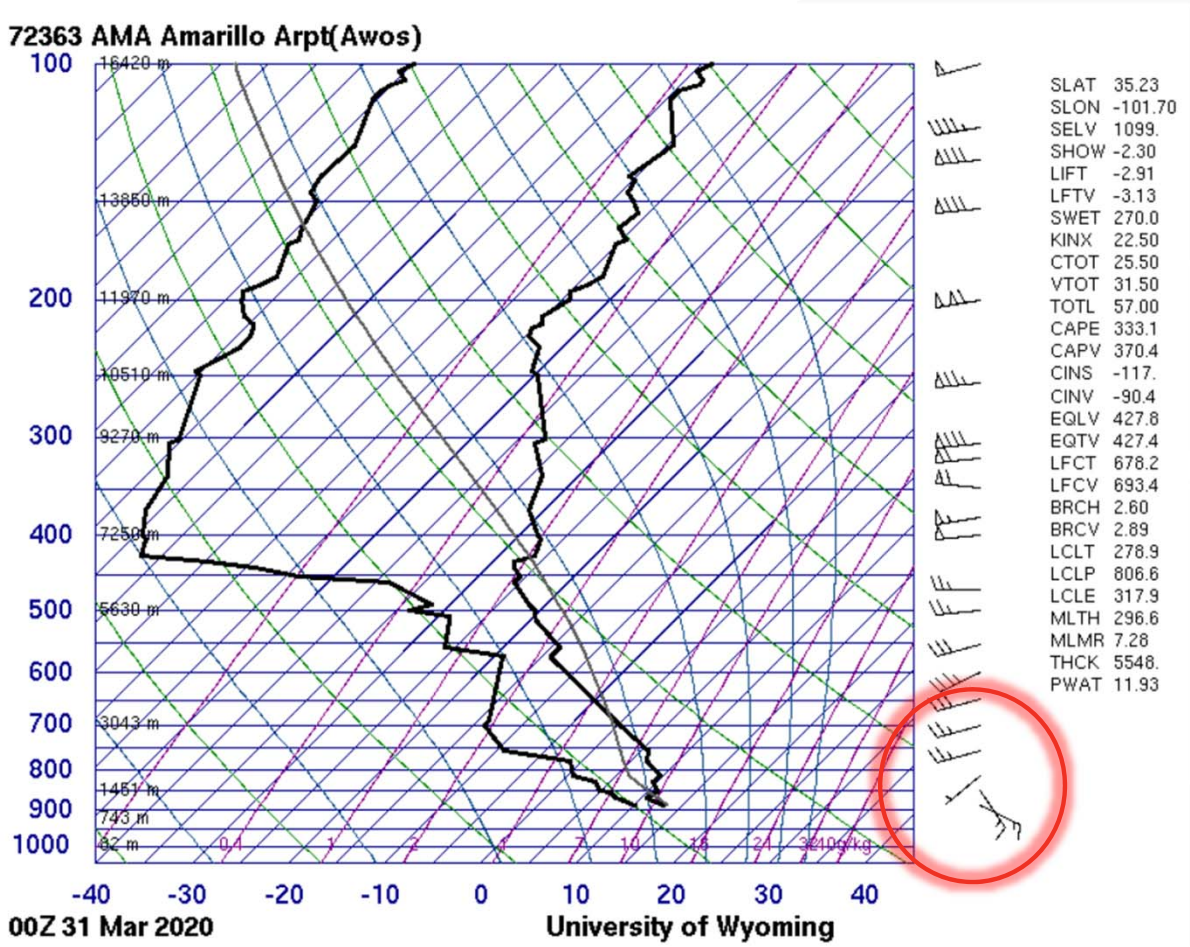
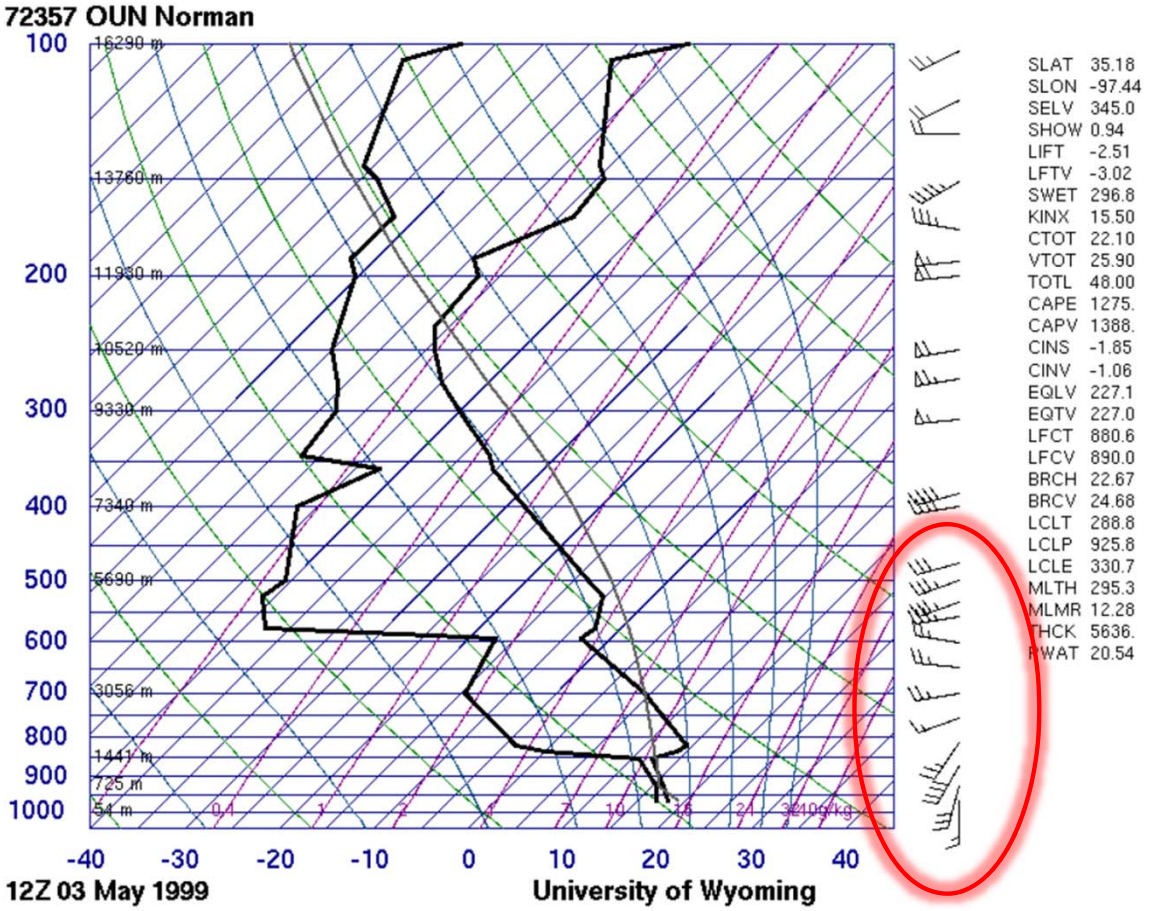


Meteorological Setup for May 3, 1999, Moore, OK, F5 Tornado



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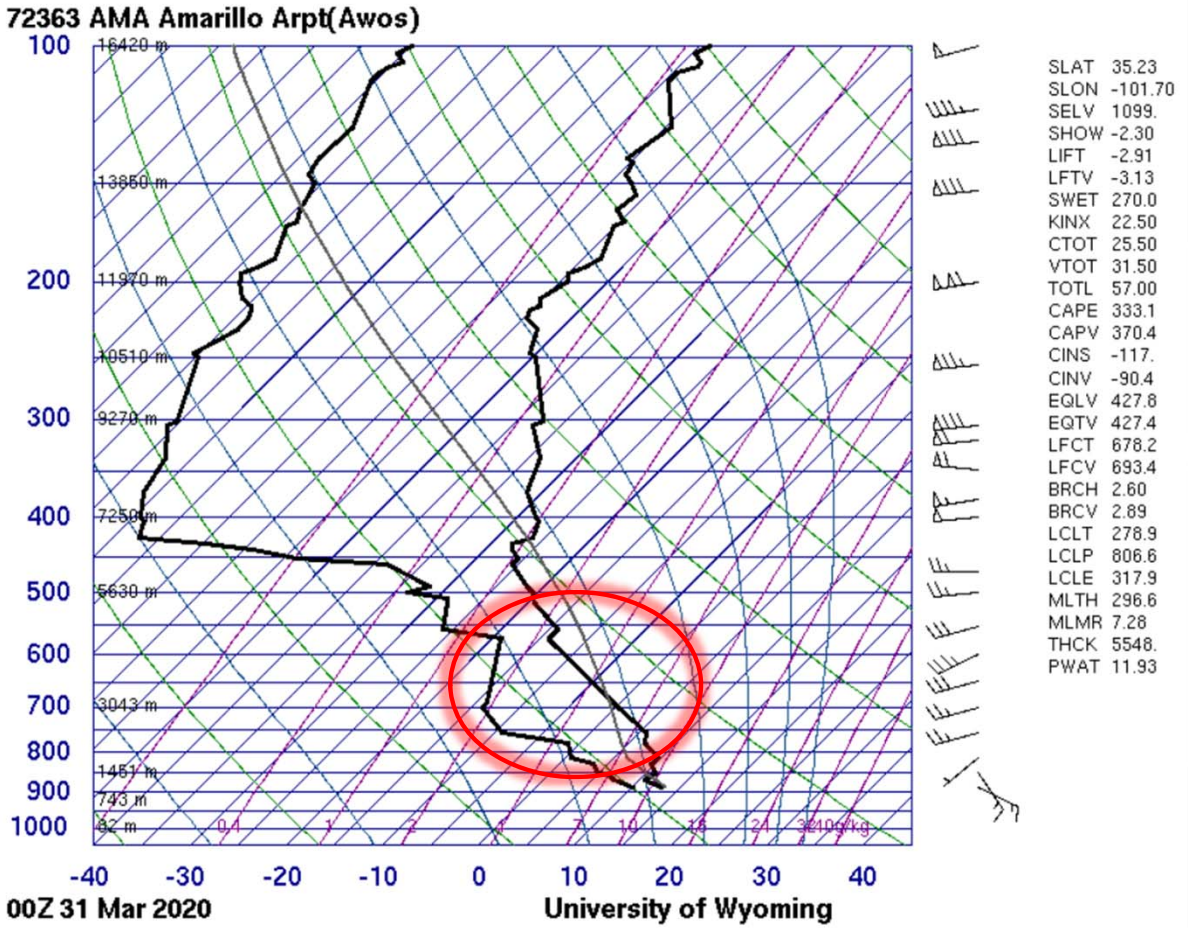

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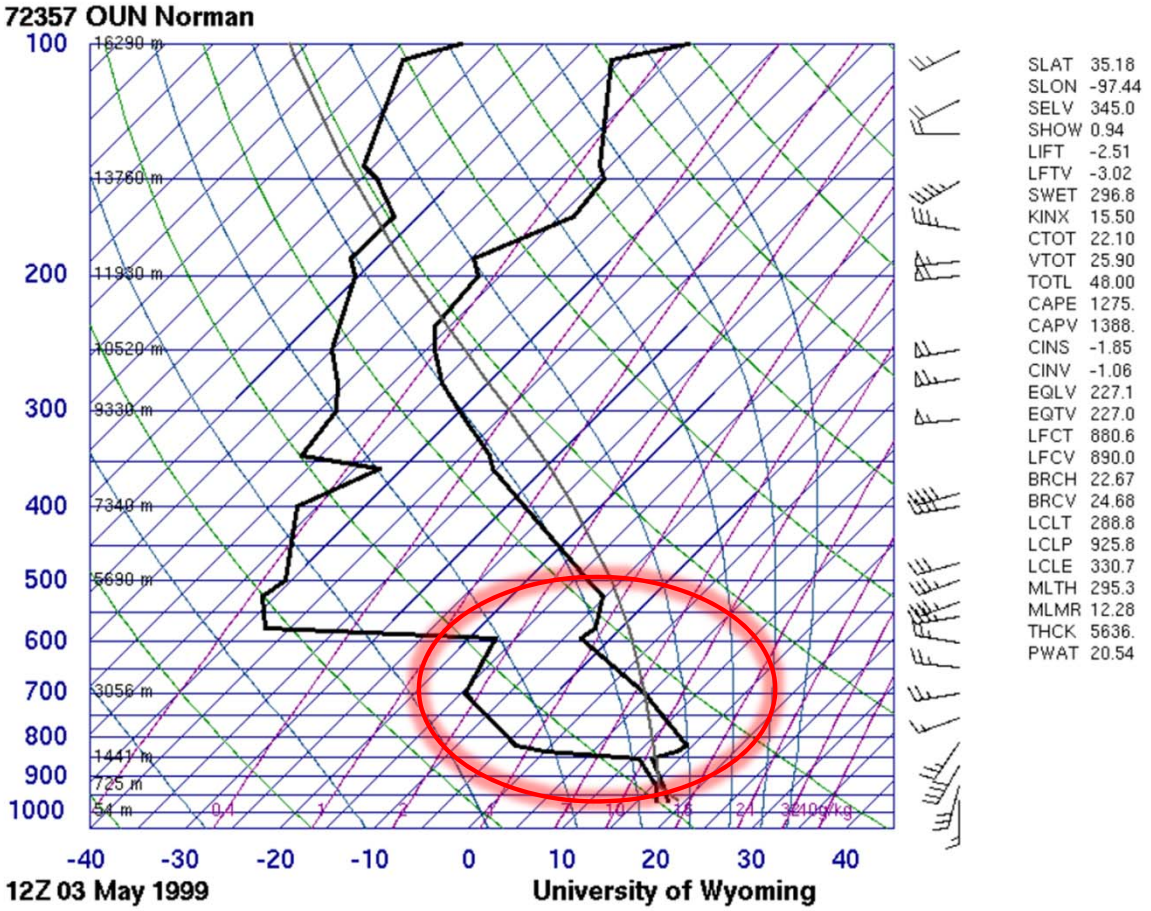

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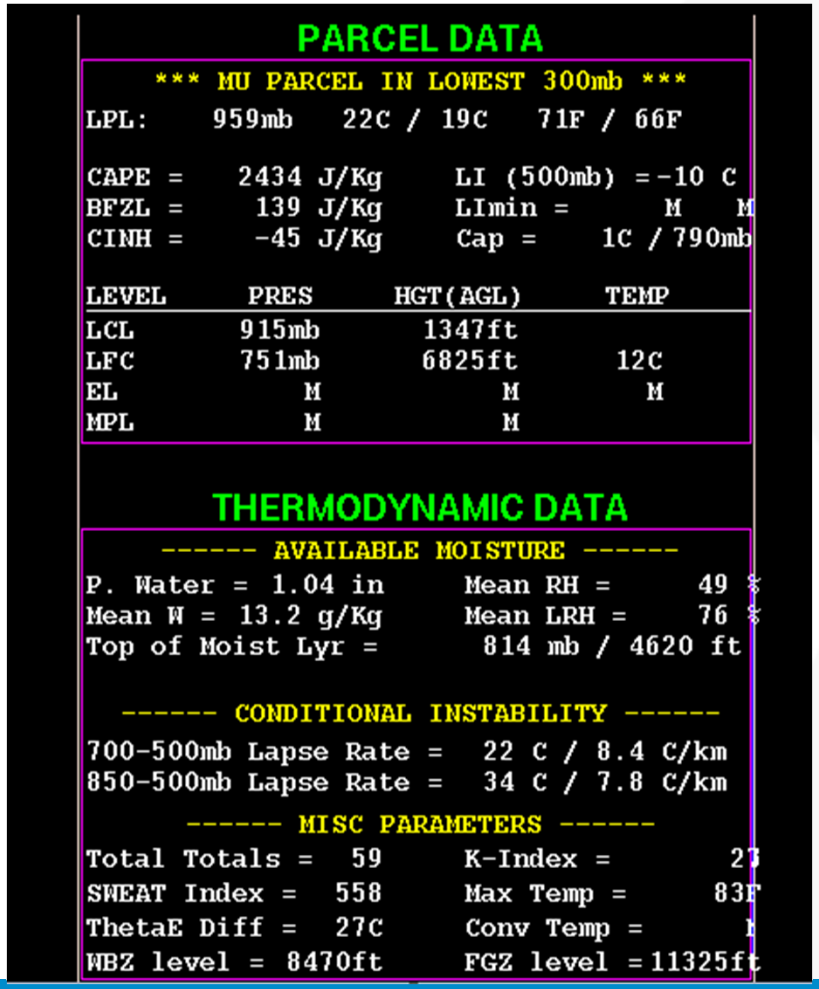


PARCEL DATA

*** MU PARCEL IN LOWEST 300mb ***

LPL: 959mb 22C / 19C 71F / 66F

CAPE = 2434 J/Kg LI (500mb) = -10 C
BFZL = 139 J/Kg LImin = M M
CINH = -45 J/Kg Cap = 1C / 790mb

LEVEL	PRES	HGT(AGL)	TEMP
LCL	915mb	1347ft	
LFC	751mb	6825ft	12C
EL	M	M	M
MPL	M	M	

THERMODYNAMIC DATA

------ AVAILABLE MOISTURE ------

P. Water = 1.04 in Mean RH = 49 %
Mean W = 13.2 g/Kg Mean LRH = 76 %
Top of Moist Lyr = 814 mb / 4620 ft

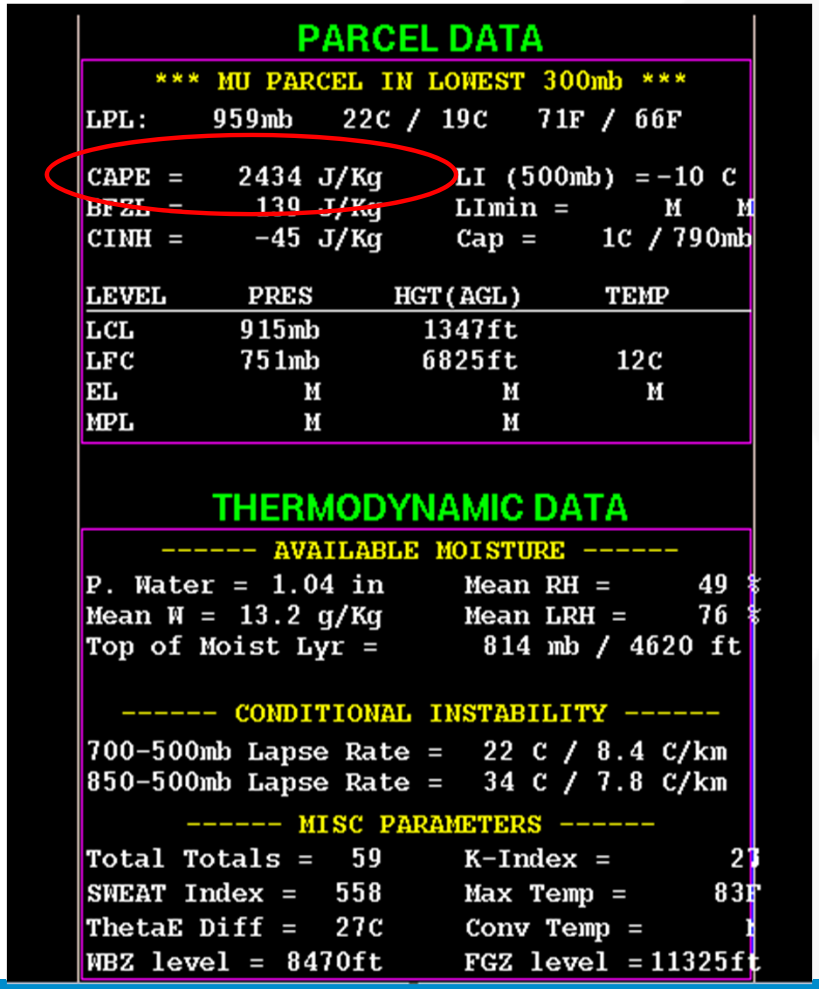
------ CONDITIONAL INSTABILITY ------

700-500mb Lapse Rate = 22 C / 8.4 C/km
850-500mb Lapse Rate = 34 C / 7.8 C/km

------ MISC PARAMETERS ------

Total Totals = 59 K-Index = 27
SWEAT Index = 558 Max Temp = 83F
ThetaE Diff = 27C Conv Temp = I
WBZ level = 8470ft FGZ level = 11325ft

Meteorological Setup for May 3, 1999, Moore, OK, F5 Tornado



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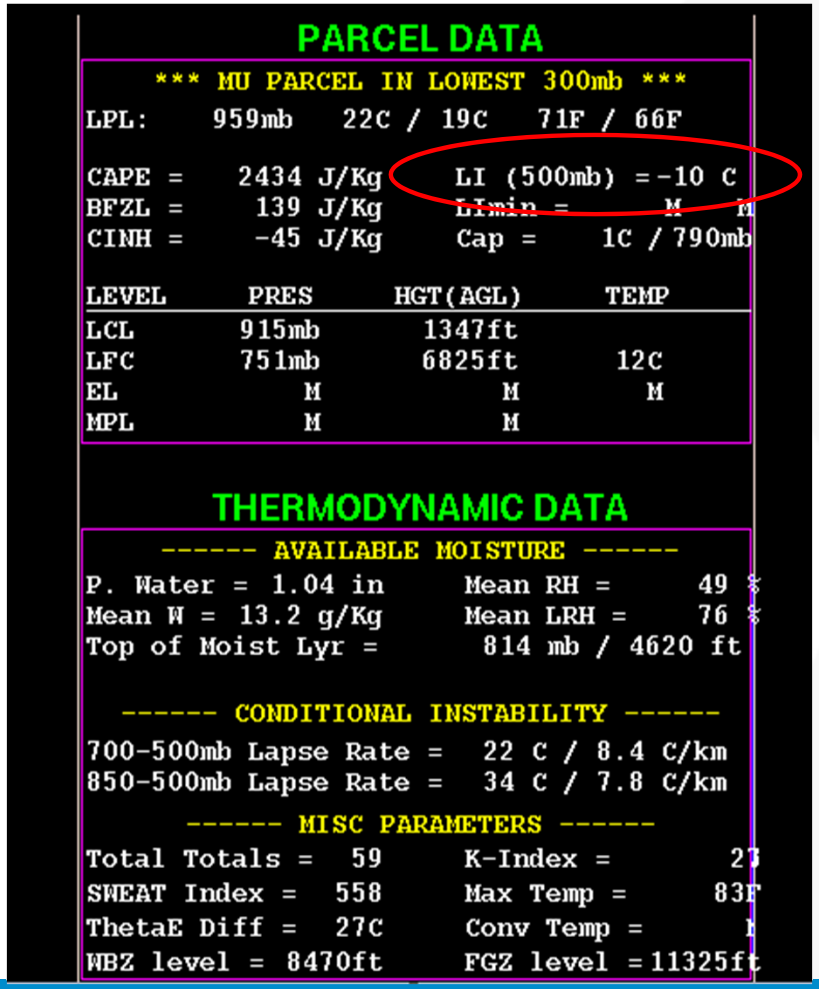

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Mean W = 13.2 g/Kg Mean LRH = 76 %
Top of Moist Lyr = 814 mb / 4620 ft

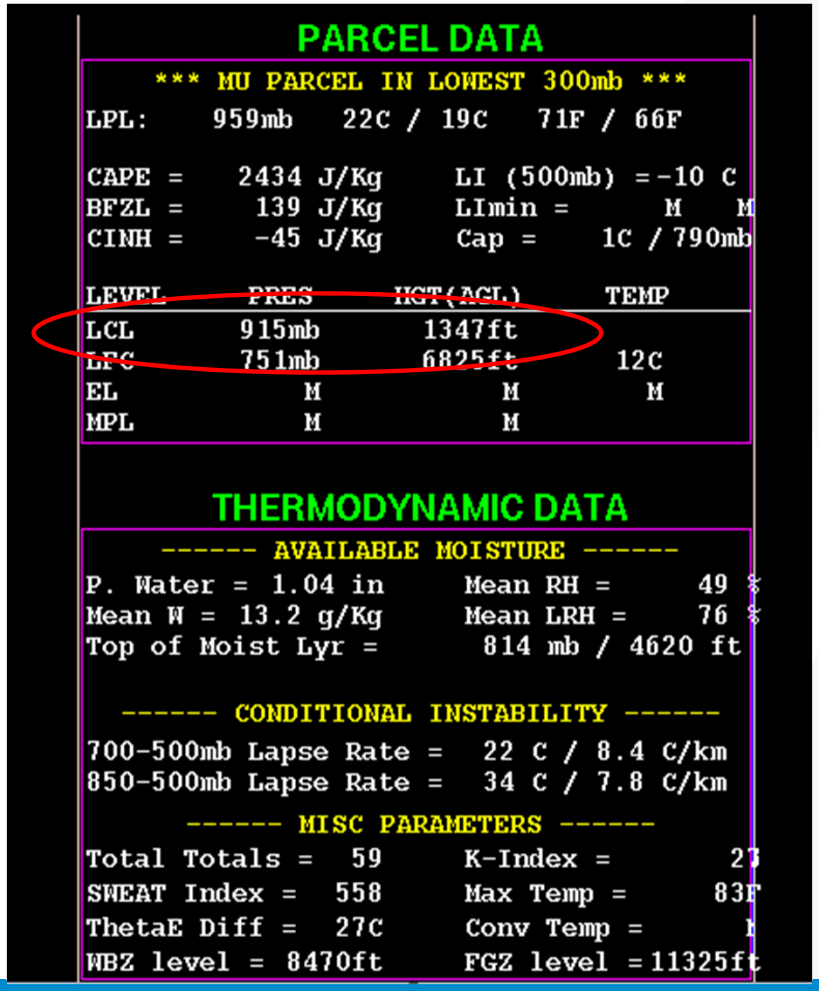
------ CONDITIONAL INSTABILITY ------

700-500mb Lapse Rate = 22 C / 8.4 C/km
850-500mb Lapse Rate = 34 C / 7.8 C/km

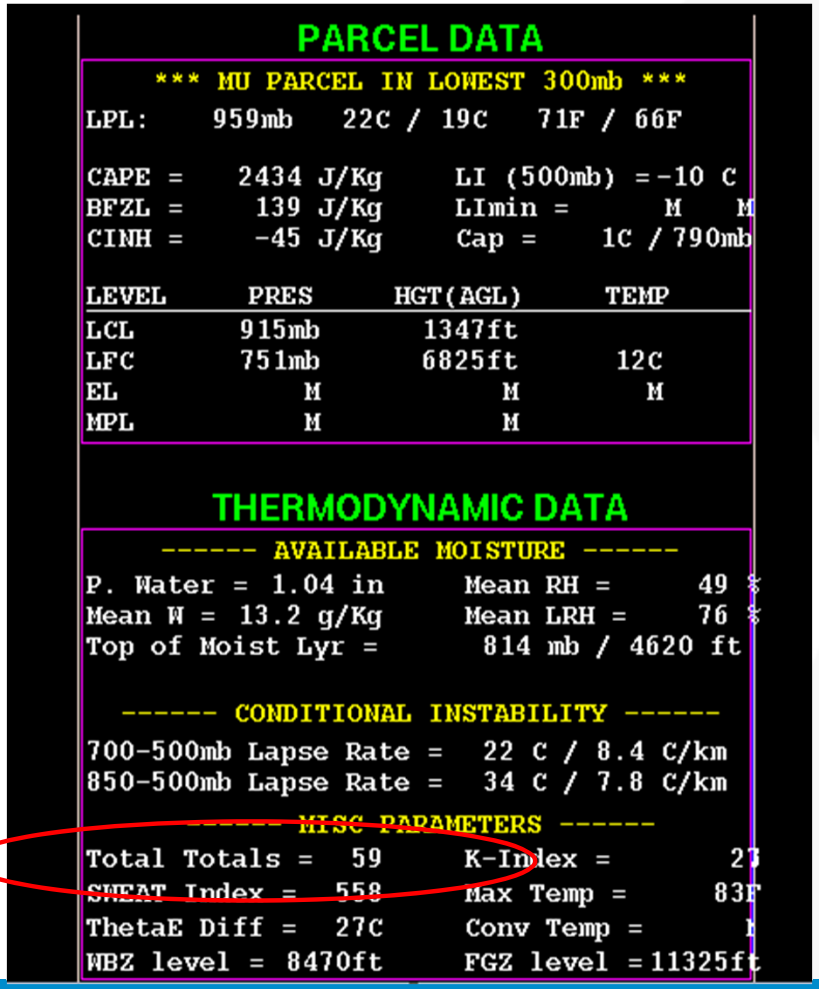
------ MISC PARAMETERS ------

Total Totals = 59 K-Index = 27
SWEAT Index = 558 Max Temp = 83F
ThetaE Diff = 27C Conv Temp = I
WBZ level = 8470ft FGZ level = 11325ft

Meteorological Setup for May 3, 1999, Moore, OK, F5 Tornado



Meteorological Setup for May 3, 1999, Moore, OK, F5 Tornado



PARCEL DATA

*** MU PARCEL IN LOWEST 300mb ***

LPL: 959mb 22C / 19C 71F / 66F

CAPE = 2434 J/Kg LI (500mb) = -10 C
BFZL = 139 J/Kg LImin = M M
CINH = -45 J/Kg Cap = 1C / 790mb

LEVEL	PRES	HGT(AGL)	TEMP
LCL	915mb	1347ft	
LFC	751mb	6825ft	12C
EL	M	M	M
MPL	M	M	

THERMODYNAMIC DATA

------ AVAILABLE MOISTURE ------

P. Water = 1.04 in Mean RH = 49 %
Mean W = 13.2 g/Kg Mean LRH = 76 %
Top of Moist Lyr = 814 mb / 4620 ft

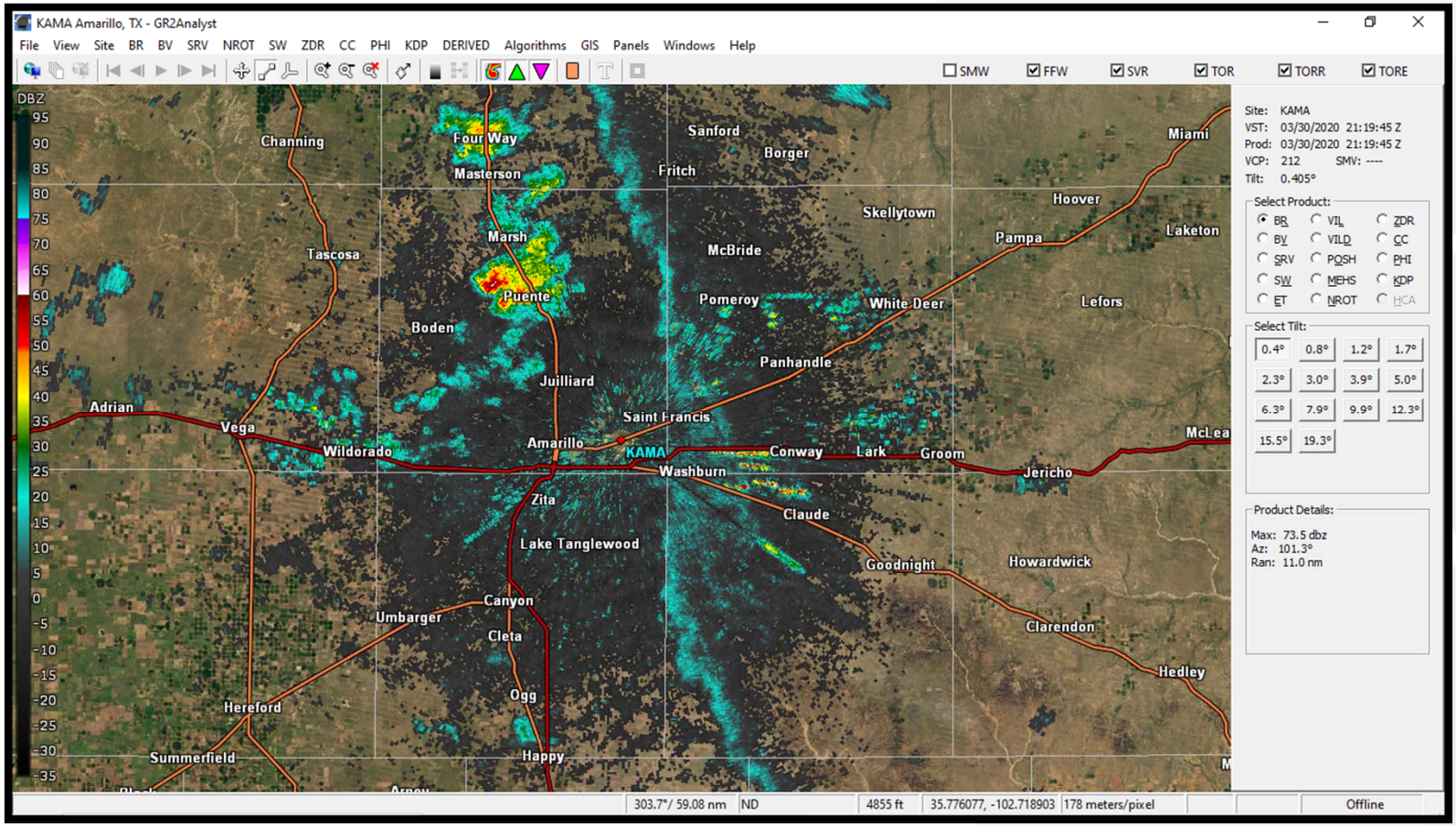
------ CONDITIONAL INSTABILITY ------

700-500mb Lapse Rate = 22 C / 8.4 C/km
850-500mb Lapse Rate = 34 C / 7.8 C/km

------ MISC PARAMETERS ------

Total Totals = 59 K-Index = 27
SWEAT Index = 558 Max Temp = 83F
ThetaE Diff = 27C Conv Temp = M
WBZ level = 8470ft FGZ level = 11325ft

KAMA 88-D – BR Scan – 16:19



Hourly Observations for KAMA on 3/30/20

Daily Observations

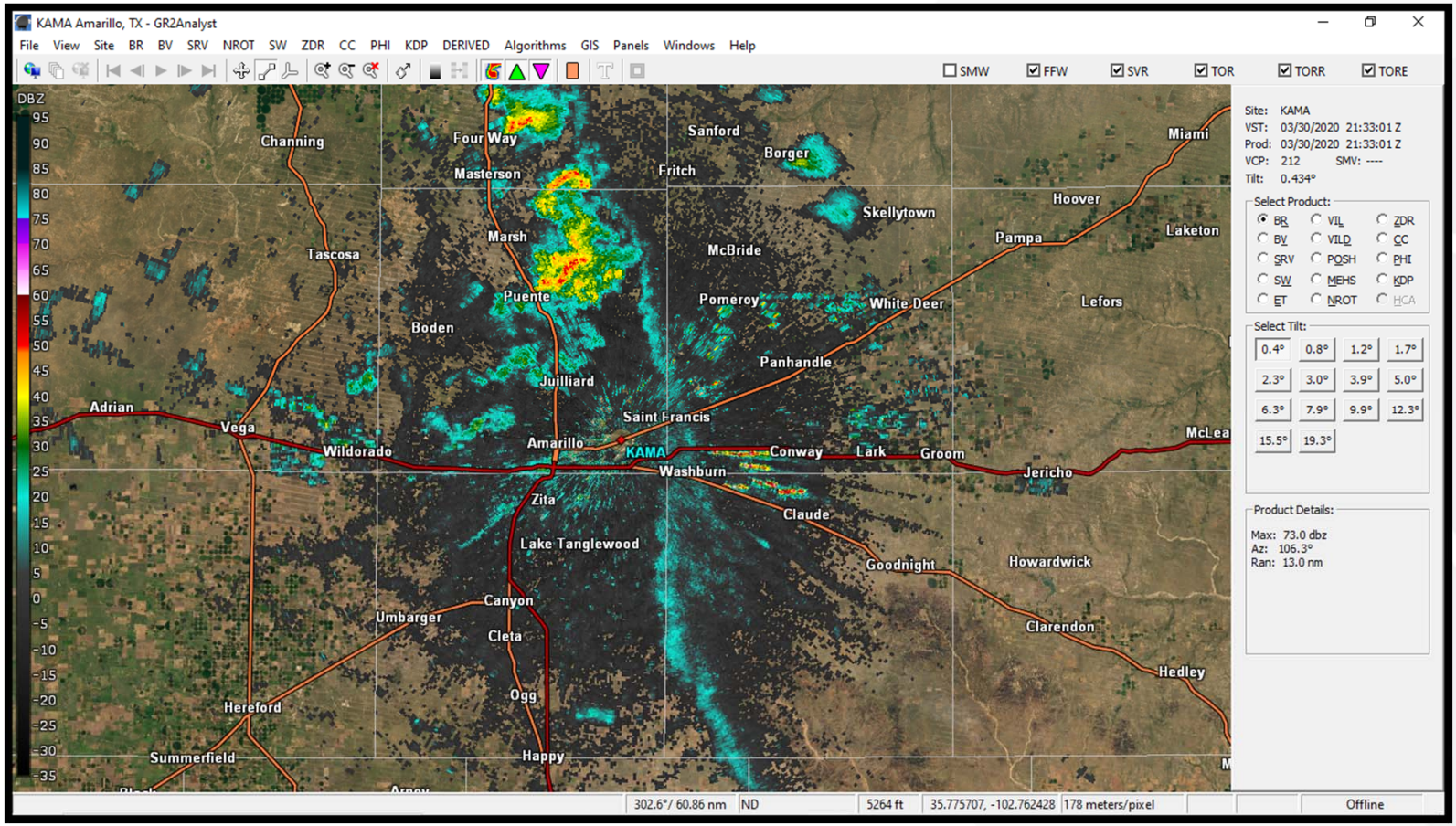
Time	Temperature	Dew Point	Humidity	Wind	Wind Speed	Wind Gust	Pressure	Precip.	Condition
12:53 AM	50 °F	37 °F	61 %	SSE	16 mph	0 mph	26.34 in	0.0 in	Fair
1:53 AM	48 °F	37 °F	66 %	SE	15 mph	0 mph	26.33 in	0.0 in	Fair
2:53 AM	47 °F	38 °F	71 %	SE	13 mph	0 mph	26.33 in	0.0 in	Fair
3:53 AM	45 °F	38 °F	76 %	ESE	12 mph	0 mph	26.32 in	0.0 in	Fair
4:53 AM	44 °F	38 °F	79 %	ESE	10 mph	0 mph	26.30 in	0.0 in	Fair
5:53 AM	45 °F	40 °F	82 %	SE	14 mph	0 mph	26.29 in	0.0 in	Fair
6:53 AM	45 °F	40 °F	82 %	SE	14 mph	0 mph	26.28 in	0.0 in	Fair
7:53 AM	45 °F	41 °F	86 %	SE	13 mph	0 mph	26.29 in	0.0 in	Fair
8:53 AM	46 °F	42 °F	86 %	SE	8 mph	0 mph	26.29 in	0.0 in	Fair
9:53 AM	52 °F	43 °F	71 %	SSE	12 mph	0 mph	26.30 in	0.0 in	Mostly Cloudy
10:53 AM	58 °F	44 °F	60 %	SSE	18 mph	0 mph	26.29 in	0.0 in	Fair
11:53 AM	61 °F	43 °F	52 %	S	22 mph	28 mph	26.25 in	0.0 in	Fair / Windy
12:53 PM	64 °F	41 °F	43 %	S	16 mph	0 mph	26.24 in	0.0 in	Fair
1:53 PM	65 °F	39 °F	39 %	SSW	14 mph	20 mph	26.21 in	0.0 in	Partly Cloudy
2:53 PM	69 °F	40 °F	35 %	SW	15 mph	18 mph	26.18 in	0.0 in	Fair
3:53 PM	70 °F	38 °F	31 %	S	16 mph	23 mph	26.15 in	0.0 in	Fair
4:53 PM	61 °F	35 °F	38 %	NW	10 mph	30 mph	26.12 in	0.0 in	Light Rain
5:26 PM	58 °F	49 °F	72 %	E	22 mph	41 mph	26.14 in	0.0 in	Cloudy / Windy
5:53 PM	57 °F	49 °F	74 %	ESE	20 mph	0 mph	26.16 in	0.0 in	Cloudy
6:53 PM	54 °F	48 °F	80 %	E	22 mph	0 mph	26.18 in	0.0 in	Mostly Cloudy / Windy

Hourly Observations for KAMA on 3/30/20

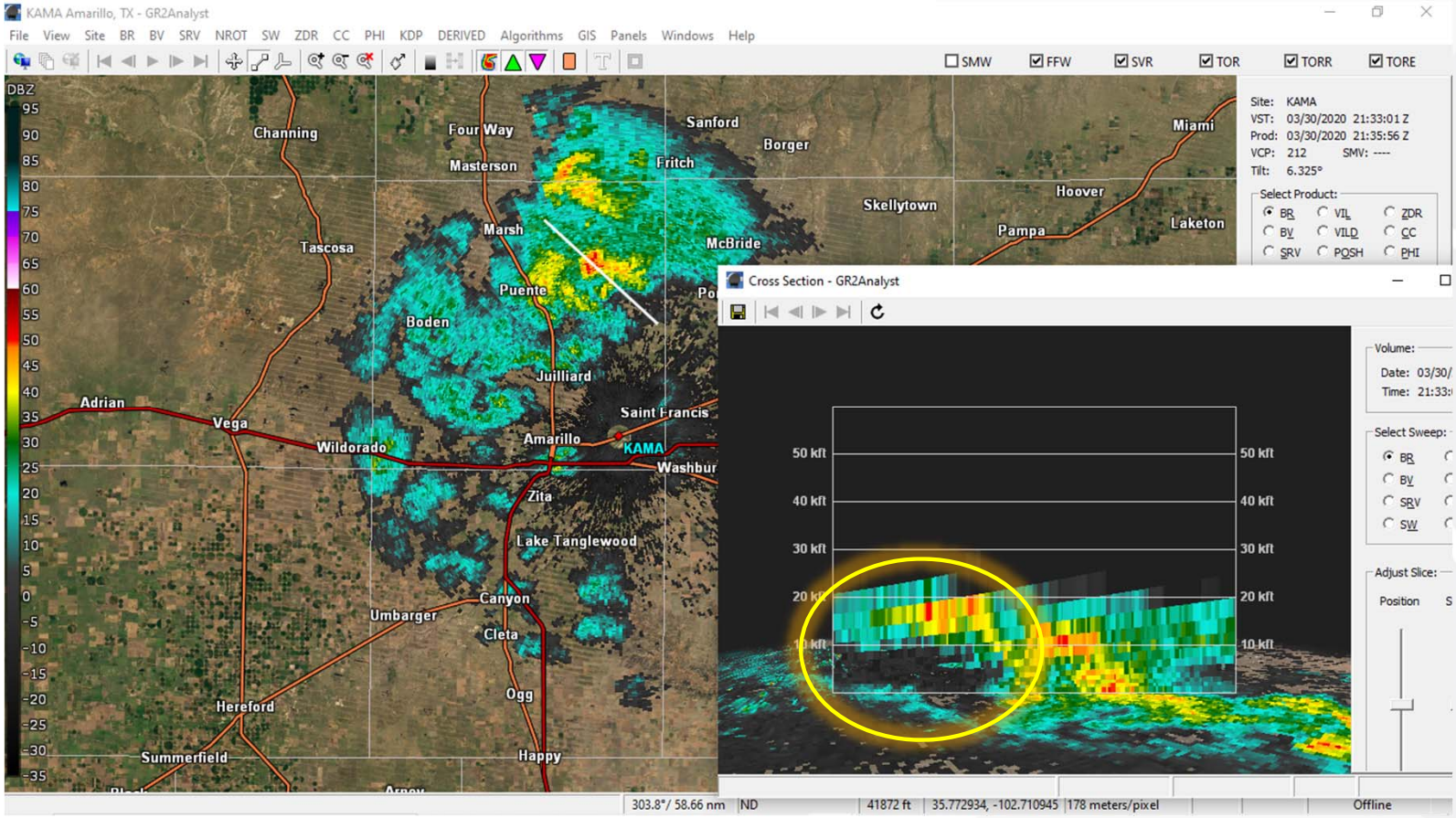
Daily Observations

Time	Temperature	Dew Point	Humidity	Wind	Wind Speed	Wind Gust	Pressure	Precip.	Condition
12:53 AM	50 °F	37 °F	61 %	SSE	16 mph	0 mph	26.34 in	0.0 in	Fair
1:53 AM	48 °F	37 °F	66 %	SE	15 mph	0 mph	26.33 in	0.0 in	Fair
2:53 AM	47 °F	38 °F	71 %	SE	13 mph	0 mph	26.33 in	0.0 in	Fair
3:53 AM	45 °F	38 °F	76 %	ESE	12 mph	0 mph	26.32 in	0.0 in	Fair
4:53 AM	44 °F	38 °F	79 %	ESE	10 mph	0 mph	26.30 in	0.0 in	Fair
5:53 AM	45 °F	40 °F	82 %	SE	14 mph	0 mph	26.29 in	0.0 in	Fair
6:53 AM	45 °F	40 °F	82 %	SE	14 mph	0 mph	26.28 in	0.0 in	Fair
7:53 AM	45 °F	41 °F	86 %	SE	13 mph	0 mph	26.29 in	0.0 in	Fair
8:53 AM	46 °F	42 °F	86 %	SE	8 mph	0 mph	26.29 in	0.0 in	Fair
9:53 AM	52 °F	43 °F	71 %	SSE	12 mph	0 mph	26.30 in	0.0 in	Mostly Cloudy
10:53 AM	58 °F	44 °F	60 %	SSE	18 mph	0 mph	26.29 in	0.0 in	Fair
11:53 AM	61 °F	43 °F	52 %	S	22 mph	28 mph	26.25 in	0.0 in	Fair / Windy
12:53 PM	64 °F	41 °F	43 %	S	16 mph	0 mph	26.24 in	0.0 in	Fair
1:53 PM	65 °F	39 °F	39 %	SSW	14 mph	20 mph	26.21 in	0.0 in	Partly Cloudy
2:53 PM	69 °F	40 °F	35 %	SW	15 mph	18 mph	26.18 in	0.0 in	Fair
3:53 PM	70 °F	38 °F	31 %	S	16 mph	23 mph	26.15 in	0.0 in	Fair
4:53 PM	61 °F	35 °F	38 %	NW	10 mph	30 mph	26.12 in	0.0 in	Light Rain
5:26 PM	58 °F	49 °F	72 %	E	22 mph	41 mph	26.14 in	0.0 in	Cloudy / Windy
5:53 PM	57 °F	49 °F	74 %	ESE	20 mph	0 mph	26.16 in	0.0 in	Cloudy
6:53 PM	54 °F	48 °F	80 %	E	22 mph	0 mph	26.18 in	0.0 in	Mostly Cloudy / Windy

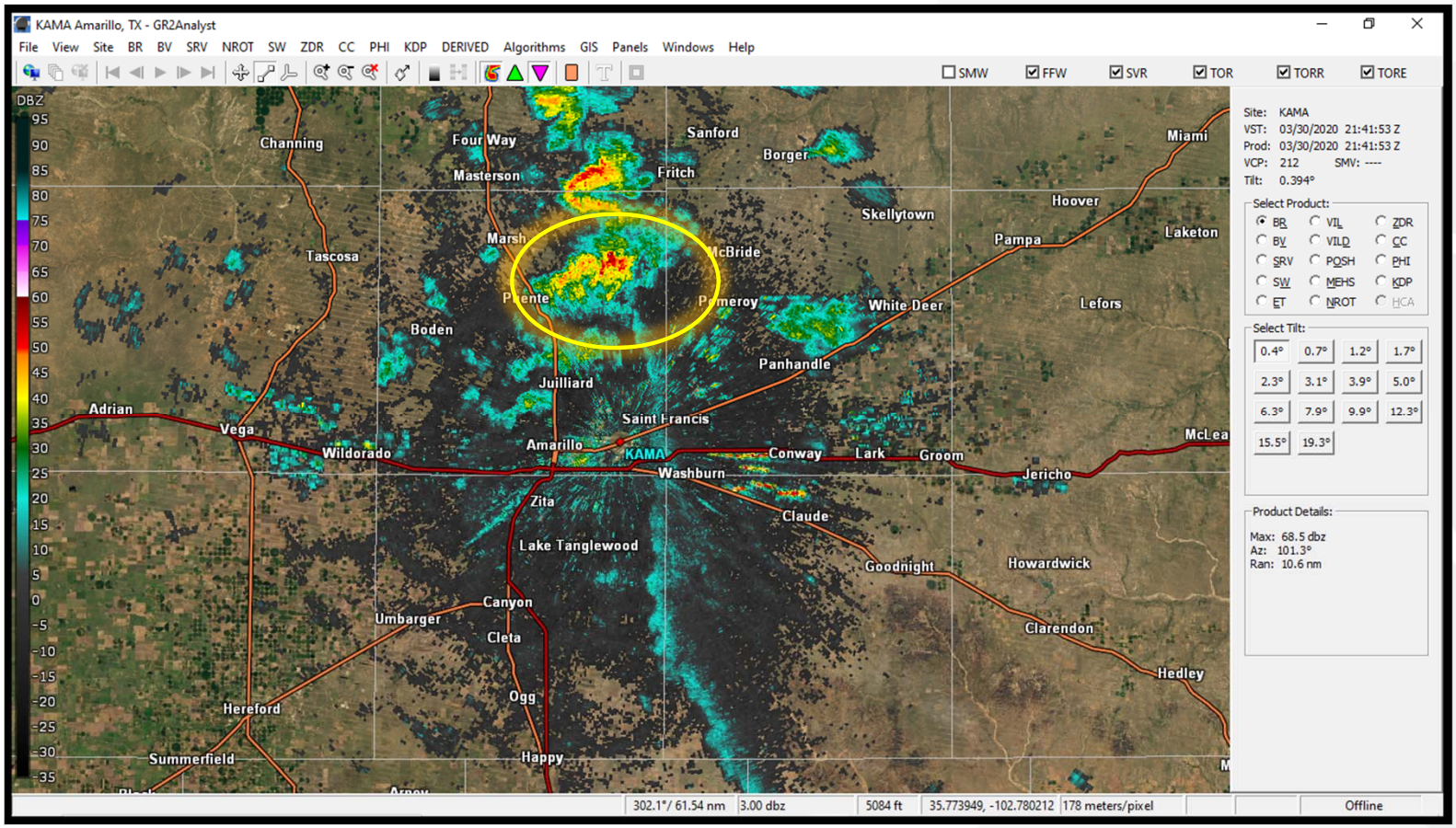
KAMA 88-D – BR Scan (0.4 Degree Tilt) – 16:33



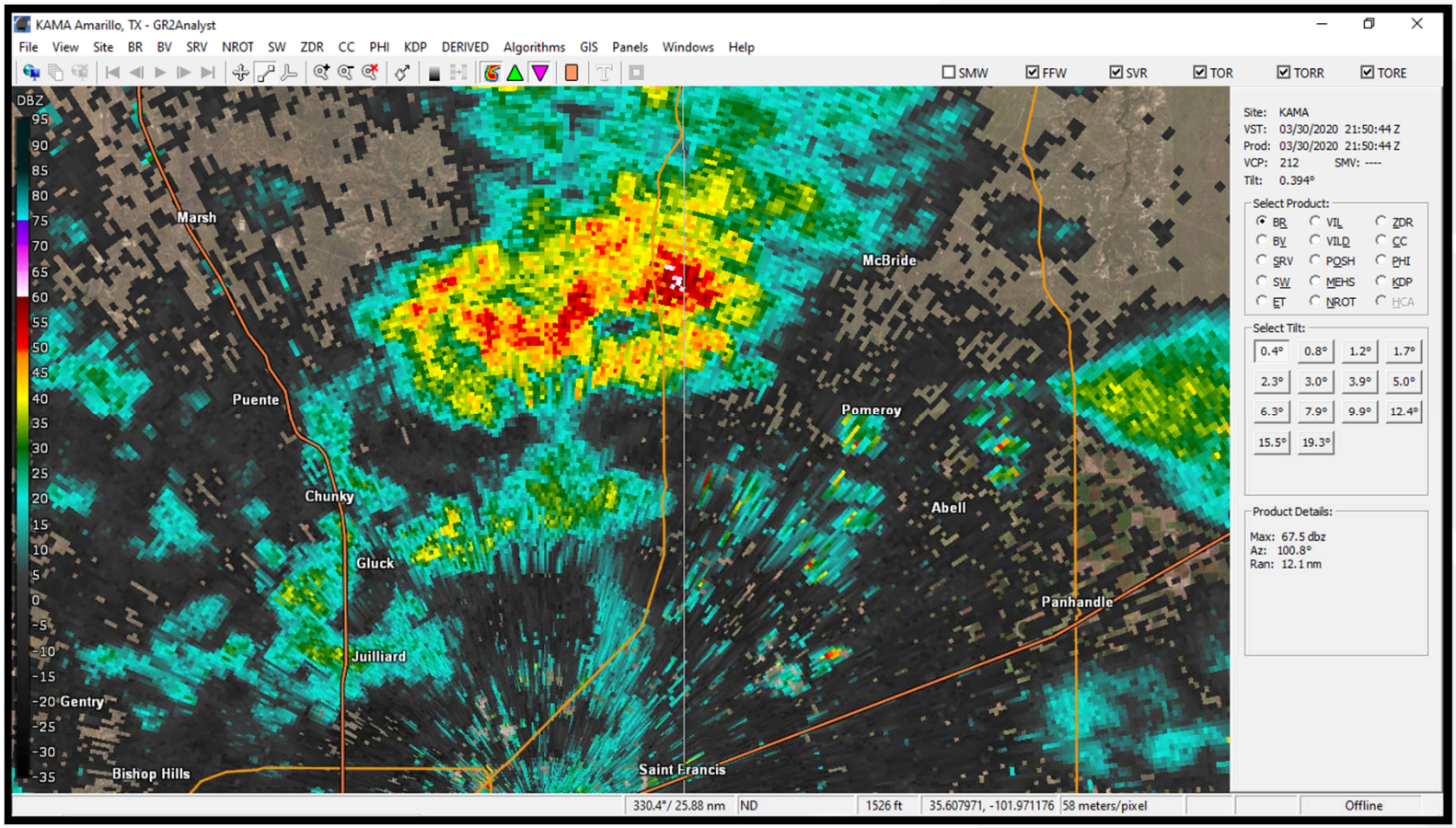
KAMA 88-D – Cross Section Scan (6.4 Degree Tilt) 16:33



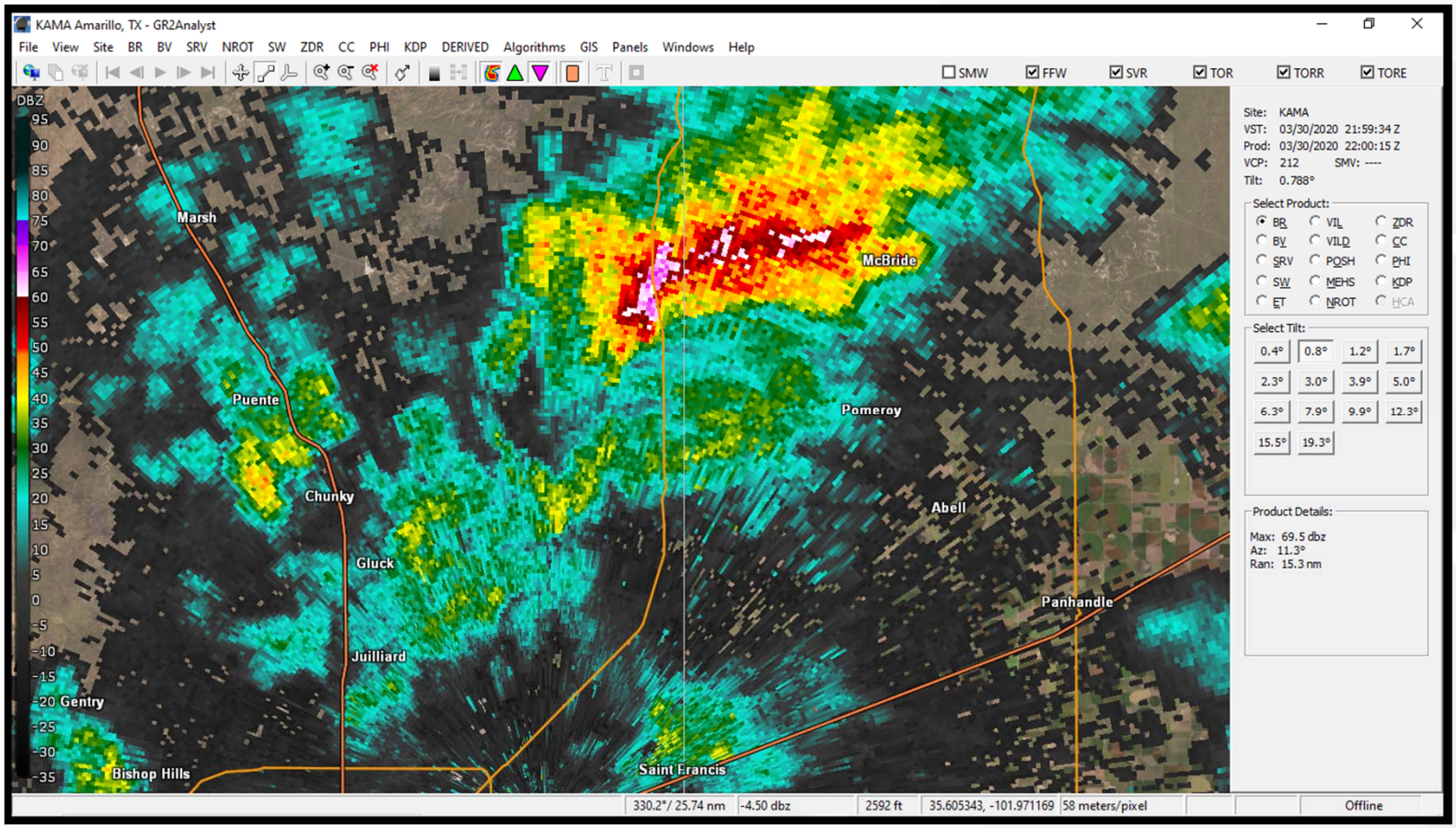
KAMA 88-D – BR Scan (0.4 Degree Tilt) 16:41



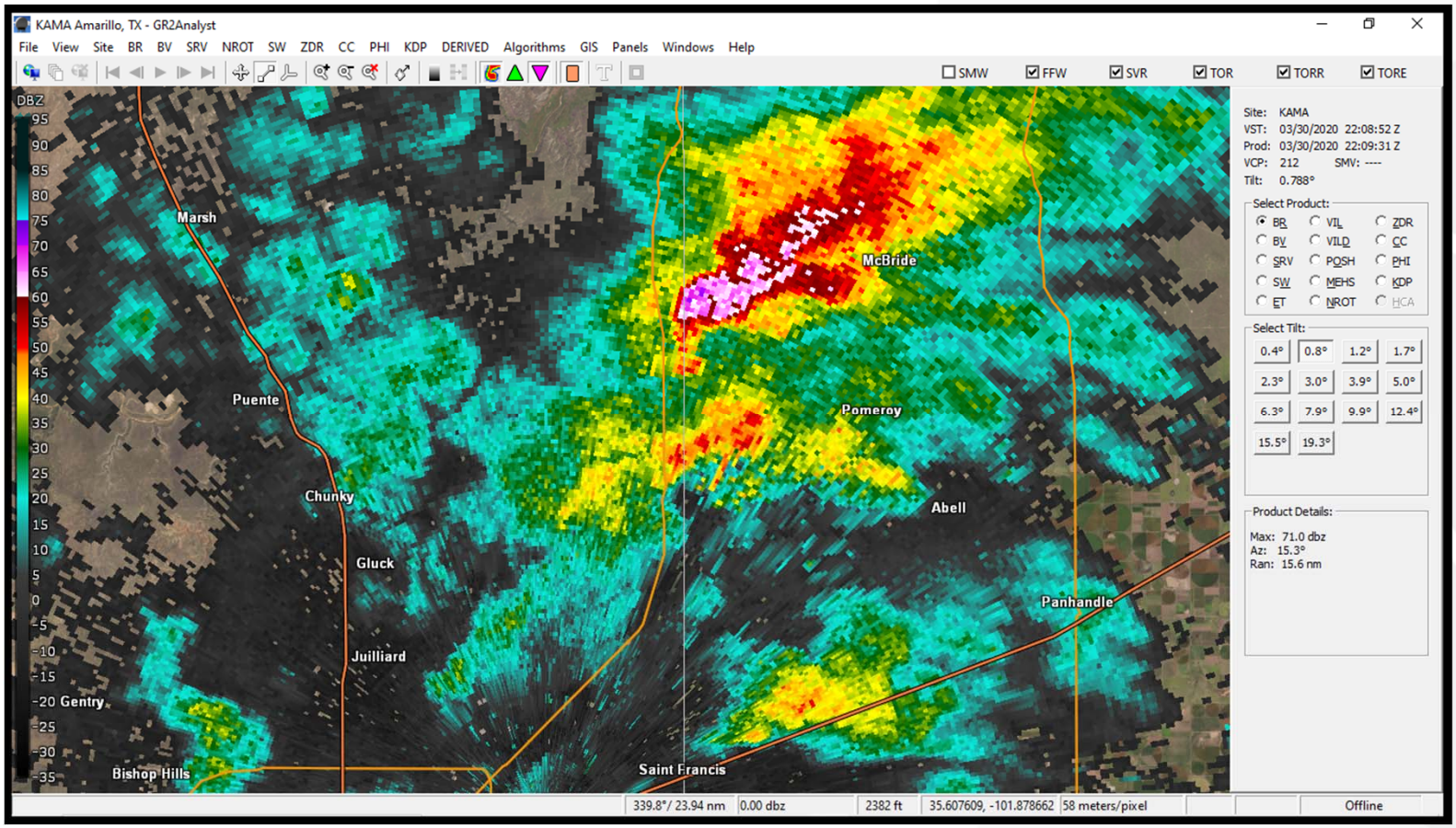
KAMA 88-D – BR Scan (0.4 Degree Tilt) 16:50



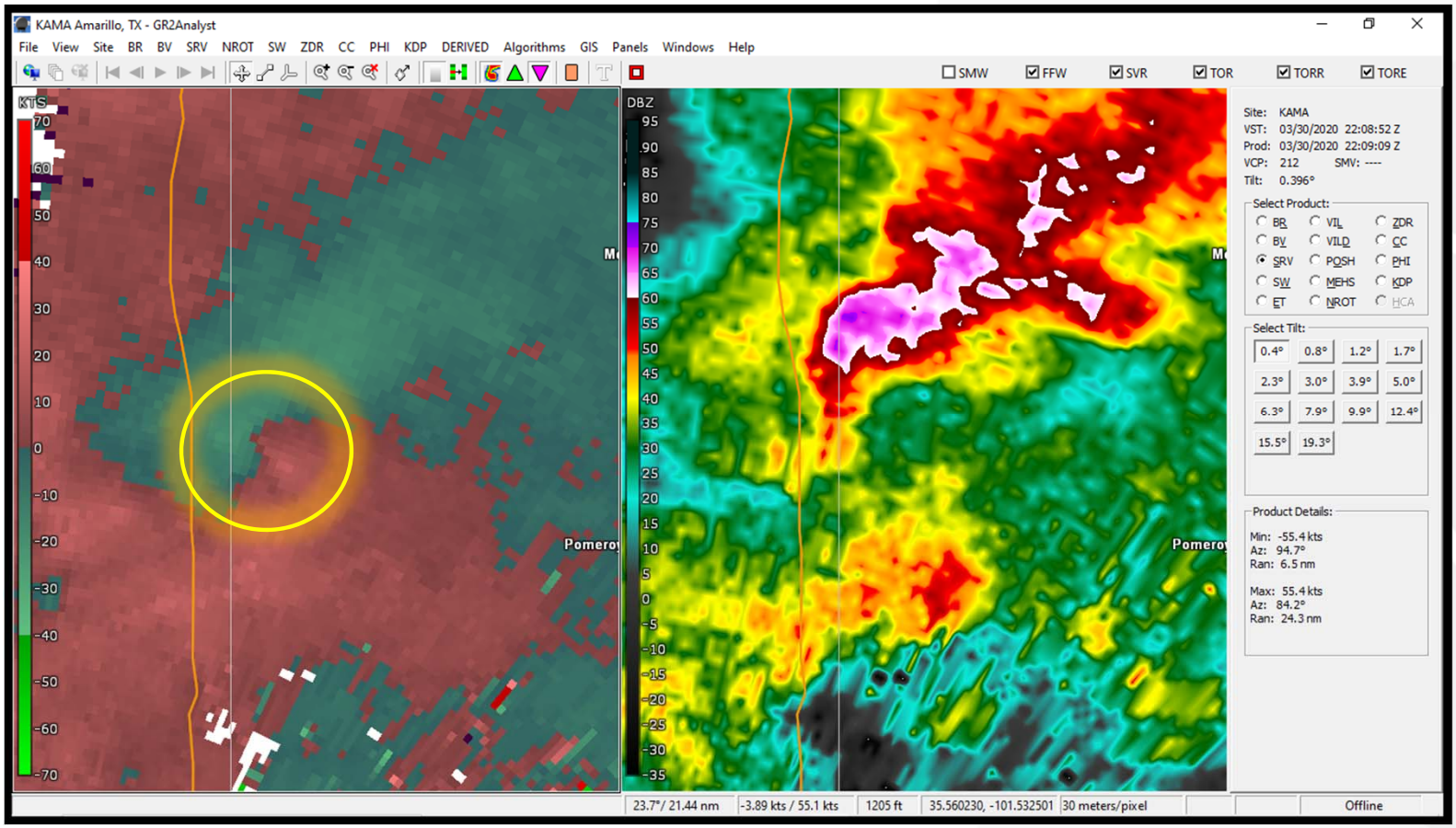
KAMA 88-D – BR Scan (0.8 Degree Tilt) 16:59



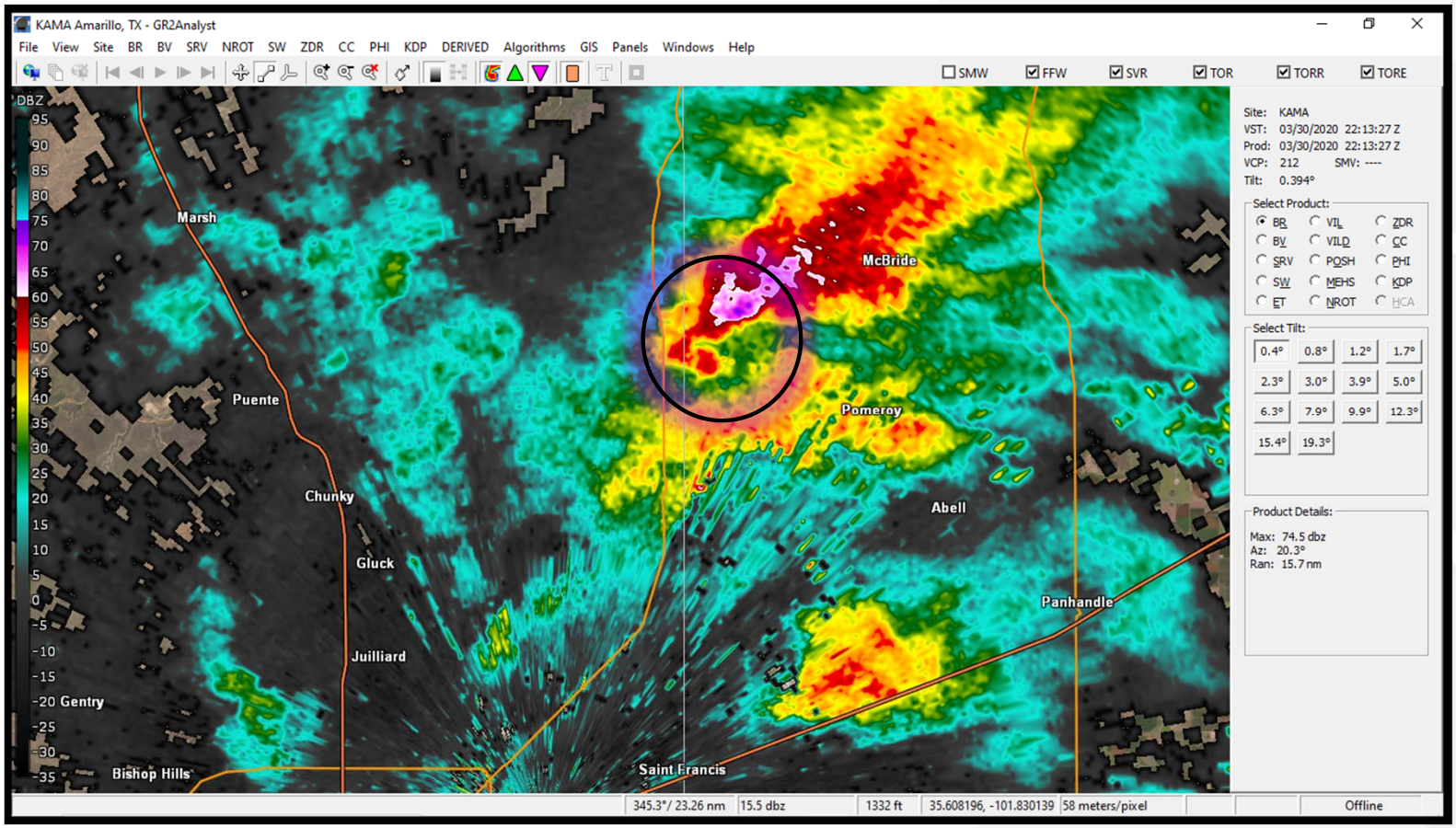
KAMA 88-D – BR Scan (0.8 Degree Tilt) 17:08



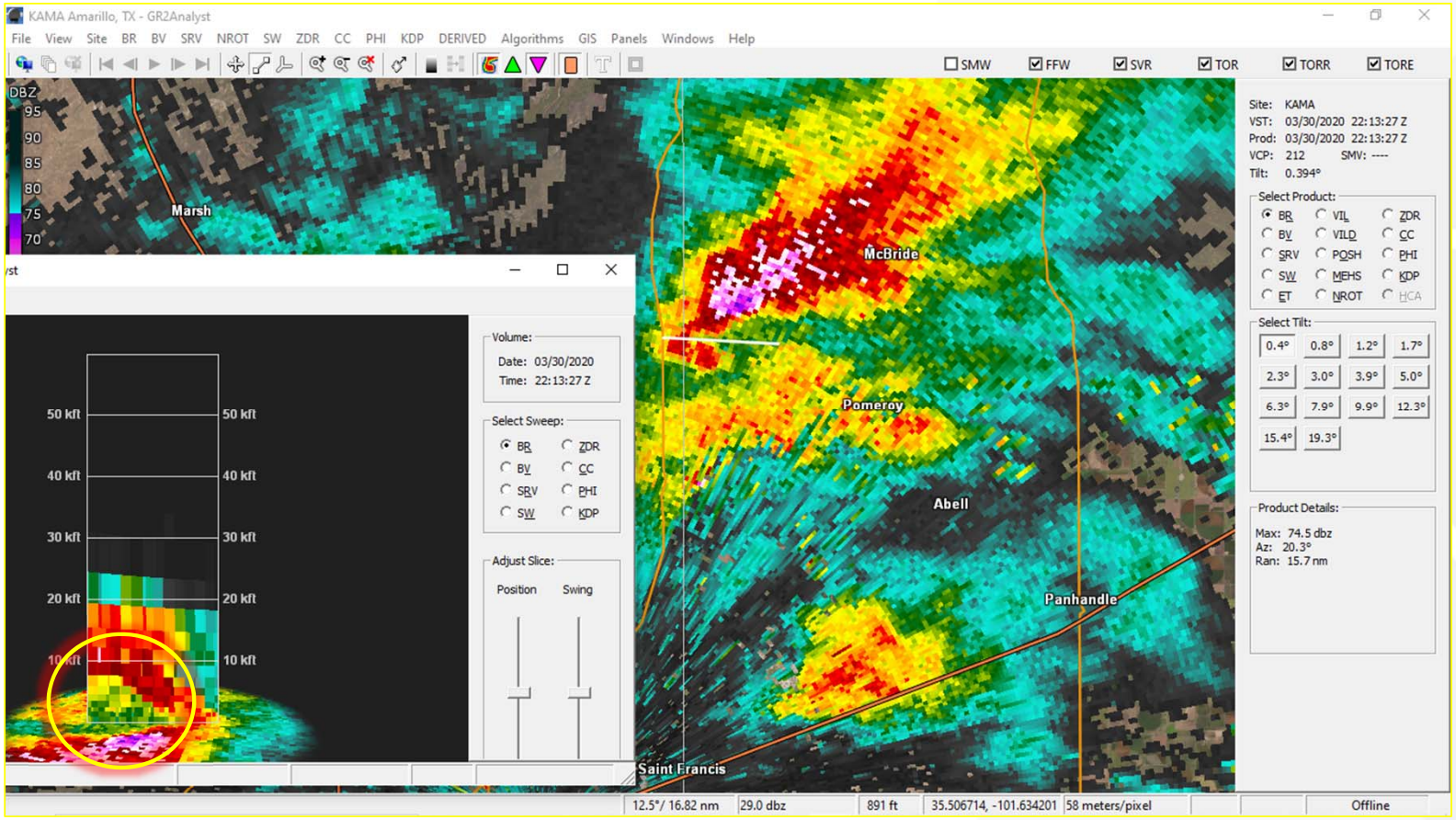
KAMA 88-D – Dual Display (SRV & BR 0.4 Degree Tilt) 17:08



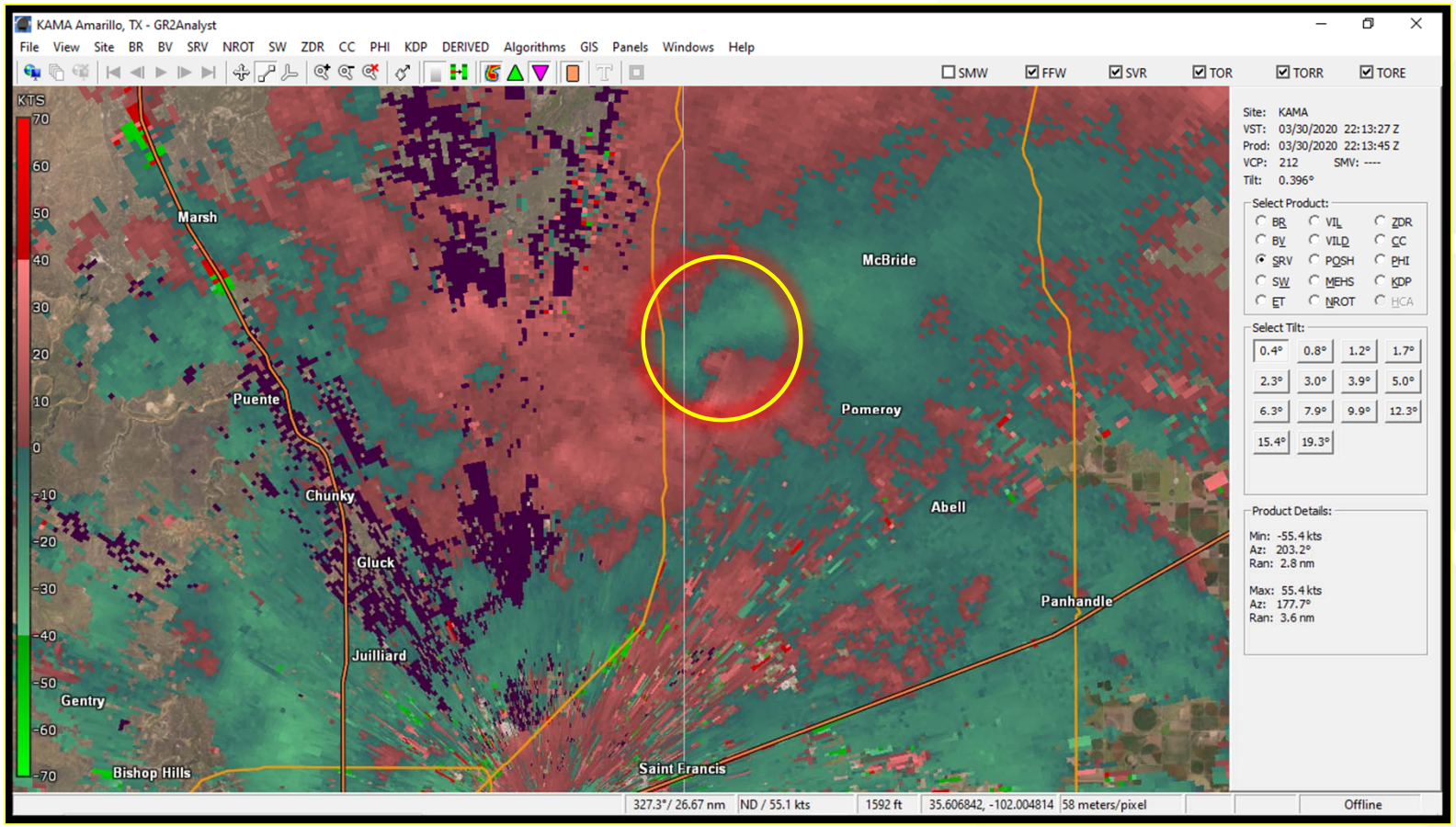
KAMA 88-D – BR Scan (0.4 Degree Tilt) 17:13



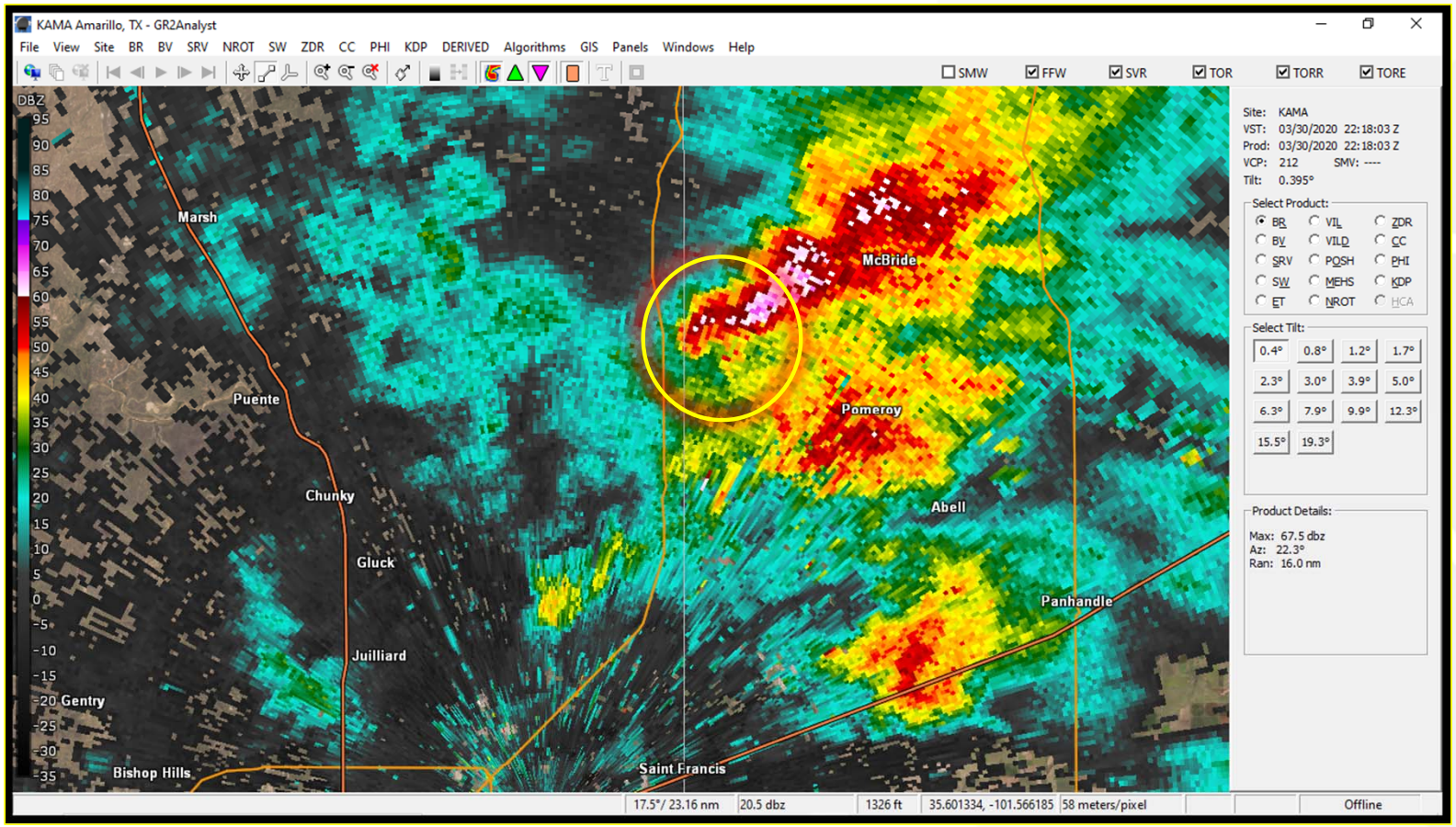
KAMA 88-D – Cross-Section Scan (0.4 Degree Tilt) 17:13



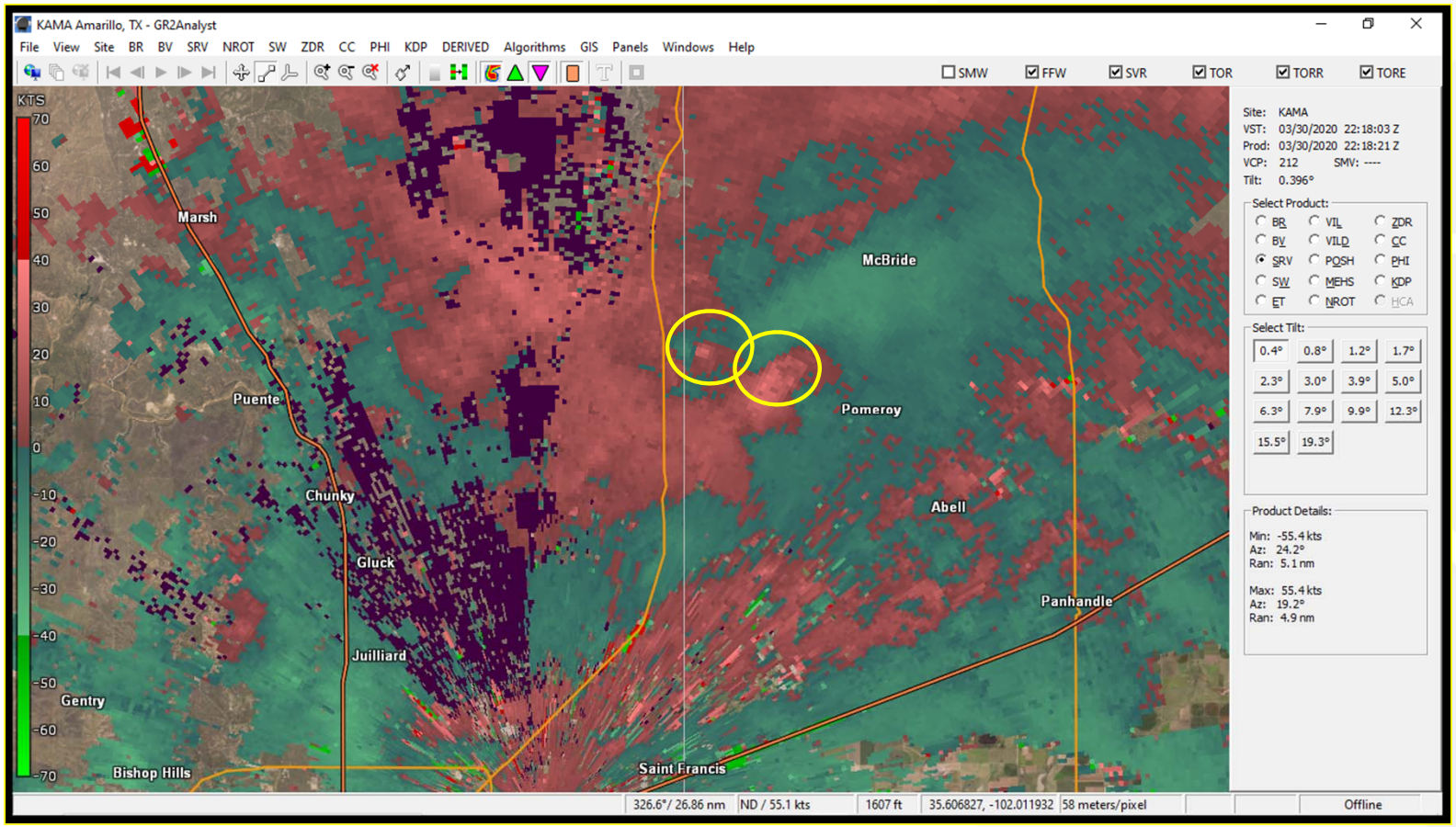
KAMA 88-D – BR Scan (0.4 Degree Tilt) 17:13



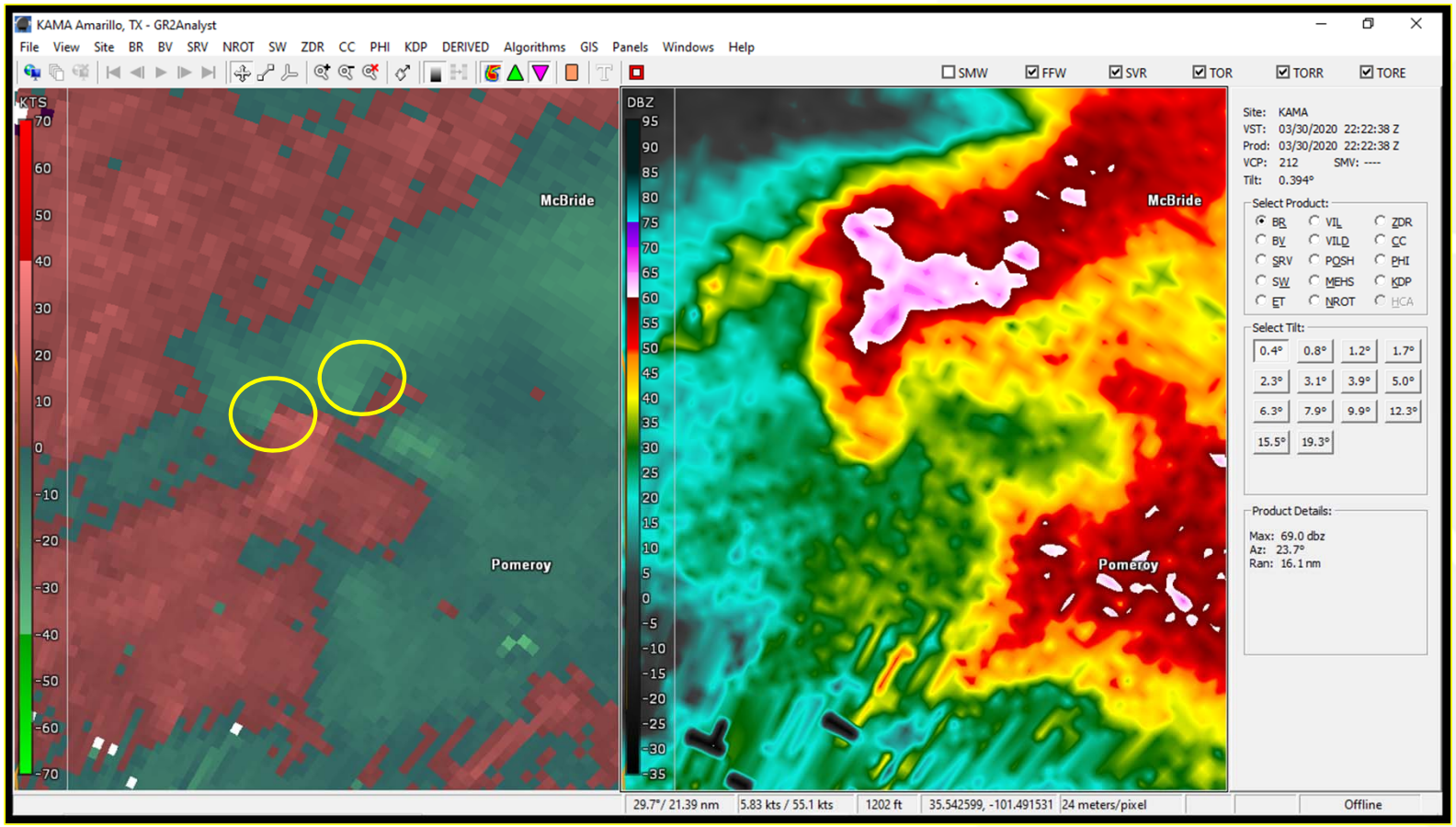
KAMA 88-D – BR Scan (0.4 Degree Tilt) 17:18



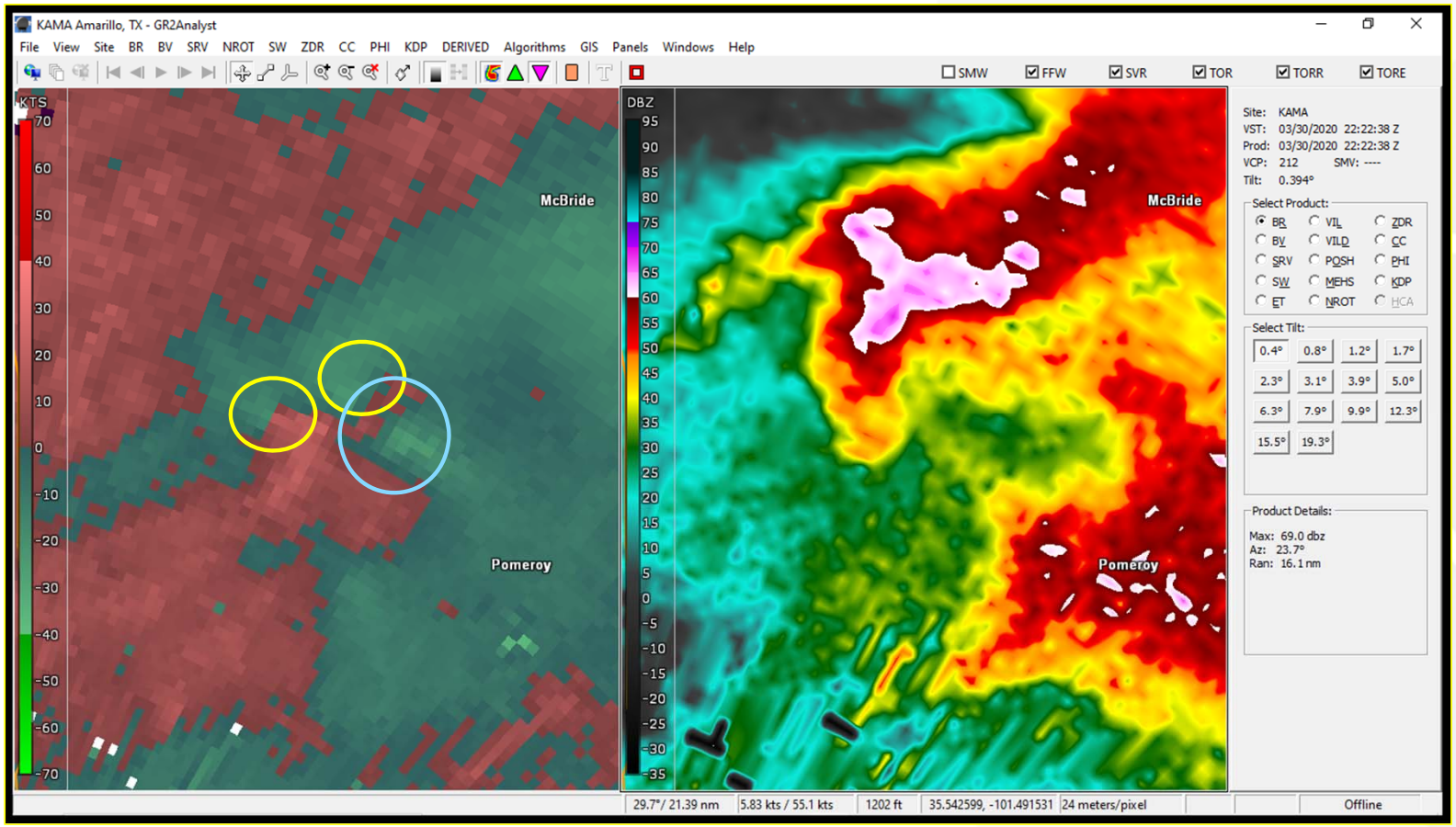
KAMA 88-D – SRV Scan (0.4 Degree Tilt) 17:18



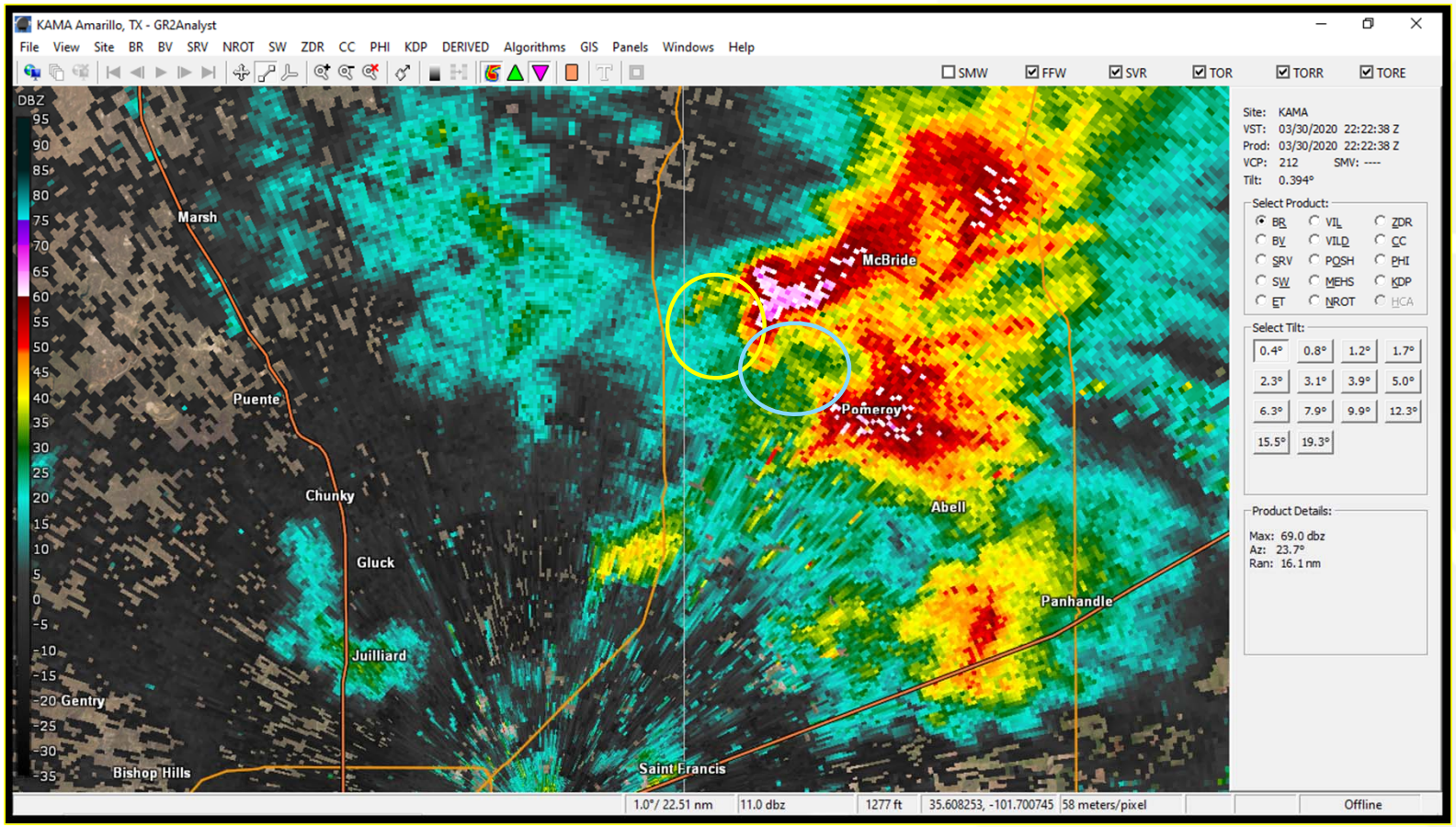
KAMA 88-D – SRV & BR Scan (0.4 Degree Tilt) 17:22



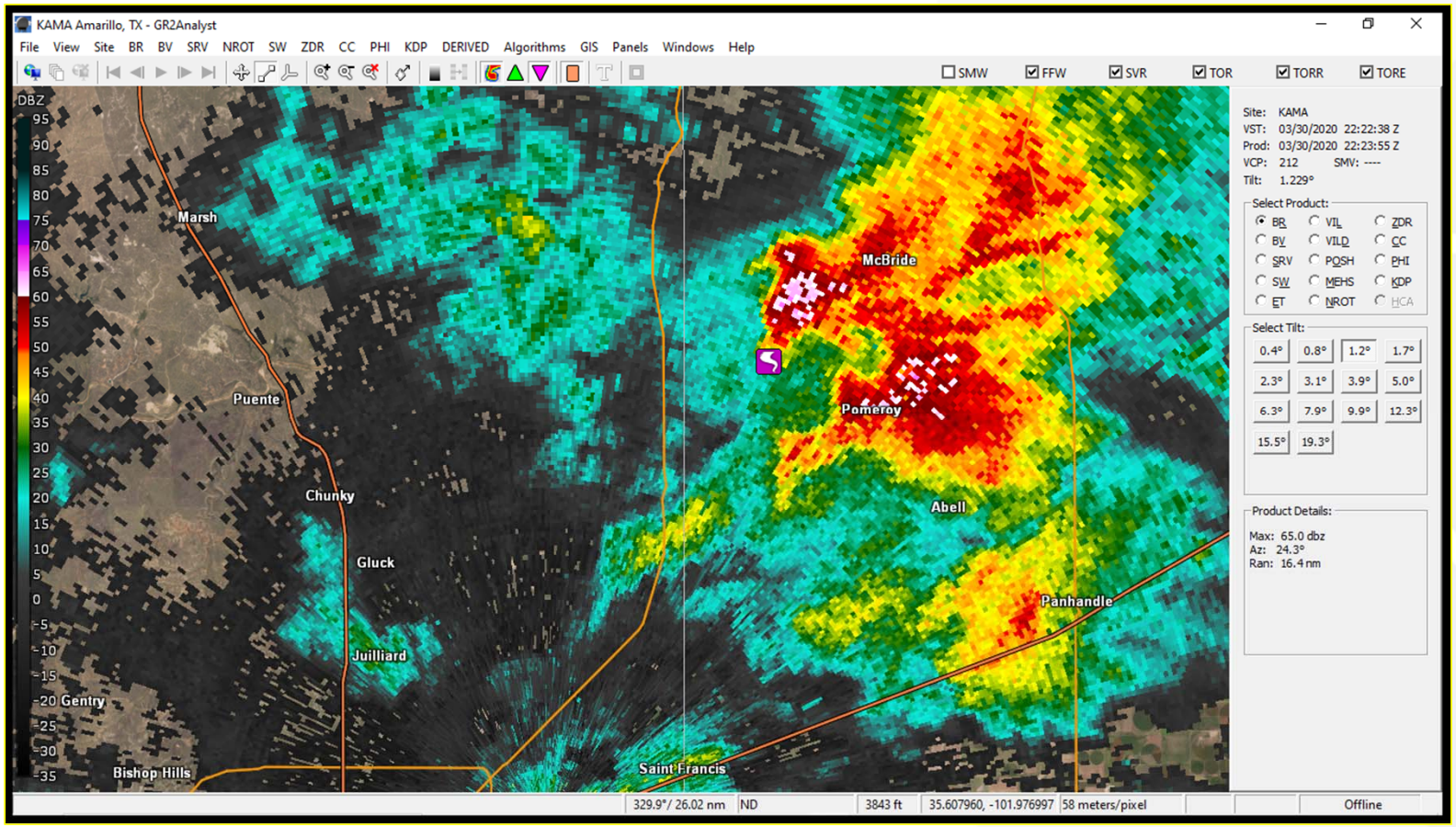
KAMA 88-D – SRV & BR Scan (0.4 Degree Tilt) 17:22



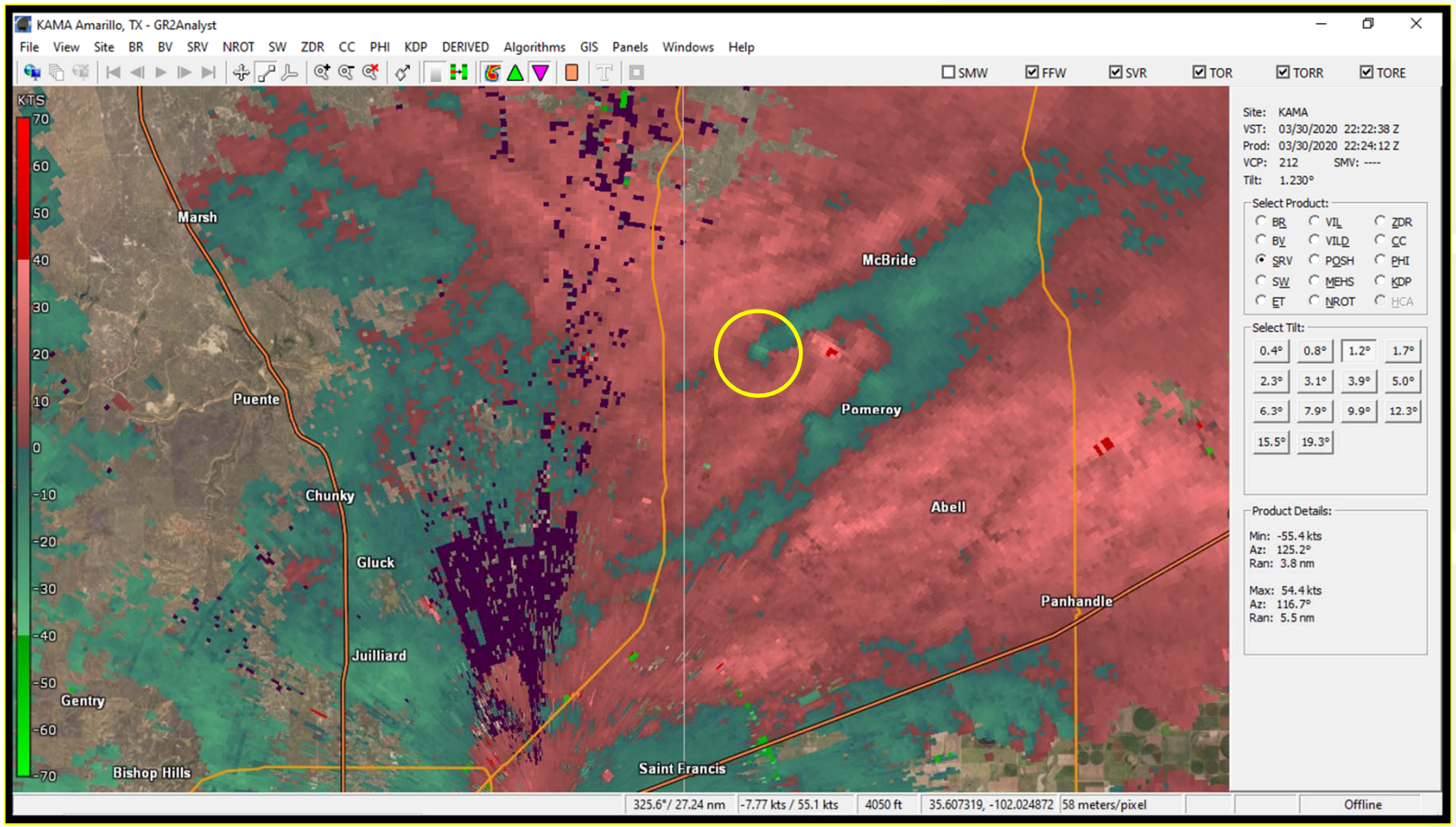
KAMA 88-D – SRV & BR Scan (0.4 Degree Tilt) 17:22



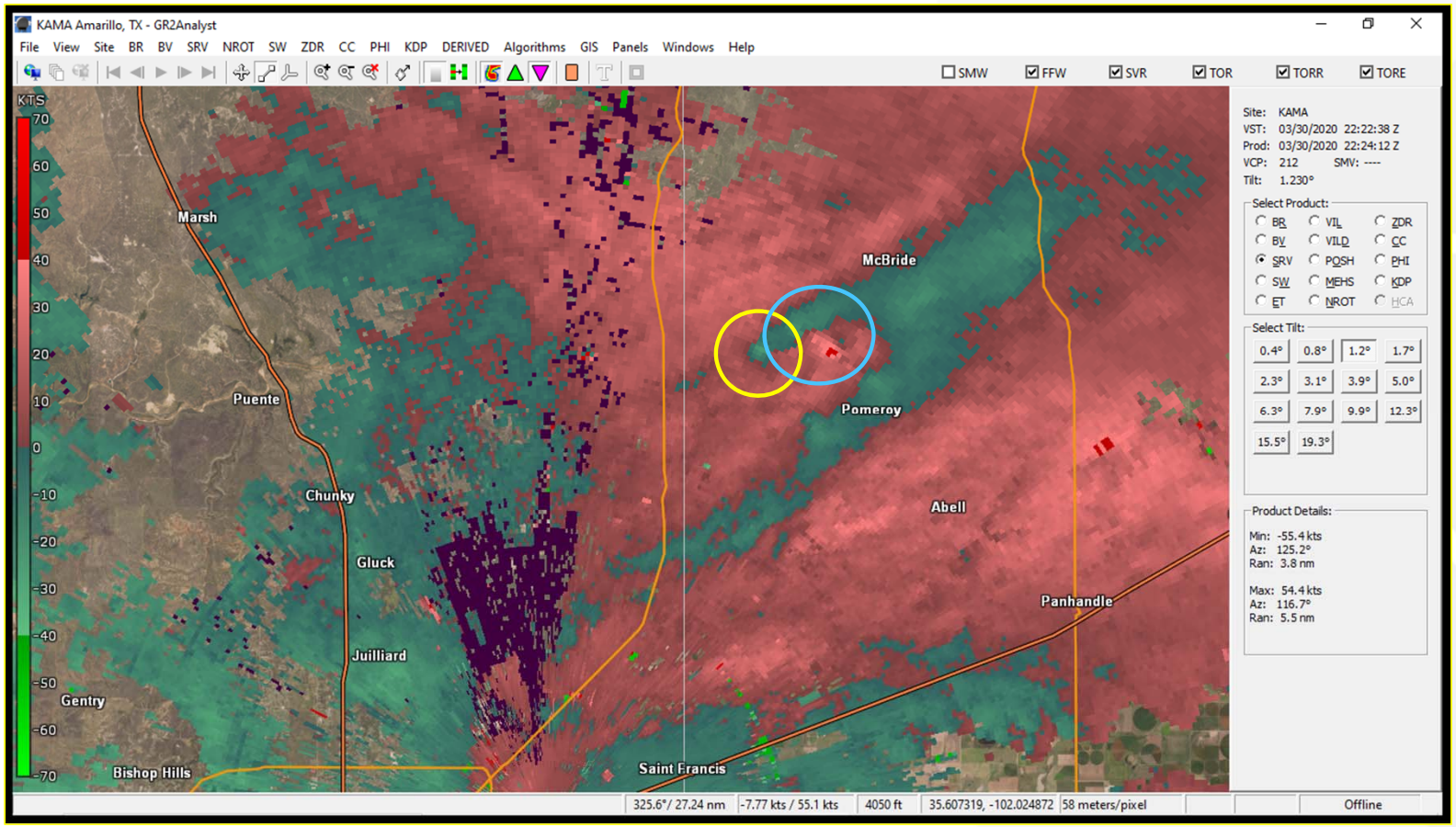
KAMA 88-D – SRV & BR Scan (1.2 Degree Tilt) 17:22



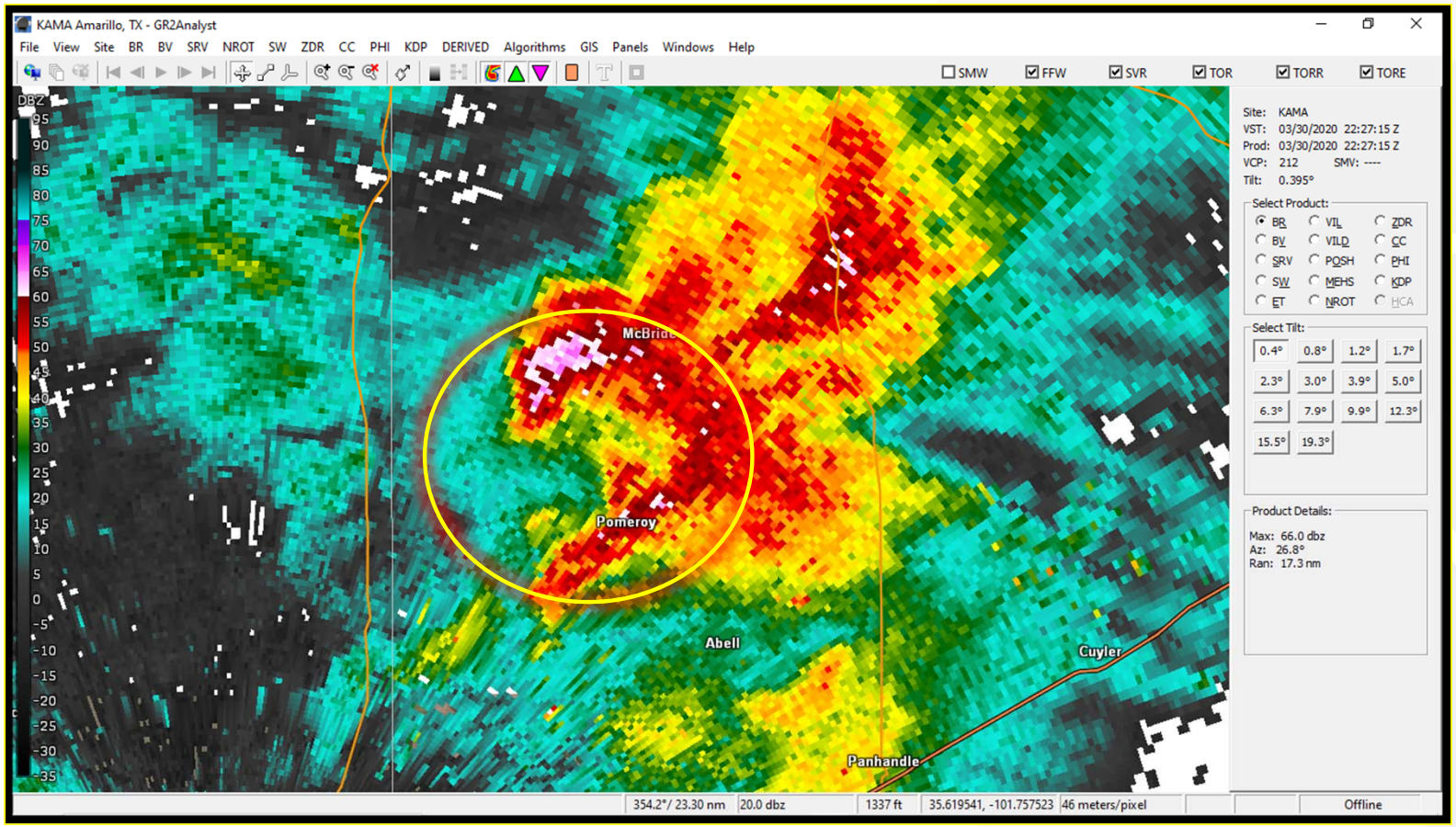
KAMA 88-D – SRV Scan (1.2 Degree Tilt) 17:22



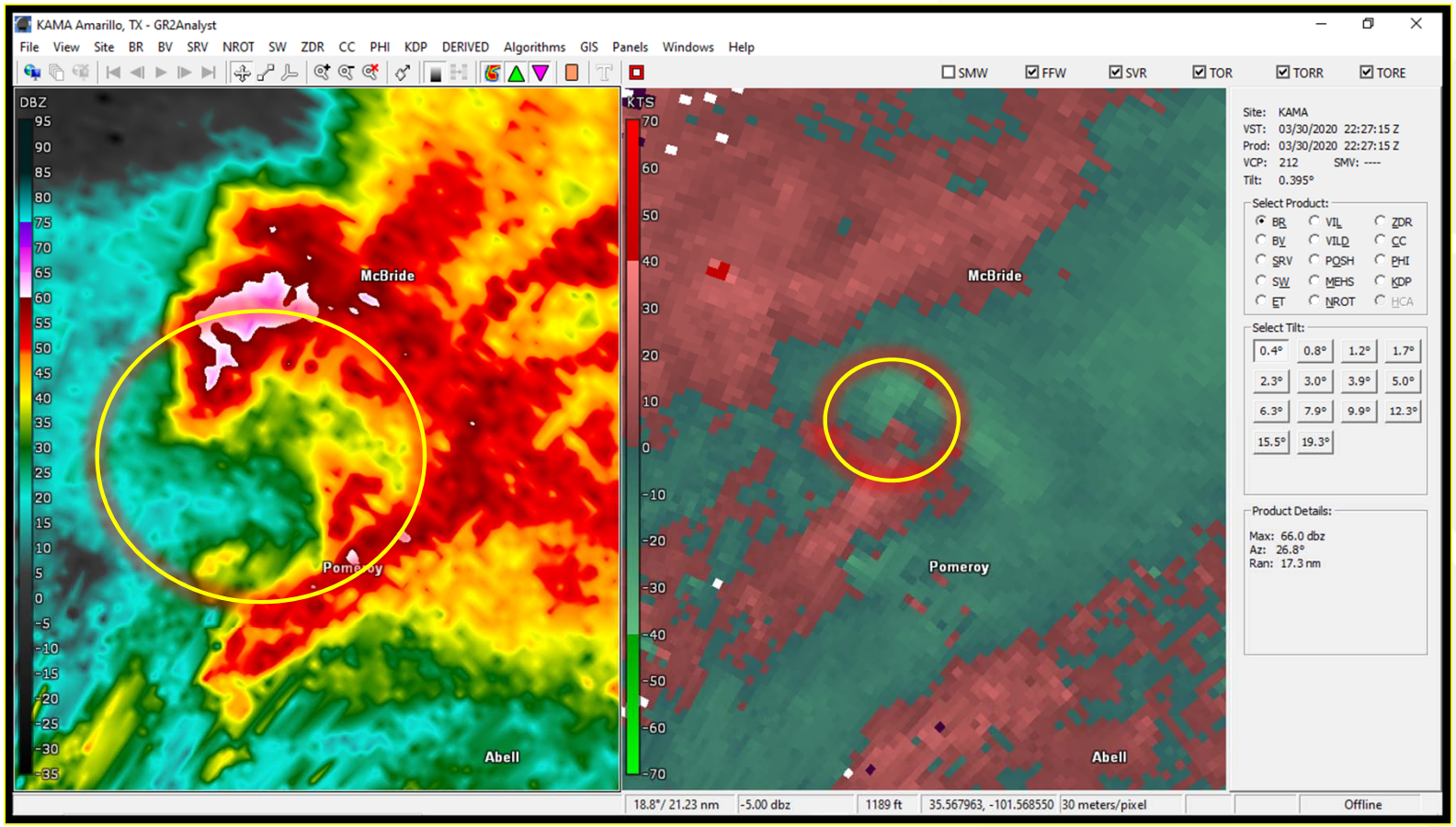
KAMA 88-D – SRV Scan (1.2 Degree Tilt) 17:22



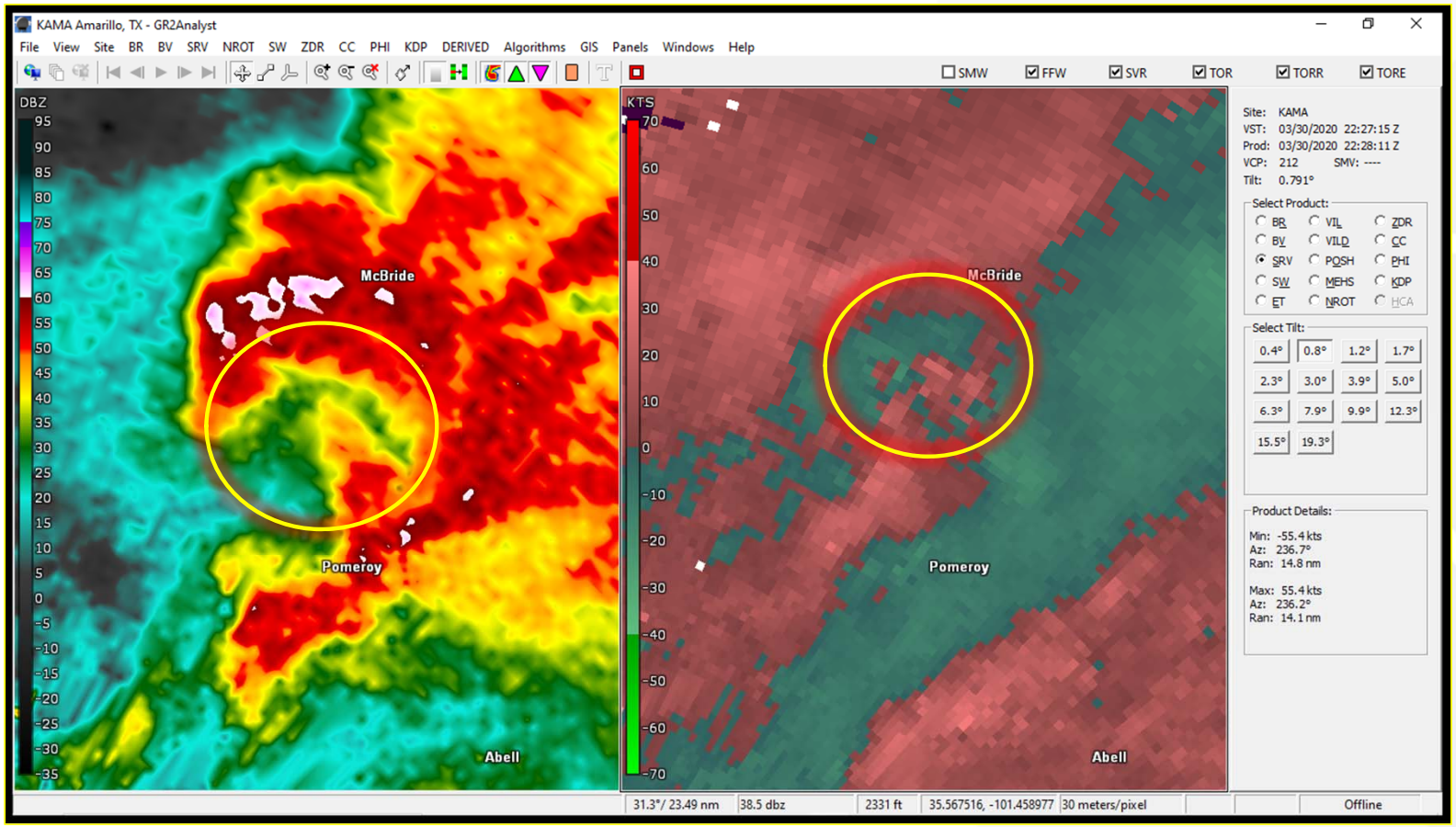
KAMA 88-D – BR Scan (0.4 Degree Tilt) 17:27



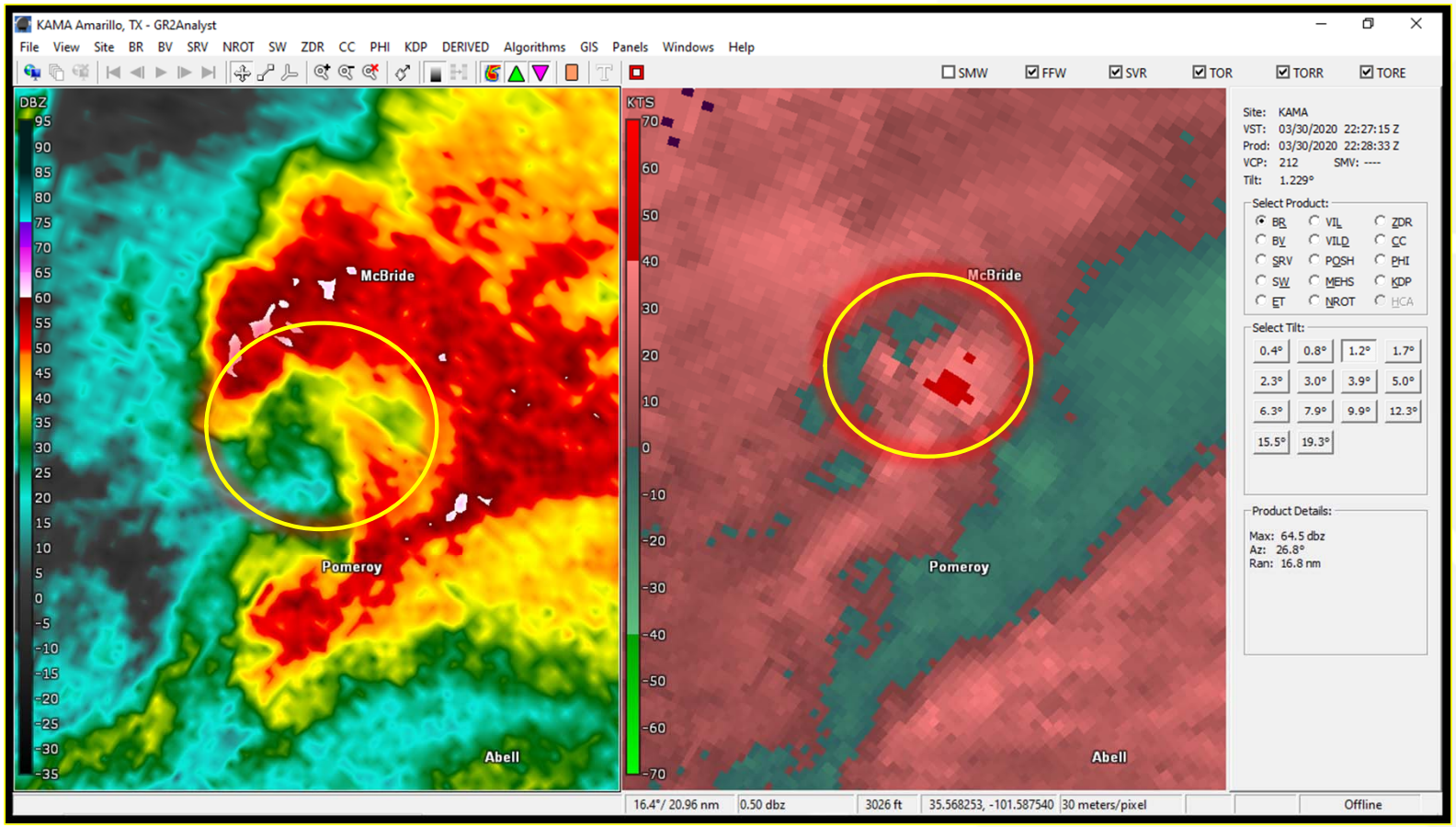
KAMA 88-D – BR & SRV Scan (0.4 Degree Tilt) 17:27



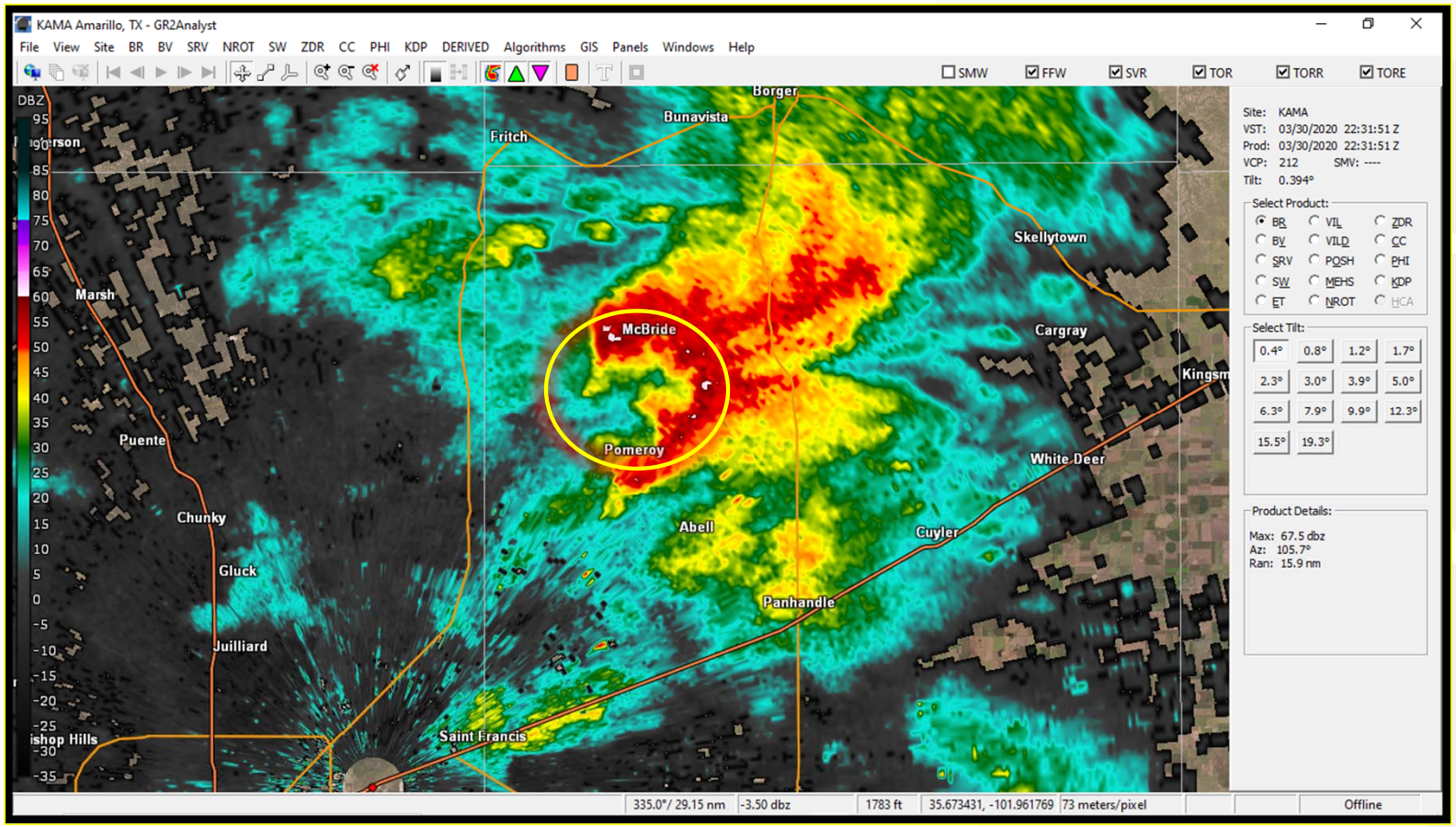
KAMA 88-D – BR & SRV Scan (0.8 Degree Tilt) 17:27



KAMA 88-D – BR & SRV Scan (1.2 Degree Tilt) 17:27



KAMA 88-D – BR (0.4 Degree Tilt) 17:31

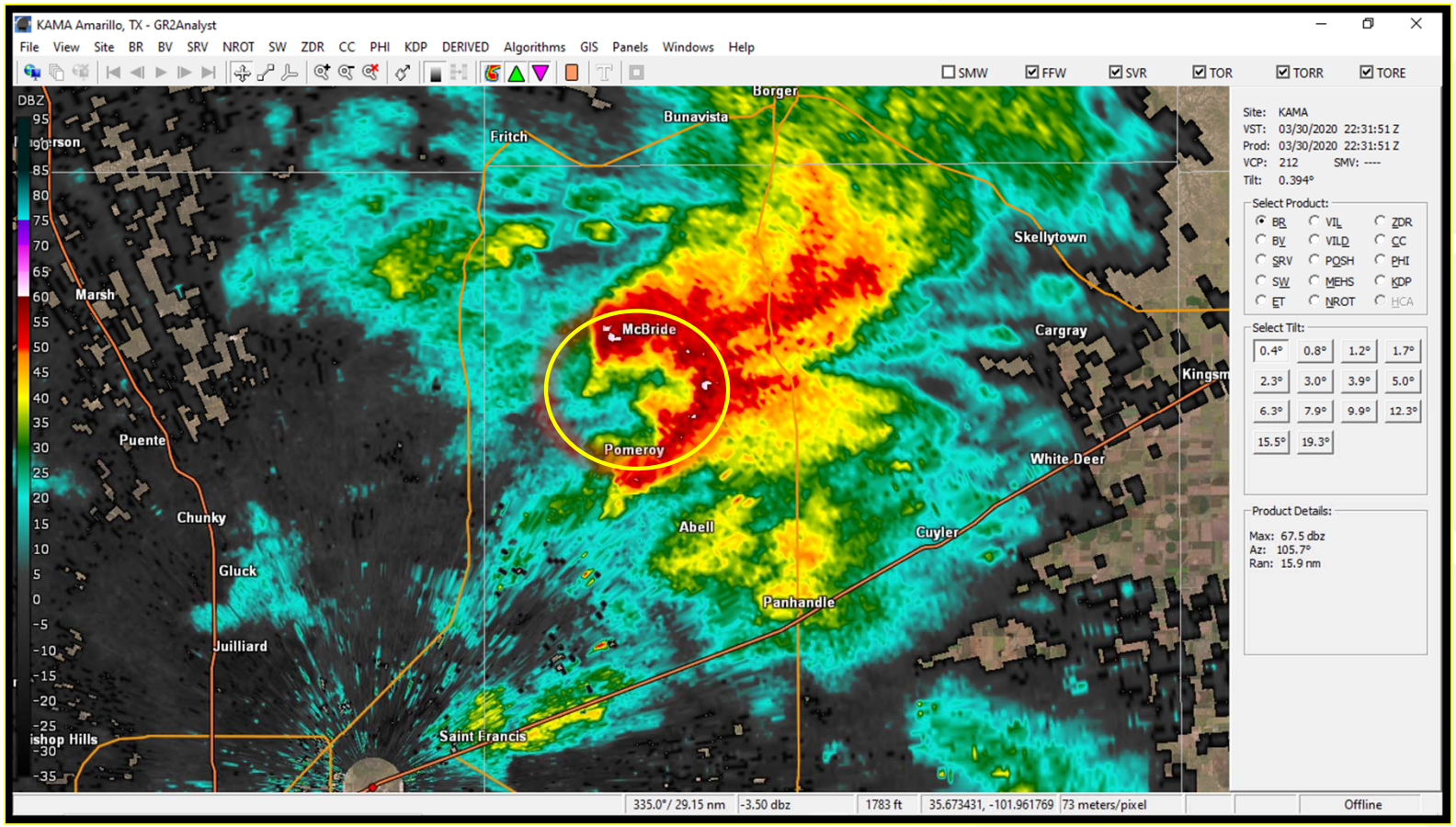


Tornado Near Pantex at 17:31 on 3/30/20 – Pic Courtesy – Wes Luginbyhl

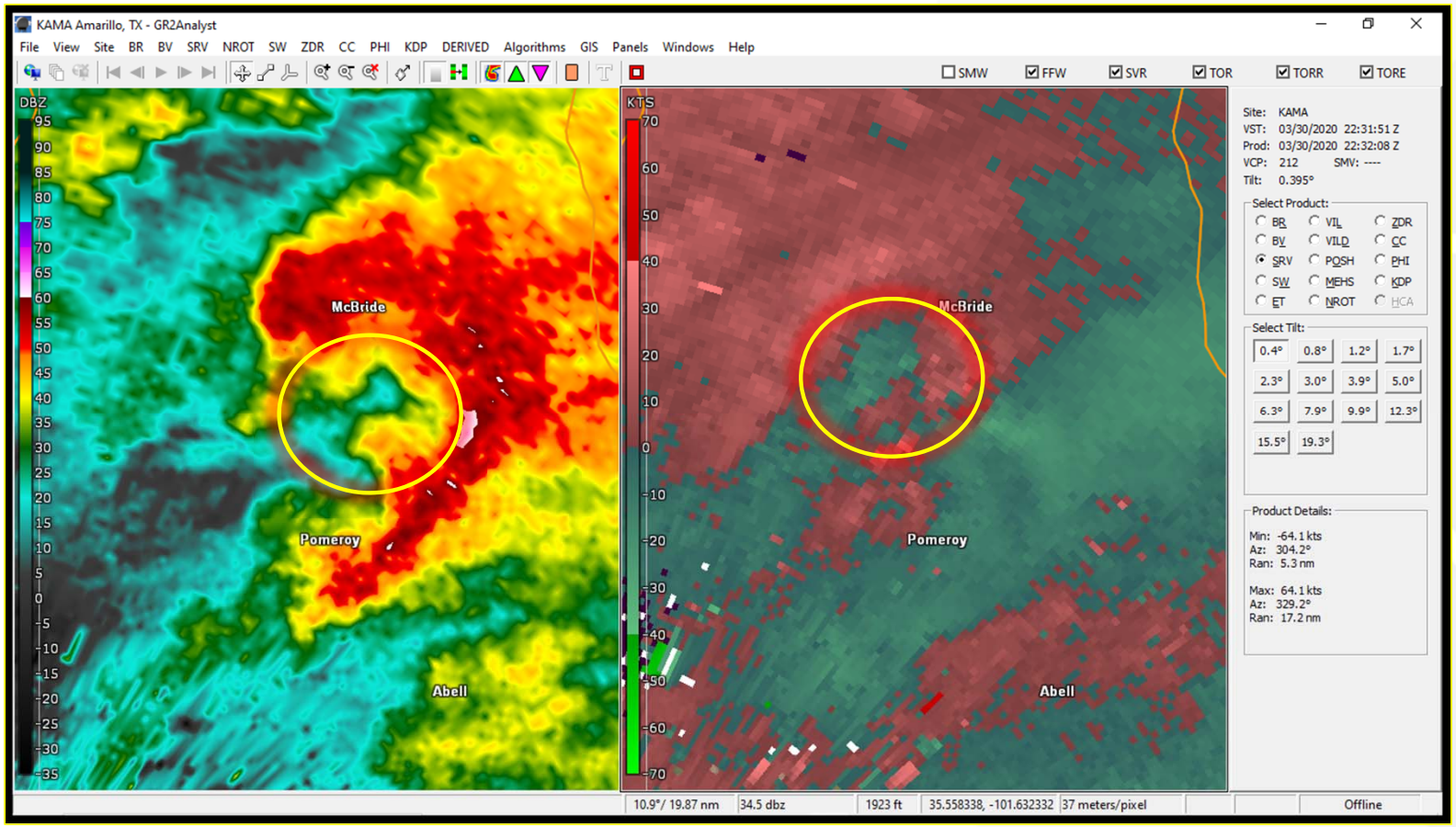
Tornado Near Pantex at 17:32 on 3/30/20 – Pic Courtesy – Wes Luginbyhl

Tornado Near Pantex at 17:33 on 3/30/20 – Pic Courtesy – Wes Luginbyhl

KAMA 88-D – BR (0.4 Degree Tilt) 17:31



KAMA 88-D – BR & SRV Scan (0.4 Degree Tilt) 17:31



National Weather Service - Amarillo, Texas, Official Storm Report

Public Information Statement
National Weather Service Amarillo TX
636 PM CDT Tue Mar 31 2020

...NWS DAMAGE SURVEY FOR 03/30/20 TORNADO EVENT...

High-based thunderstorms developed across the west central Panhandles Monday afternoon. As these thunderstorms moved east, they crossed a north-south oriented dryline, with cloud bases lowering considerably. Additionally, with winds out of the east present on the eastern side of the dryline, these storms moved into an environment with low level shear profiles conducive for the development of tornadoes. Furthermore, the presence of the dryline allowed for the potential development of landspouts for any storms that were located directly on or very close to the dryline. Two tornadoes did occur - one in Carson County and a landspout north of Sunray.

.Pantex 11 North...

Rating:	EF-Unknown
Estimated Peak Wind:	Unknown
Path Length /statute/:	3.55 miles
Path Width /maximum/:	50.0 yards
Fatalities:	0
Injuries:	0
Start Date:	03/30/2020
Start Time:	05:22 PM CDT
Start Location:	10 N Pantex / Carson County / TX
Start Lat/Lon:	35.47 / -101.57
End Date:	03/30/2020
End Time:	05:33 PM CDT
End Location:	11 NNE Pantex / Carson County / TX
End Lat/Lon:	35.484 / -101.5095

Survey Summary:
The tornado remained in open country grasslands and did no visible damage. Path details were estimated based on chaser pictures/reports and radar.

Lessons Learned / Summary Of The 3/30/20 Tornadic Storm

1. This storm developed in the “dry” air to the west of a stationary dry-line, between Amarillo & Pantex.

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3. A “hook echo” developed at 17:08 with a tornado forming, according to storm chasers at 17:22.

Lessons Learned / Summary Of The 3/30/20 Tornadic Storm

1. This storm developed in the “dry” air to the west of a stationary dry-line, between Amarillo & Pantex.

2. The storm crossed over the dry-line and became “rooted” in the more moist air.

3. A “hook echo” developed at 17:08 with a tornado forming, according to storm chasers at 17:22.

4. Even though the circulation (couplet) wasn’t the strongest, it was strong enough to produce a tornado that stayed on the ground for 3 ½ miles for a duration of 11 minutes!

PanTEX

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Consolidated Nuclear Security, LLC

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