USE OF LOCAL ANALYSIS AND PREDICTION SYSTEM (LAPS) DURING A HIGH BUOYANCY / LOW SHEAR SEVERE THUNDERSTORM OUTBREAK IN THE CENTRAL CALIFORNIA INTERIOR

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July 11, 2003

Introduction and Synopsis:

A large area of high pressure kept a warm airmass over the interior of Central California from May 12, 2002 through May 19, 2002. On the evening of Sunday May 19, 2002, a strong cold front crossed the San Joaquin Valley as the result of a cold upper low pressure trough which dropped out of the Gulf of Alaska the day before. The front brought strong winds down to the valley floor as it crossed Central California. On the following day, the cold upper trough began to swing inland, resulting in continued cold air advection aloft over Central California. Meanwhile skies cleared out across the San Joaquin Valley on the morning of the 20th, allowing for strong surface heating. By midday the atmosphere had become unstable enough for thunderstorms to break out across the San Joaquin Valley (Fig. 1). One storm produced a tornado near Madera while several other storms produced large hail. The storms caused over $25 million in hail damage, mainly because of crop losses. The Hanford Office issued six severe thunderstorm warnings, and a tornado warning during the event. Two neighboring offices also issued multiple warnings during the event as well. The storm system itself produced as much as two feet of snow accumulations in the higher elevations of the Southern Sierra Nevada on the 20th through the early morning of the 21st.

The Thunderstorm Outbreak:

Thunderstorms broke out in the Central and Southern San Joaquin Valley as well as across the Southern Sierra Nevada Foothills by 1200 PDT on the 20th. The thunderstorms became more numerous in coverage by 1400 PDT. On the KHNX (Hanford) WSR-88D Composite Reflectivity scan at 1410 PDT, cell J8 (Fig. 2) just north of the Fresno-Clovis area, indicated a reflectivity of 64 dBz and a Vertically Integrated Liquid (VIL) of 42. Cross section profiles and elevation scan comparisons indicated that this cell was likely a large hail producer as good tilt was indicated. A severe thunderstorm warning was issued for this cell at 1418 PDT. The cell produced hail as large as an inch in diameter by 1440 PDT and verified the issuance of the warning. Using the warning event simulator (WES) workstation, overlays of the 1400 PDT Local Analysis and Prediction System (LAPS) surface equivalent potential temperature (Theta-E) convergence analysis (Fig. 3), 1400 PDT LAPS Convective Available Potential Energy (CAPE); and the 1400 PDT LAPS surface relative humidities (RH field) indicated that the cell became severe near an area of 800 J/kg CAPE (Fig. 4) as well as inside a strong surface RH gradient (Fig. 5). The cell then moved northeast a little slower than anticipated and split into two individual cells. The right mover, cell P8 (Fig. 6), indicated a 65 dBz reflectivity and a 34 VIL at 1450 PDT when the first warning was close to expiring. Since the 88D hail algorithm indicated a high probability of large hail with this cell, the decision was made to re-issue the severe thunderstorm warning. The storm quickly verified as it produced 1 inch diameter hail near Clovis. Once again LAPS analysis indicated that the cell was in a strong surface RH gradient (Fig. 7), and in an area of high CAPE (Fig. 8). Before the second warning was set to expire, another cell (I1 on Fig. 9) rapidly developed over Fresno as it moved near a CAPE maxima (Fig. 10) inside the strong surface RH gradient (Fig. 11). This development subsequently triggered the issuance of another severe thunderstorm warning at 1535 PDT after a report of large hail was received. Following the issuance of the warning, there were several reports of large hail as it tracked east-northeast through northern Fresno and Clovis.

Meanwhile, a spotter reported a tornado on the ground near Madera at 1550 PDT. The 88D composite reflectivity combined attribute table indicated that the tornado was likely associated with cell F1 in Fig. 12, and based on the composite reflectivity image and the spotter report, a tornado warning was issued at 1600 PDT on this cell until 1645 PDT. However, the cell that actually produced the tornado was not identified in the KHNX storm attribute table; and was actually a few miles to the southwest of the cell that was warned on. From observation of the LAPS analysis, the tornado likely formed in an area of stronger surface RH convergence to the southwest of cell F1 (Fig. 13). The tornado track on the ground was about 2 ½ miles long and 300 feet wide as it tracked from west to east just south of Madera. Damage was minimal from this F1 tornado as it traveled mainly across open fields. Meanwhile, cell F1 which was warned on, produced a path of large hail to the northeast of Madera through 1630 PDT which caused over a quarter million dollars in crop damage. The warning was allowed to expire at 1645 after the cell had significantly weakened.

The cell that was warned earlier for the Fresno and Clovis areas weakened and split east of Clovis which allowed for the warning to expire as scheduled at 1620 PDT; however, the right mover intensified to 62 dBz and 22 VIL by 1625 PDT (cell M8 in Fig. 14), and also indicated a high probability of large hail as it tracked nearly parallel to the strong surface RH gradient (Fig. 15). A severe thunderstorm warning was issued on this cell at 1630 PDT which produced large hail over Centerville as it moved east. As a result, another warning was issued on the same cell at 1657 PDT as radar indicated that the cell had further intensified to 68 dBz and 35 VIL (Fig. 16). Spotter reports indicated that this cell continued to produce large hail near Sanger and Orange Cove. Although the cell was weakening by 1735 PDT (cell M8 in Fig. 17), observations of large hail were still being reported to the staff at WFO Hanford so the warning was extended until 1830 PDT. After one more report of large hail near Orange Cove, the cell finally weakened after reaching the Sierra Nevada Foothills around 1800 PDT. Short term forecasts were then used to highlight showers and some embedded thunderstorms through the evening hours until the precipitation tapered off.

Conclusions:

What was most noticeable from this event was that all of the cells that produced large hail and/or tornadoes were in areas of sharp surface relative humidity contrasts or (surface RH gradients). The severe cells also had a tendency to move parallel to the sharp RH contrast boundary. Convective Available Potential Energy (CAPE) also played a role as all three parent cells which were warned on during this event were located near a CAPE maxima when they intensified. However, the third cell maintained it's intensity when it moved through areas of lower CAPE. In summary, for determining the locations where large hail is probable, it might actually be better for a forecaster or a radar operator to use the LAPS surface RH gradient in combination with composite reflectivity and cross section profiles. This method appears to work well for a high buoyancy / low shear severe convective event (such as this event) rather than using CAPE, surface Theta-E convergence or V/R Shear (which work well in events driven by strong low level shear). Future tests still need to be done to see if surface RH gradients would be useful for predicting large hail and/or tornadoes in a low buoyancy / high shear event (which are more common in the San Joaquin Valley) or in a thunderstorm outbreak in a tropical airmass (such as the event of May 31, 2002).

Warning #	Time Issued (PDT)	Time Expired (PDT)	Cell ID #	CAPE (J/kg)	Theta-E Convergence (C/hr)
1	1418	1500	J8	820	40
2	1500	1545	P8	710	-200
3	1535	1620	I1	660	-100
4	1600	1645	F1	550	-180
5	1630	1700	M8	5	25
6	1657	1745	M8	70	180
7	1742	1830	M8	330	100

Figures:

Fig. 1. 2100 UTC GOES-10 IR Satellite Imagery and 1800 UTC MesoETA 3 hour 500 mb. Height Forecast.

Fig. 2. KHNX 2110 UTC Composite Reflectivity with overlay of 5 Minute Lightning.

Fig. 3. KHNX 2110 UTC Composite Reflectivity with overlays of 5 Minute Lightning, and 2100 LAPS Surface Equivalent Potential Temperature (Theta-E).

Fig. 4. KHNX 2110 UTC Composite Reflectivity with overlays of 5 Minute Lightning, and 2100 LAPS Surface CAPE.

Fig. 5. KHNX 2110 UTC Composite Reflectivity with overlays of 5 Minute Lightning, and 2100 LAPS Surface Relative Humidity.

Fig. 6. KHNX 2150 UTC Composite Reflectivity with overlay of 5 Minute Lightning.

Fig. 7. KHNX 2150 UTC Composite Reflectivity with overlays of 5 Minute Lightning, and 2200 LAPS Surface Relative Humidity.

Fig. 8. KHNX 2150 UTC Composite Reflectivity with overlays of 5 Minute Lightning, and 2200 LAPS Surface CAPE.

Fig. 9. KHNX 2225 UTC Composite Reflectivity with overlay of 5 Minute Lightning.

Fig. 10. KHNX 2225 UTC Composite Reflectivity with overlays of 5 Minute Lightning, and 2200 LAPS Surface CAPE.

Fig. 11. KHNX 2225 UTC Composite Reflectivity with overlays of 5 Minute Lightning, and 2200 LAPS Surface Relative Humidity.

Fig. 12. KHNX 2250 UTC Composite Reflectivity with overlay of 5 Minute Lightning.

Fig. 13. KHNX 2250 UTC Composite Reflectivity with overlays of 5 Minute Lightning, and 2300 LAPS Surface Relative Humidity.

Fig. 14. KHNX 2325 UTC Composite Reflectivity with overlay of 5 Minute Lightning.

Fig. 15. KHNX 2325 UTC Composite Reflectivity with overlays of 5 Minute Lightning, and 2300 LAPS Surface Relative Humidity.

Fig. 16. KHNX 2350 UTC Composite Reflectivity with overlay of 5 Minute Lightning.

Fig. 17. KHNX 0036 UTC Composite Reflectivity with overlay of 5 Minute Lightning.

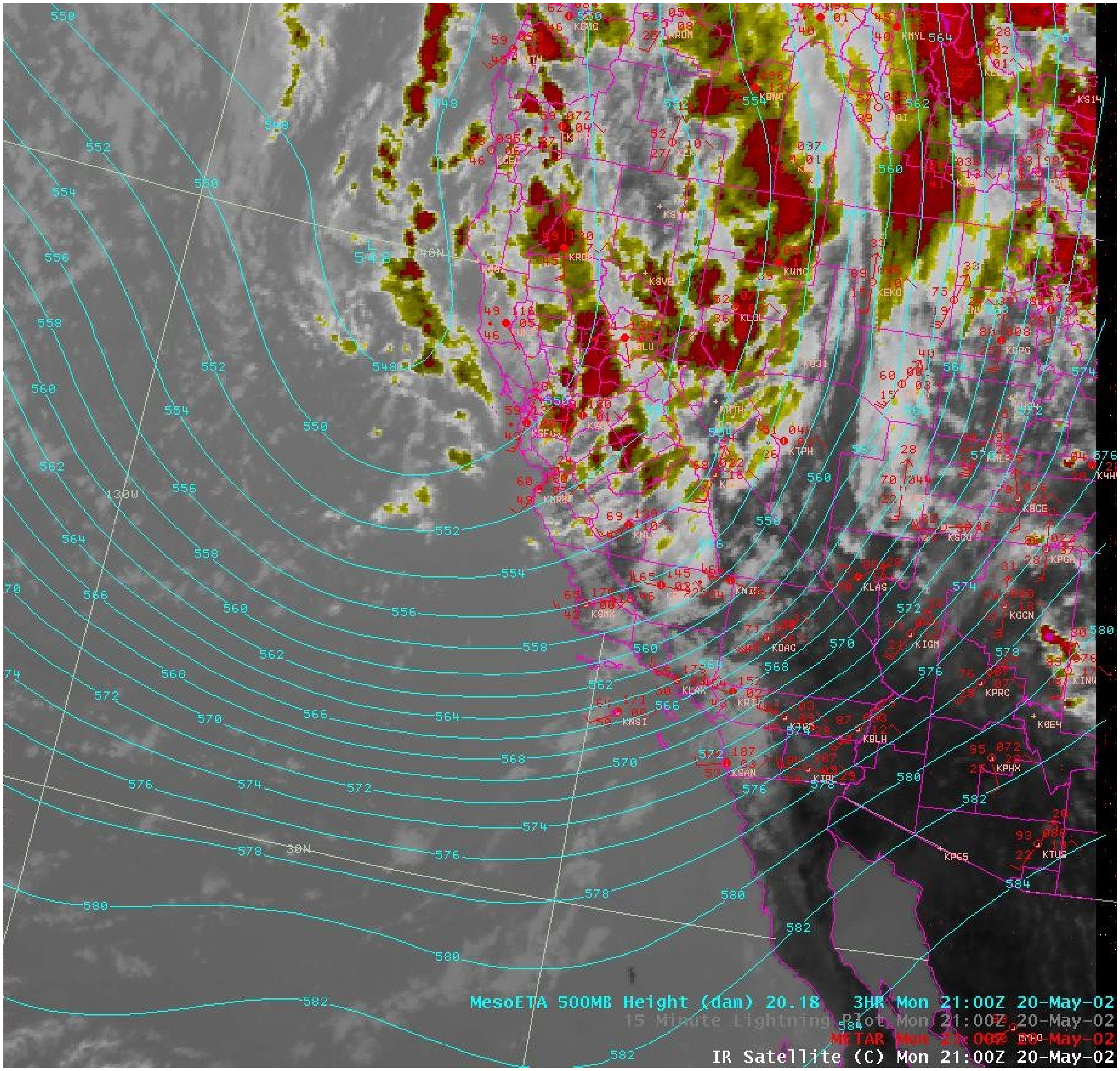
Acknowledgments:

The author would like to thank Jeffery Nesmith and Larry Greiss for archiving and compiling data from the May 20, 2002 event. The author also wishes to thank Michael Brittain and James Bentzien for help with the color printouts that were used for the figures.

References:

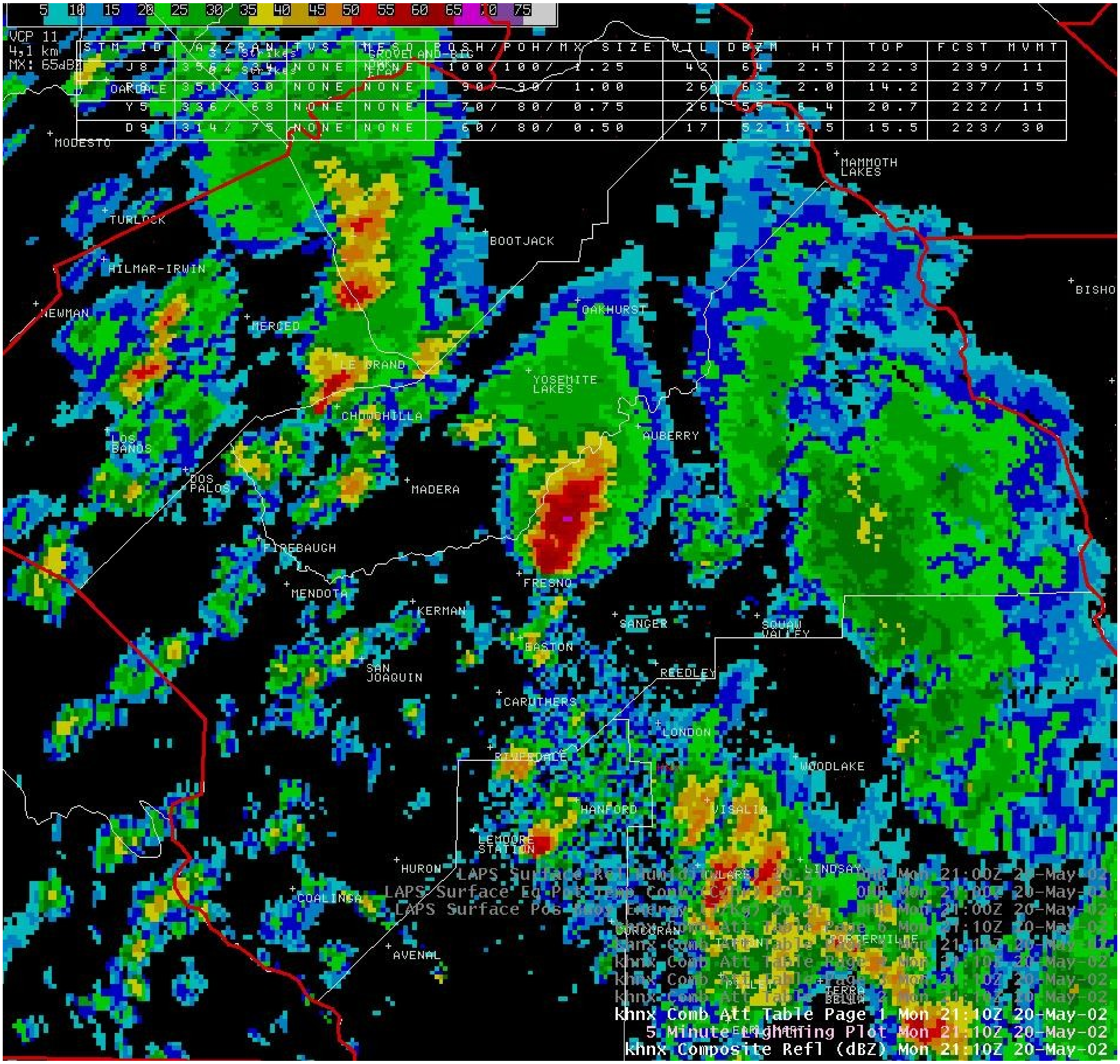
Nesmith, Jeff, 2002: Mayhem in May. Central California Weather Digest. Summer 2002.

Figure 1



MesoETA 500MB Height (dam) 20.18 3HR Mon 21:00Z 20-May-02
15 Minute Lightning Plot Mon 21:00Z 20-May-02
METAR Mon 21:00Z 20-May-02
IR Satellite (C) Mon 21:00Z 20-May-02

Figure 2



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VCP 11
4.1 km
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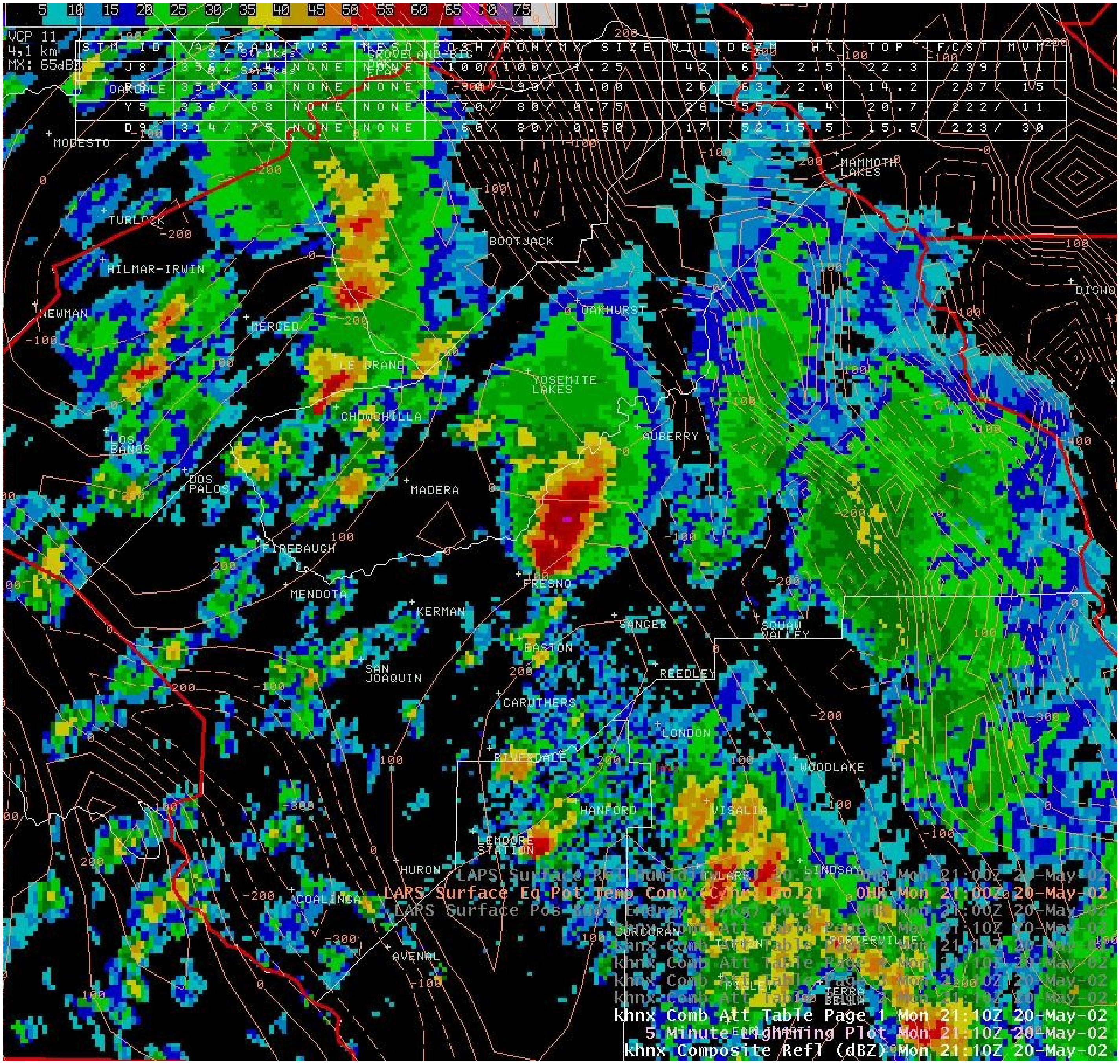
Y5 336/ 68 NONE NONE 70/ 80/ 0.75 26 55 6.4 20.7 222/ 11
D9 314/ 75 NONE NONE 60/ 80/ 0.50 17 52 15.5 15.5 223/ 30
MODESTO
TURLOCK
HILMAR-IRWIN
NEWMAN
MERCED
LE GRAND
CHOWCHILLA
LOS BANOS
DOS PALOS
MADERA
FIREBAUGH
MENDOTA
KERMAN
SAN JOAQUIN
BOOTJACK
OAKHURST
YOSEMITE LAKES
AUBERRY
FRESNO
SANGER
SQUAW VALLEY
EASTON
REEDLEY
CARUTHERS
LONDON
RIVERDALE
WOODLAKE
HANFORD
VISALIA
LEMOORE STATION
HURON
COALINGA
AVENAL
MAMMOTH LAKES
BISHO
khnx Comb Att Table Page 1 Mon 21:10Z 20-May-02
5 Minute Lightning Plot Mon 21:10Z 20-May-02
khnx Composite Refl (dBZ) Mon 21:10Z 20-May-02

Figure 3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STM ID
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TVS
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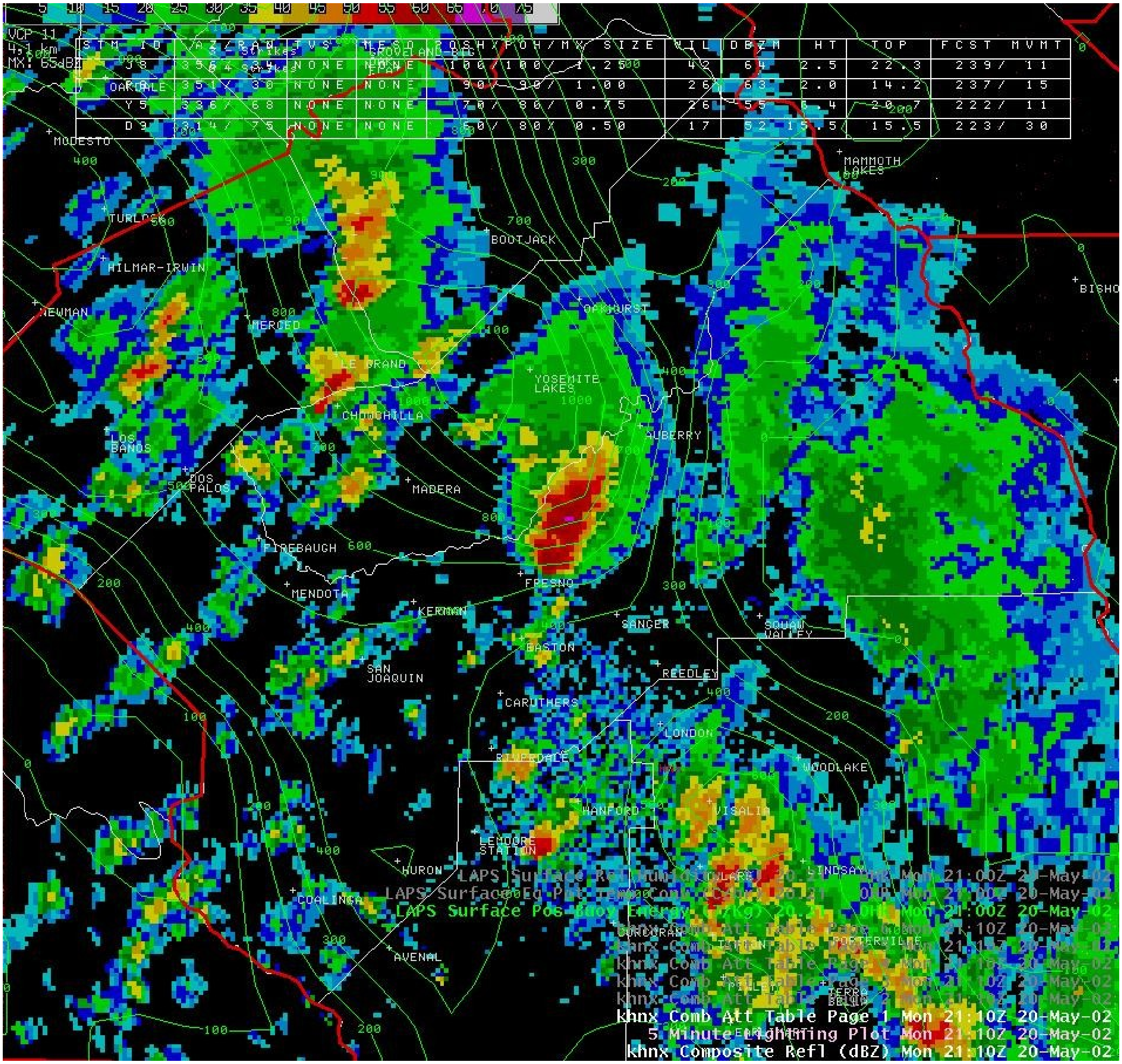
POSH/POH/MX SIZE
VIL
DBZM
HT
TOP
FCST MVMT
J8
356/ 34
NONE
NONE
100/100/ 1.25
42
64
2.5
22.3
239/ 11
Y5
336/ 68
NONE
NONE
70/ 80/ 0.75
26
55
6.4
20.7
222/ 11
D9
314/ 75
NONE
NONE
60/ 80/ 0.50
17
52
15.5
15.5
223/ 30
MODESTO
TURLOCK
HILMAR-IRWIN
NEWMAN
MERCED
LE GRAND
CHOWCHILLA
LOS BANOS
DOS PALOS
MADERA
FIREBAUCH
MENDOTA
KERMAN
FRESNO
SANGER
EASTON
SAN JOAQUIN
CARUTHERS
REEDLEY
LONDON
RIVERDALE
HANFORD
VISALIA
WOODLAKE
LEMOORE STATION
HURON
COALINGA
AVENAL
CORCORAN
PORTERVILLE
LINDSAY
OAKHURST
YOSEMITE LAKES
AUBERRY
BOOTJACK
SQUAW VALLEY
MAMMOTH LAKES
BISHOP
LAPS Surface Eq Pot Temp Conv
0HR Mon 21:00Z 20-May-02
khnx Comb Att Table Page 1 Mon 21:10Z 20-May-02
5 Minute Lightning Plot Mon 21:10Z 20-May-02
khnx Composite Refl (dBZ) Mon 21:10Z 20-May-02

Figure 4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DOS PALOS
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FIREBAUGH
MENDOTA
KERMAN
FRESNO
BOOTJACK
OAKHURST
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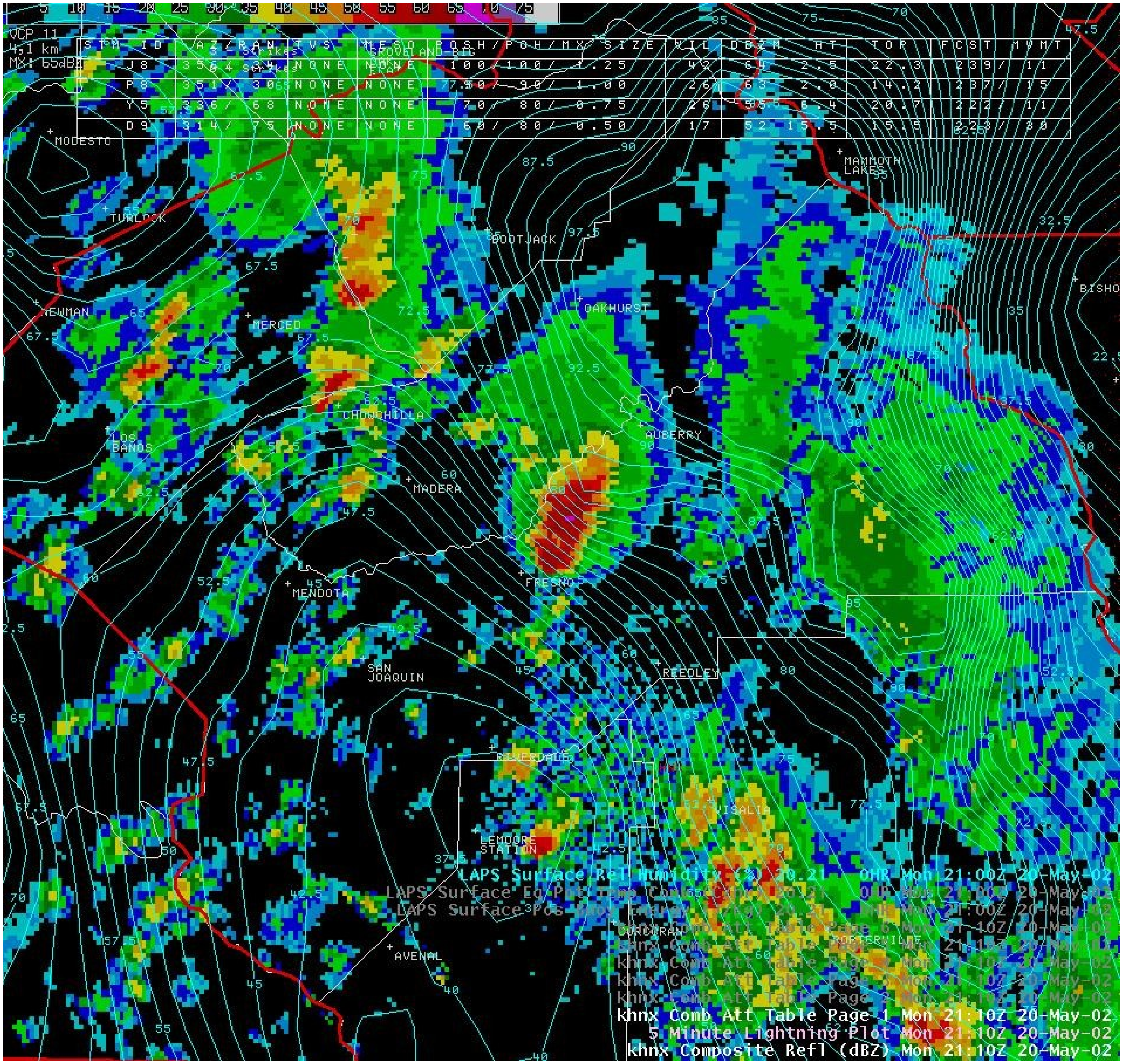
AUBERRY
MAMMOTH LAKES
BISHOP
SANGER
SQUAW VALLEY
EASTON
REEDLEY
SAN JOAQUIN
CARUTHERS
LONDON
RIVERDALE
WOODLAKE
HANFORD
VISALIA
LEMOORE STATION
HURON
COALINGA
AVENAL
khnx Comb Att Table Page 1 Mon 21:10Z 20-May-02
5 Minute Lightning Plot Mon 21:10Z 20-May-02
khnx Composite Refl (dBZ) Mon 21:10Z 20-May-02

Figure 5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MERCED
CHOWCHILLA
LOS BANOS
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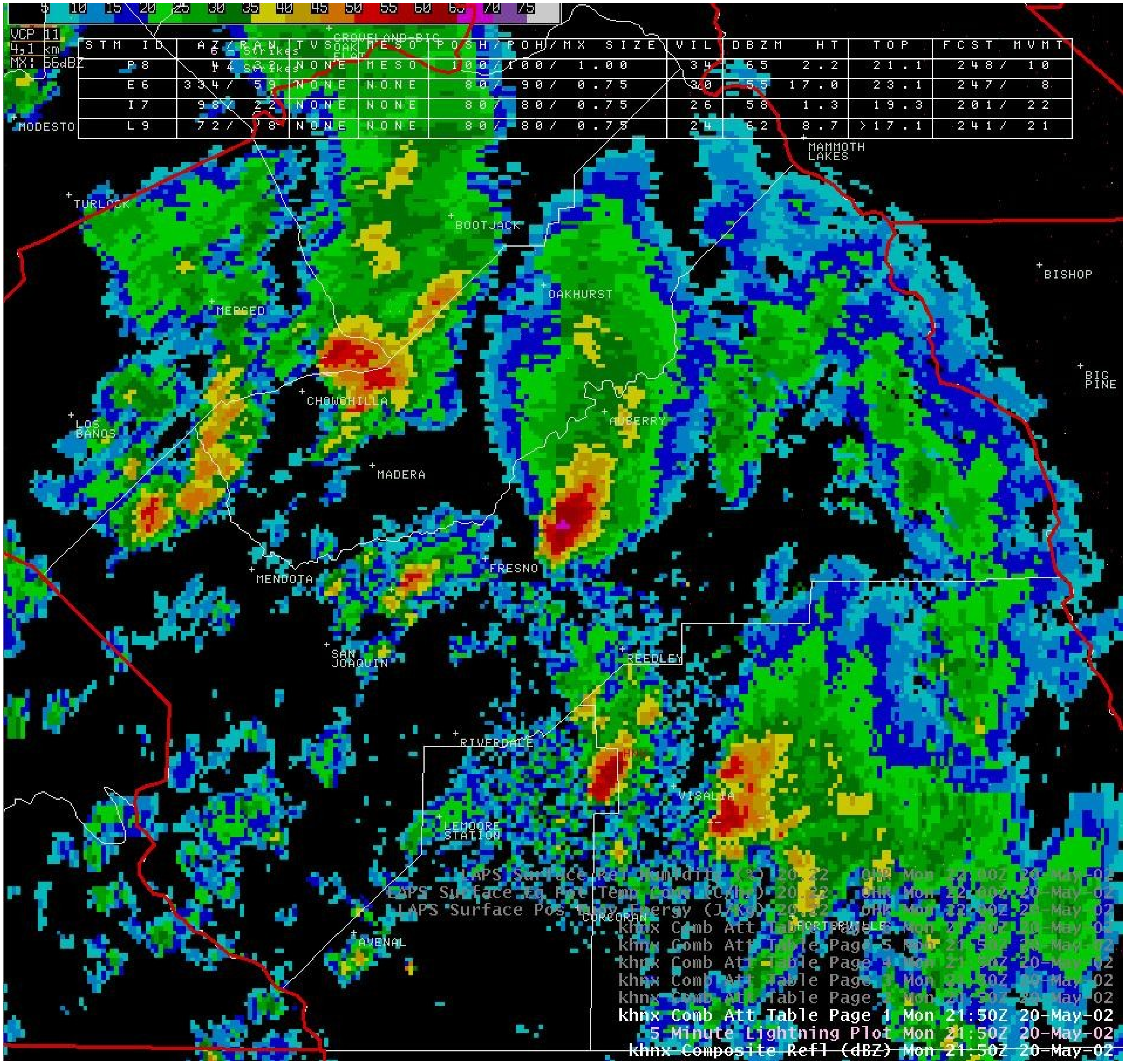
BOOTJACK
OAKHURST
AUBERRY
FRESNO
SAN JOAQUIN
REEDLEY
RIVERDALE
LEMOORE STATION
AVENAL
VISALIA
MAMMOTH LAKES
khnx Comb Att Table Page 1 Mon 21:10Z 20-May-02
5 Minute Lightning Plot Mon 21:10Z 20-May-02
khnx Composite Refl (dBZ) Mon 21:10Z 20-May-02

Figure 6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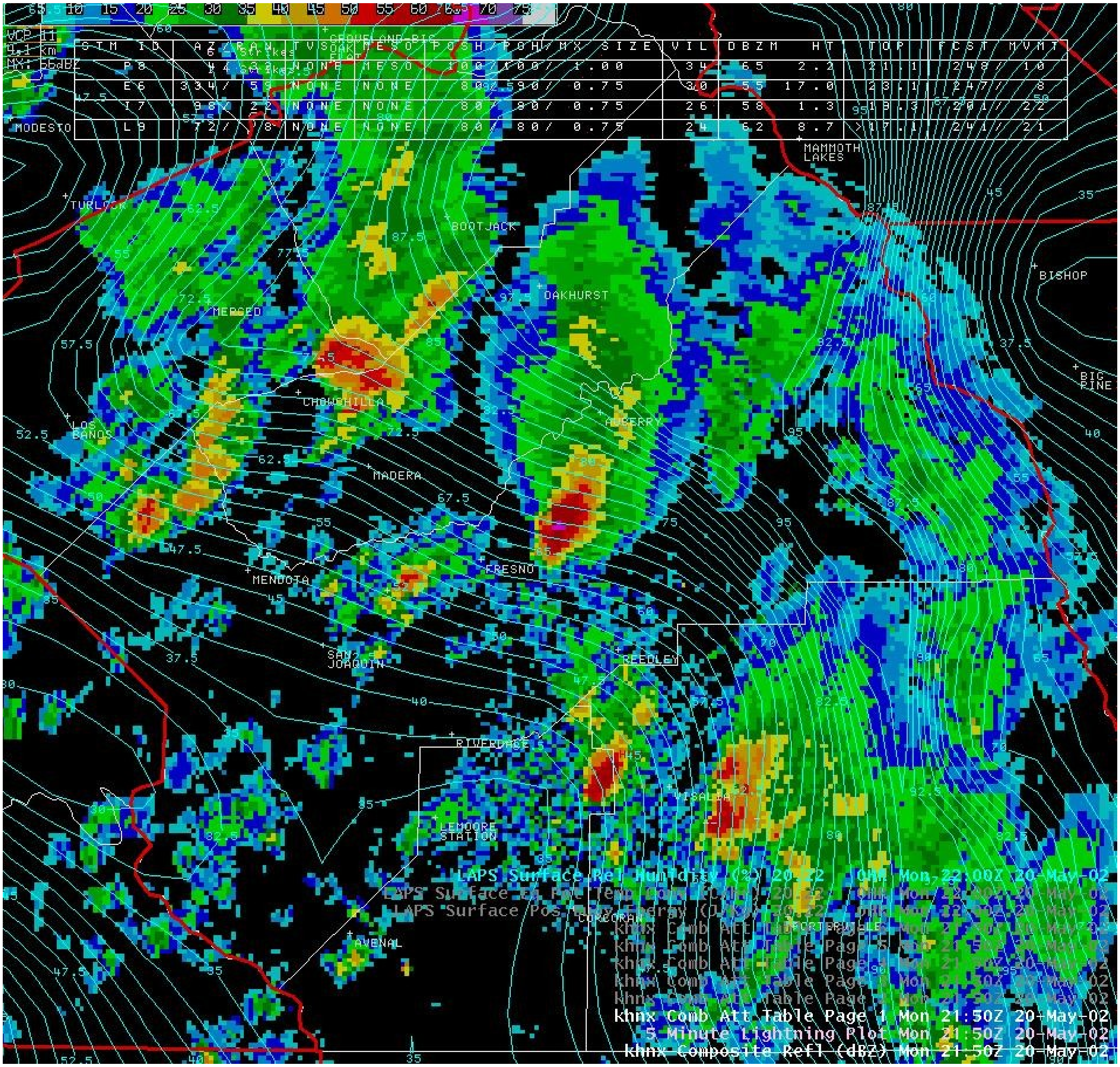
VCP 11
4.1 km
MX: 66dBZ
STM ID | AZ/RAN | TVS | MESO | POSH/POH/MX SIZE | VIL | DBZM HT | TOP | FCST MVMT
P8 | 44/ 32 | NONE | MESO | 100/100/ 1.00 | 34 | 65 2.2 | 21.1 | 248/ 10
E6 | 334/ 59 | NONE | NONE | 80/ 90/ 0.75 | 30 | 55 17.0 | 23.1 | 247/ 8
I7 | 98/ 22 | NONE | NONE | 80/ 80/ 0.75 | 26 | 58 1.3 | 19.3 | 201/ 22
L9 | 72/ 8 | NONE | NONE | 80/ 80/ 0.75 | 24 | 62 8.7 | >17.1 | 241/ 21
MODESTO
TURLOCK
MAMMOTH LAKES
BOOTJACK
BISHOP
OAKHURST
MERCED
CHOWCHILLA
BIG PINE
LOS BANOS
AUBERRY
MADERA
FRESNO
MENDOTA
SAN JOAQUIN
REEDLEY
RIVERDALE
VISALIA
LEMOORE STATION
CORCORAN
AVENAL
khnx Comb Att Table Page 1 Mon 21:50Z 20-May-02
5 Minute Lightning Plot Mon 21:50Z 20-May-02
khnx Composite Refl (dBZ) Mon 21:50Z 20-May-02

Figure 7



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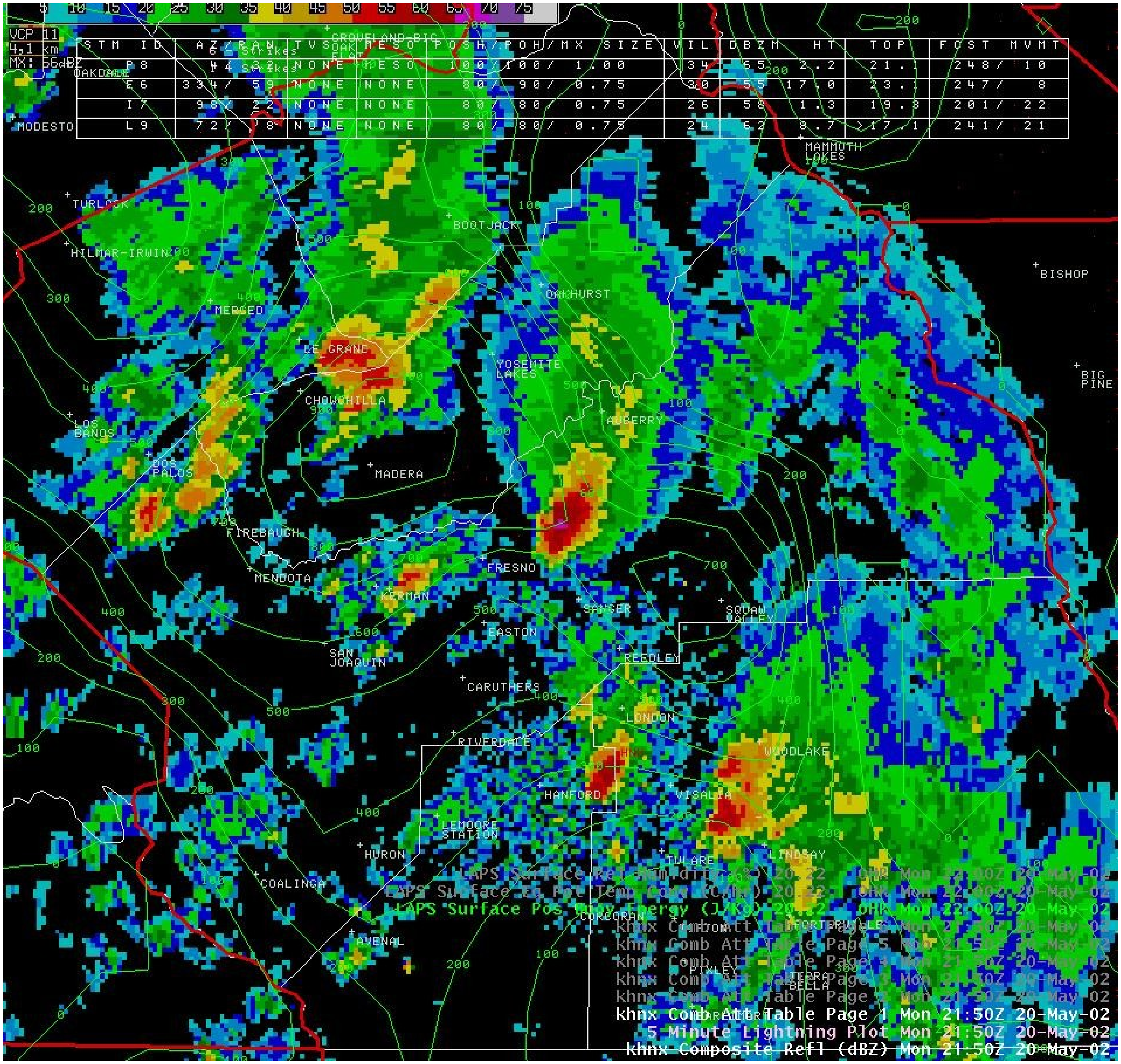
LOS BANOS
MADERA
MENDOTA
FRESNO
SAN JOAQUIN
BOOTJACK
OAKHURST
AUBERRY
REEDLEY
RIVERDALE
LEMOORE STATION
VISALIA
CORCORAN
AVENAL
MAMMOTH LAKES
BISHOP
BIG PINE
LAPS Surface Rel Humidity (%) 20.22
khnx Comb Att Table Page 1 Mon 21:50Z 20-May-02
5 Minute Lightning Plot Mon 21:50Z 20-May-02
khnx Composite Refl (dBZ) Mon 21:50Z 20-May-02

Figure 8



VCP 11
STM ID | AZ/RAN | TVS | MESO | POSH/POH/MX SIZE | VIL | DBZM HT | TOP | FCST MVMT
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E6 | 334/ 59 | NONE | NONE | 80/ 90/ 0.75 | 30 | 55 17.0 | 23.1 | 247/ 8
I7 | NONE | NONE | 80/ 80/ 0.75 | 26 | 58 1.3 | 19.8 | 201/ 22
L9 | NONE | NONE | 80/ 80/ 0.75 | 24 | 62 8.7 | >17.1 | 241/ 21
MODESTO
OAKDALE
TURLOCK
HILMAR-IRWIN
MERCED
LE GRAND
CHOWCHILLA
LOS BANOS
DOS PALOS
MADERA
FIREBAUGH
MENDOTA
KERMAN
FRESNO
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YOSEMITE LAKES
AUBERRY
MAMMOTH LAKES
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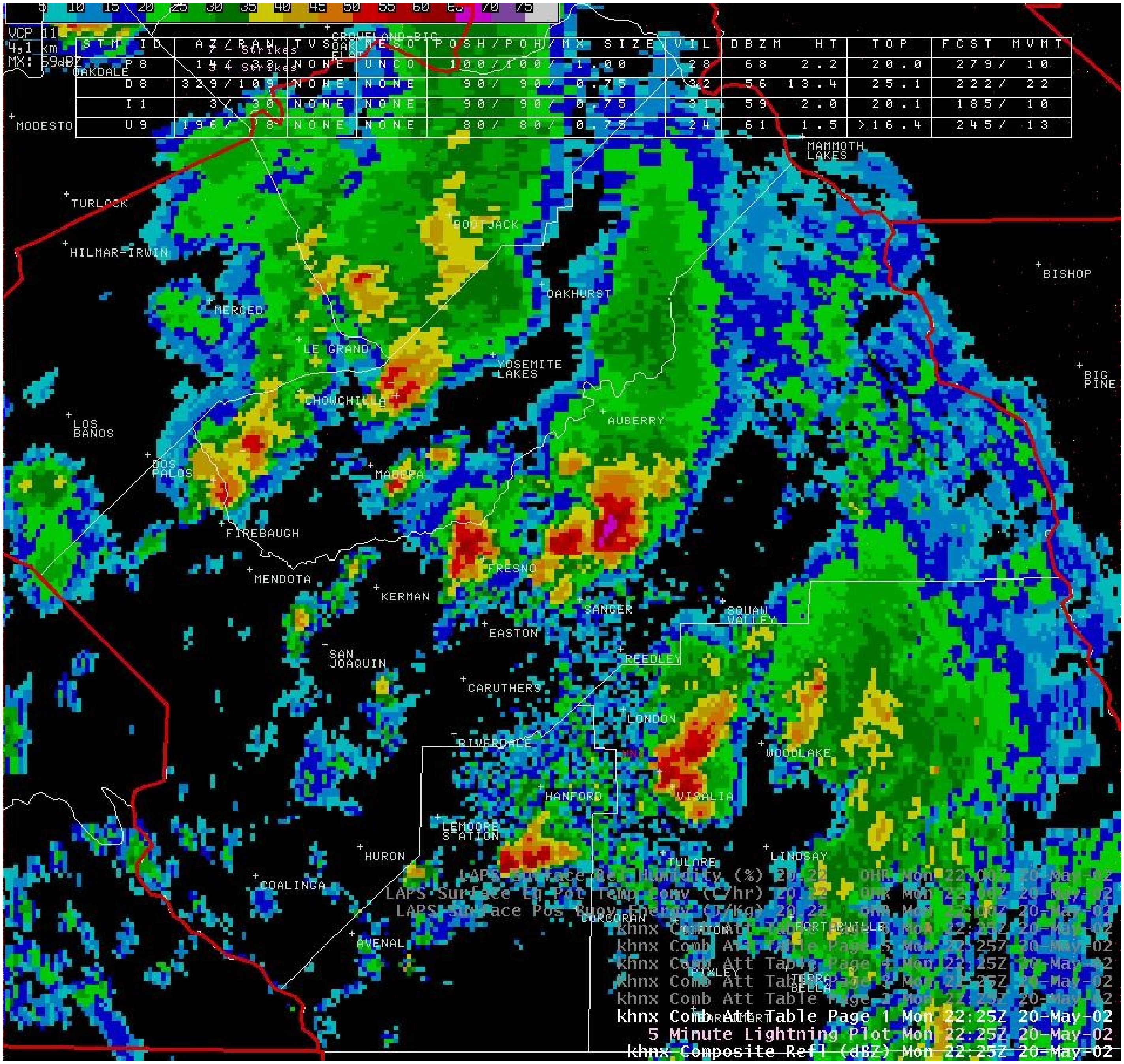
BIG PINE
SANGER
SQUAW VALLEY
EASTON
REEDLEY
SAN JOAQUIN
CARUTHERS
LONDON
RIVERDALE
WOODLAKE
HANFORD
VISALIA
LEMOORE STATION
HURON
TULARE
LINDSAY
COALINGA
CORCORAN
AVENAL
PIXLEY
TERRA BELLA
khnx Comb Att Table Page 1 Mon 21:50Z 20-May-02
5 Minute Lightning Plot Mon 21:50Z 20-May-02
khnx Composite Refl (dBZ) Mon 21:50Z 20-May-02

Figure 9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4.1 km
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D8 | 329/109 | NONE | NONE | 90/ 90/ 0.75 | 32 | 56 13.4 | 25.1 | 222/ 22
I1 | 3/ 30 | NONE | NONE | 90/ 90/ 0.75 | 31 | 59 2.0 | 20.1 | 185/ 10
U9 | | NONE | NONE | 80/ 80/ 0.75 | 24 | 61 1.5 | >16.4 | 245/ 13
MODESTO
OAKDALE
MAMMOTH LAKES
TURLOCK
HILMAR-IRWIN
BOOTJACK
OAKHURST
BISHOP
MERCED
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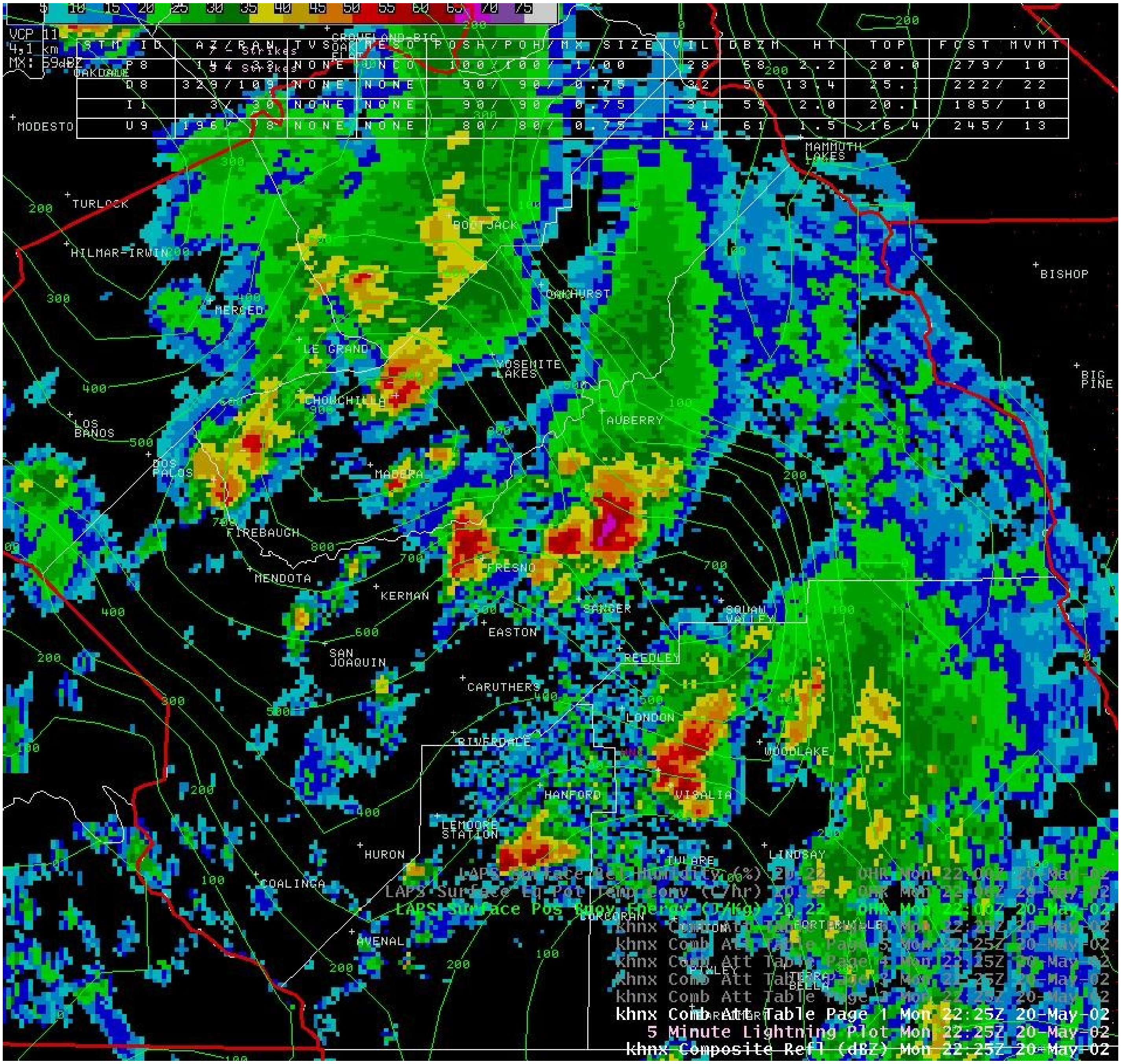
YOSEMITE LAKES
BIG PINE
CHOWCHILLA
LOS BANOS
AUBERRY
DOS PALOS
MADERA
FIREBAUGH
FRESNO
MENDOTA
KERMAN
SANGER
SQUAW VALLEY
EASTON
SAN JOAQUIN
REEDLEY
CARUTHERS
LONDON
RIVERDALE
WOODLAKE
HANFORD
VISALIA
LEMOORE STATION
HURON
TULARE
LINDSAY
COALINGA
CORCORAN
AVENAL
PIXLEY
khnx Comb Att Table Page 1 Mon 22:25Z 20-May-02
5 Minute Lightning Plot Mon 22:25Z 20-May-02
khnx Composite Refl (dBZ) Mon 22:25Z 20-May-02

Figure 10


VCP 11
MODESTO
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CHOWCHILLA
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KERMAN
MADERA
FRESNO
EASTON
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CARUTHERS
RIVERDALE
HANFORD
LEMOORE STATION
HURON
COALINGA
AVENAL
BOOTJACK
OAKHURST
YOSEMITE LAKES
AUBERRY
SANGER
SQUAW VALLEY
REEDLEY
LONDON
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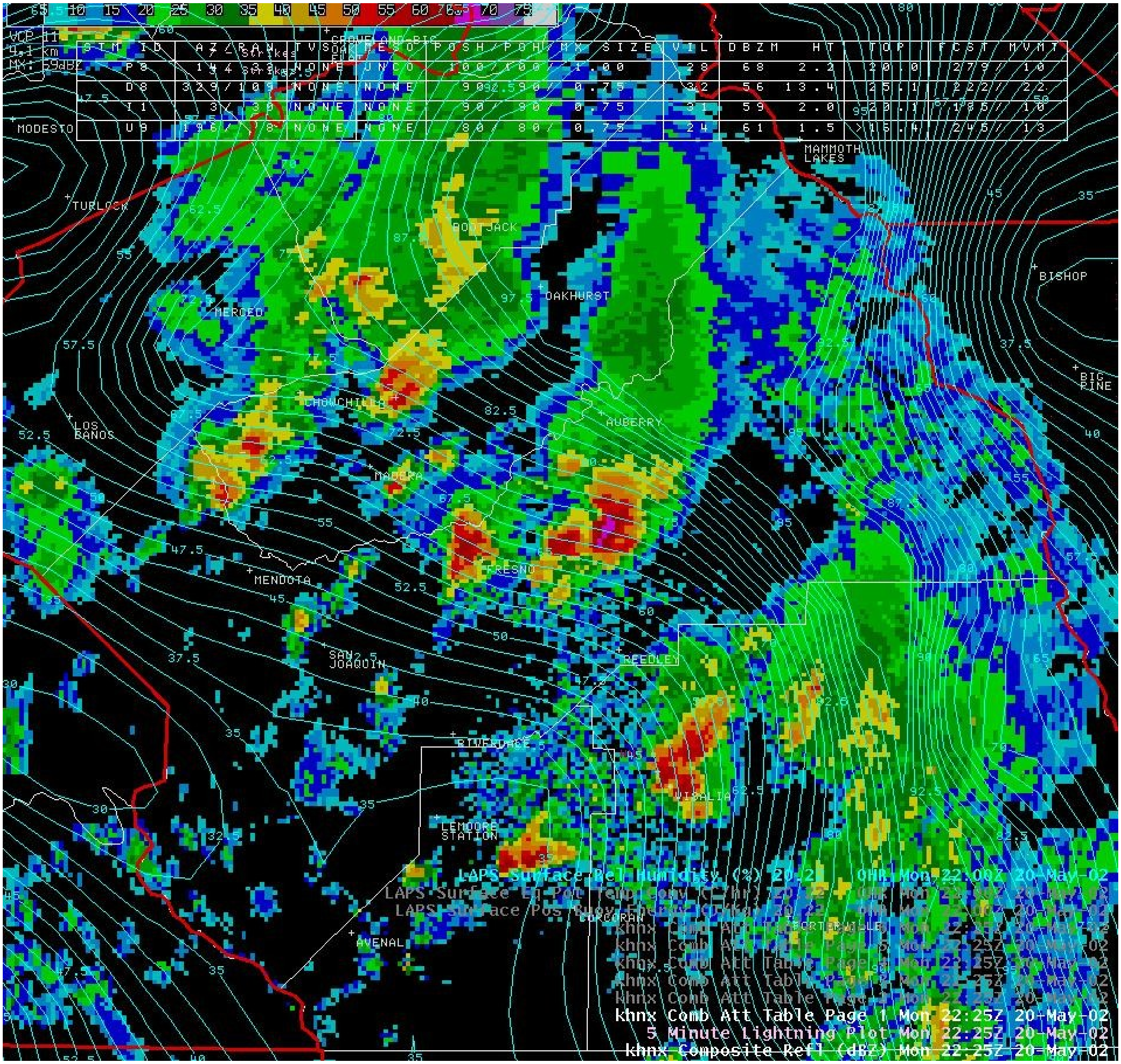
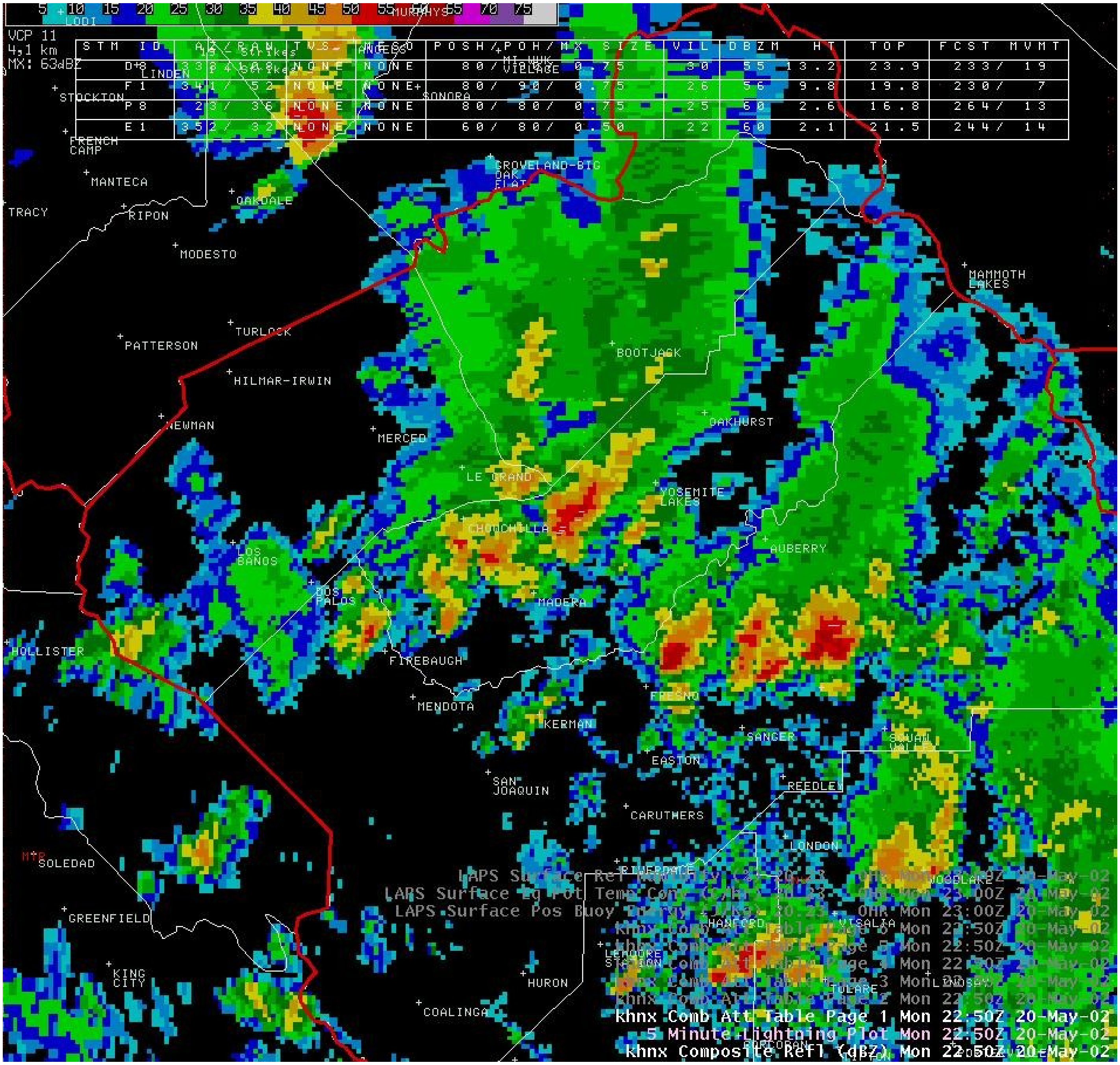
VISALIA
TULARE
LINDSAY
MAMMOTH LAKES
BISHOP
BIG PINE
khnx Comb Att Table Page 1 Mon 22:25Z 20-May-02
5 Minute Lightning Plot Mon 22:25Z 20-May-02
khnx Composite Refl (dBZ) Mon 22:25Z 20-May-02

Figure 11



STM ID | AZ/RAN | TVS | MESO | POSH/POH/MX SIZE | VIL | DBZM HT | TOP | FCST MVMT
P8 | 144/ 33 | NONE | UNCO | 100/100/ 1.00 | 28 | 68 2.2 | 20.0 | 279/ 10
D8 | 329/109 | NONE | NONE | 90/ 90/ 0.75 | 32 | 56 13.4 | 25.1 | 222/ 22
I1 | 3/ 30 | NONE | NONE | 90/ 90/ 0.75 | 31 | 59 2.0 | 20.1 | 185/ 10
U9 | 196/ 18 | NONE | NONE | 80/ 80/ 0.75 | 24 | 61 1.5 | >15.4 | 245/ 13
MODESTO
TURLOCK
MERCED
MAMMOTH LAKES
BOOTJACK
OAKHURST
BISHOP
BIG PINE
CHOWCHILLA
LOS BANOS
AUBERRY
MADERA
MENDOTA
FRESNO
SAN JOAQUIN
REEDLEY
RIVERDALE
VISALIA
LEMOORE STATION
AVENAL
CORCORAN
LAPS Surface Rel Humidity (%) 20.22 0HR Mon 22:00Z 20-May-02
khnx Comb Att Table Page 1 Mon 22:25Z 20-May-02
5 Minute Lightning Plot Mon 22:25Z 20-May-02
khnx Composite Refl (dBZ) Mon 22:25Z 20-May-02

Figure 12


VCP 11
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P8 23/ 36 NONE NONE 80/ 80/ 0.75 25 60 2.6 16.8 264/ 13
E1 352/ 32 NONE NONE 60/ 80/ 0.50 22 60 2.1 21.5 244/ 14
STOCKTON
FRENCH CAMP
MANTECA
TRACY
RIPON
OAKDALE
MODESTO
TURLOCK
PATTERSON
HILMAR-IRWIN
NEWMAN
MERCED
LE GRAND
CHOWCHILLA
LOS BANOS
DOS PALOS
MADERA
FIREBAUGH
MENDOTA
KERMAN
HOLLISTER
SOLEDAD
GREENFIELD
KING CITY
SAN JOAQUIN
HURON
COALINGA
FRESNO
SANGER
EASTON
REEDLEY
CARUTHERS
LONDON
SQUAW VALLEY
BOOTJACK
OAKHURST
YOSEMITE LAKES
AUBERRY
MAMMOTH LAKES
GROVELAND-BIG OAK FLAT
SONORA
LINDEN
HANFORD
VISALIA
TULARE
LEMOORE STATION
Khnx Comb Att Table Page 1 Mon 22:50Z 20-May-02
5 Minute Lightning Plot Mon 22:50Z 20-May-02
Khnx Composite Refl (dBZ) Mon 22:50Z 20-May-02

Figure 13

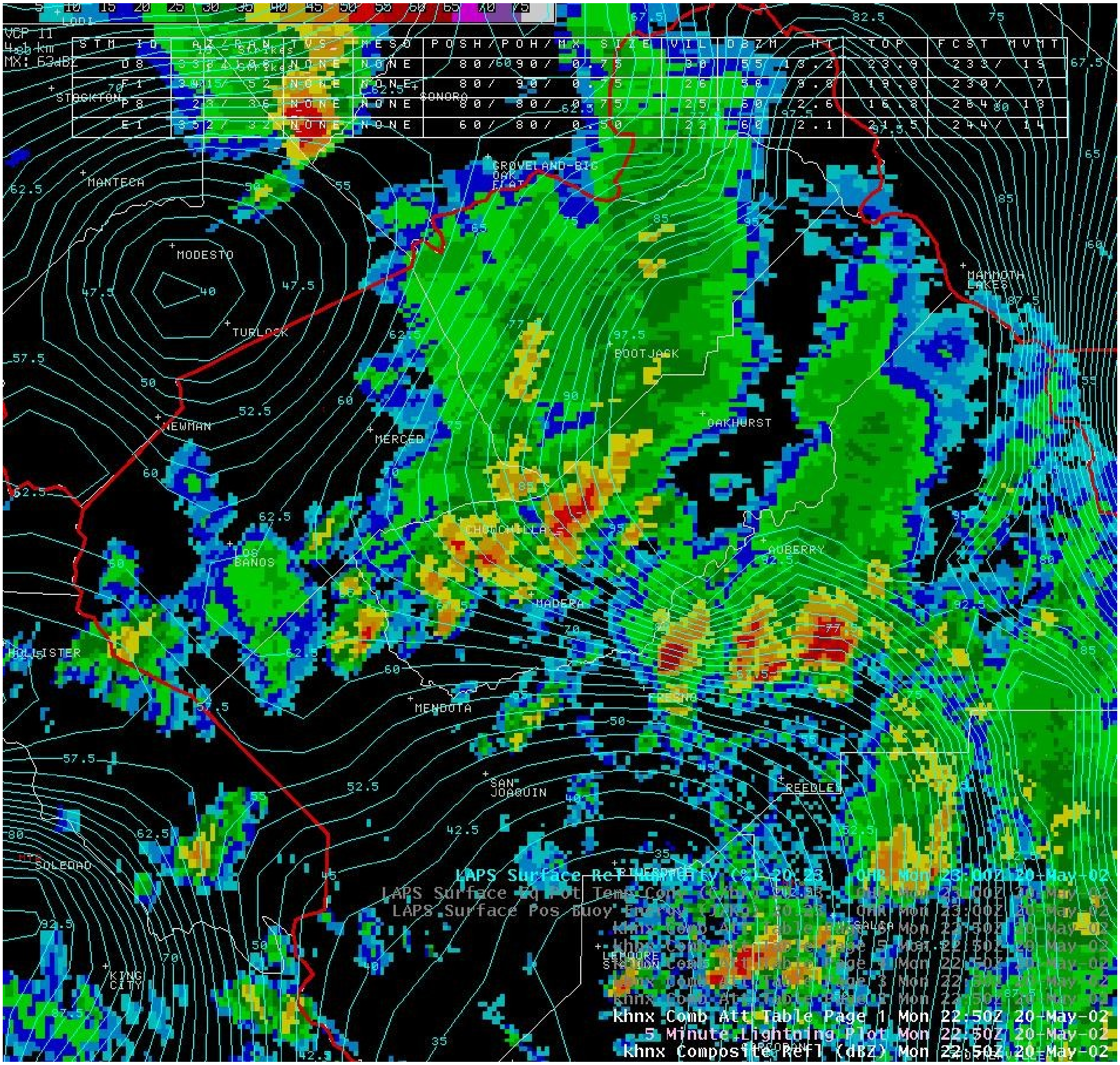

STM ID
AZ/RAN
TVS
MESO
POSH/POH/MX SIZE
VIL
DBZM
HT
TOP
FCST MVMT
LODI
STOCKTON
SONORA
MANTECA
GROVELAND-BIG OAK FLAT
MODESTO
TURLOCK
MAMMOTH LAKES
BOOTJACK
NEWMAN
MERCED
OAKHURST
CHOWCHILLA
LOS BANOS
AUBERRY
MADERA
HOLLISTER
FRESNO
MENDOTA
SAN JOAQUIN
REEDLEY
SOLEDAD
KING CITY
khnx Comb Att Table Page 1 Mon 22:50Z 20-May-02
5 Minute Lightning Plot Mon 22:50Z 20-May-02
khnx Composite Refl (dBZ) Mon 22:50Z 20-May-02

Figure 14

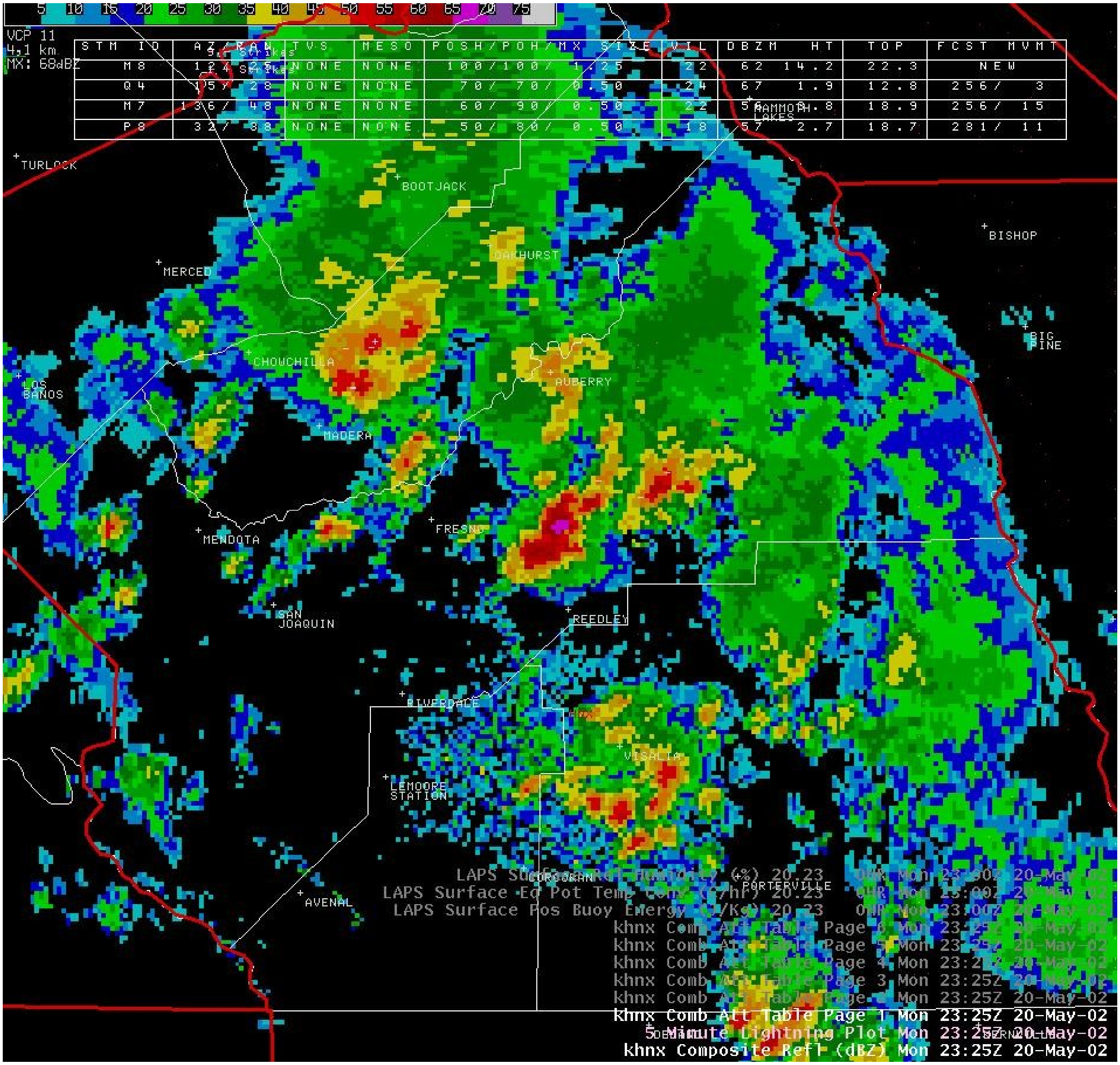

5 10 15 20 25 30 35 40 45 50 55 60 65 70 75
VCP 11
4.1 km
MX: 68dBZ
STM ID AZ/RAN TVS MESO POSH/POH/MX SIZE VIL DBZM HT TOP FCST MVMT
M8 124/ 25 NONE NONE 100/100/ 1.25 22 62 14.2 22.3 NEW
Q4 157/ 28 NONE NONE 70/ 70/ 0.50 24 67 1.9 12.8 256/ 3
M7 136/ 48 NONE NONE 60/ 90/ 0.50 22 18.9 256/ 15
P8 327/ 38 NONE NONE 50/ 80/ 0.50 18 57 2.7 18.7 281/ 11
TURLOCK
BOOTJACK
BISHOP
MERCED
OAKHURST
BIG PINE
CHOWCHILLA
AUBERRY
LOS BANOS
MADERA
MENDOTA
FRESNO
SAN JOAQUIN
REEDLEY
RIVERDALE
VISALIA
LEMOORE STATION
AVENAL
PORTERVILLE
khnx Comb Att Table Page 1 Mon 23:25Z 20-May-02
khnx Composite Refl (dBZ) Mon 23:25Z 20-May-02

Figure 15

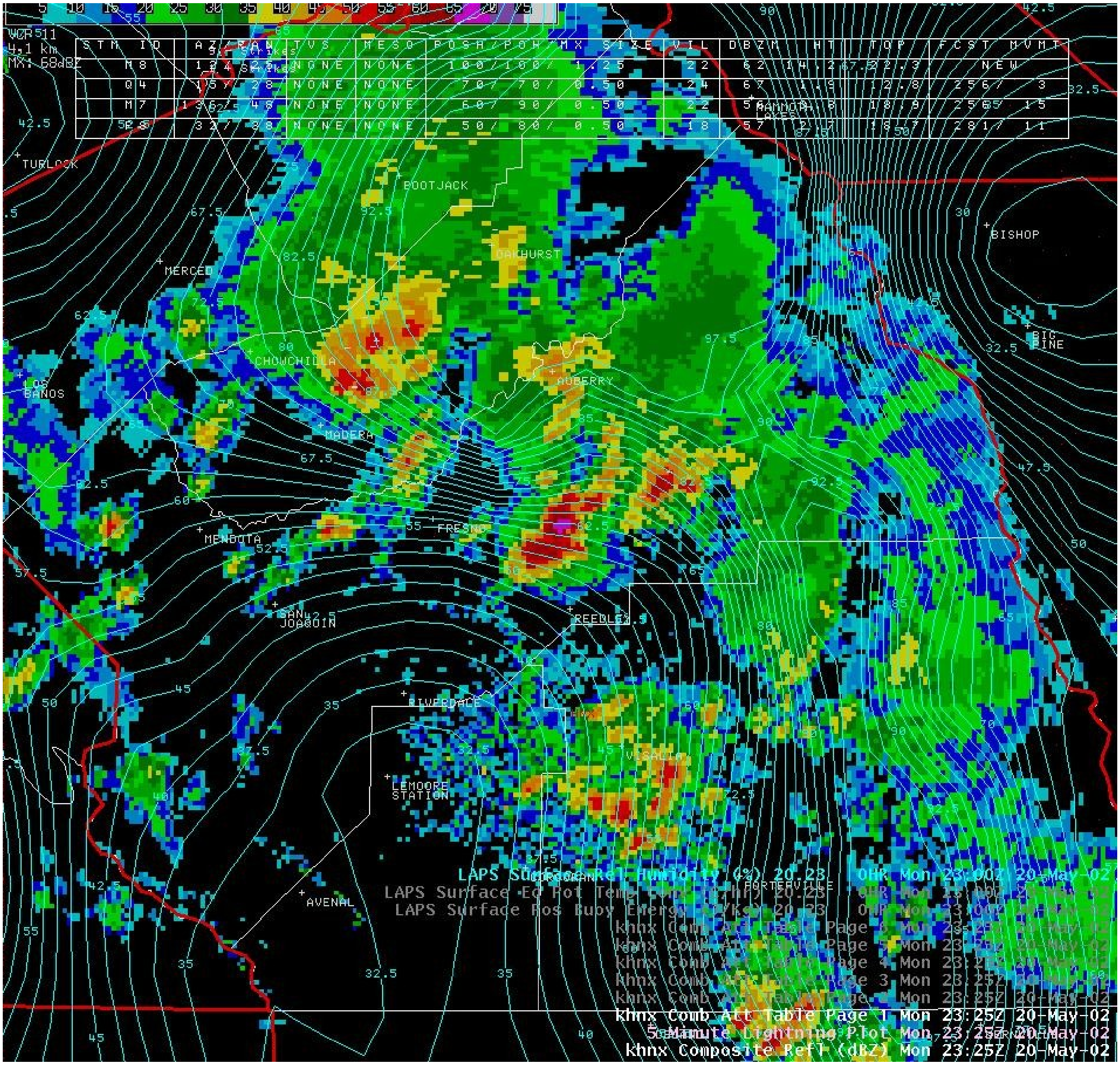

TURLOCK
BOOTJACK
MERCED
OAKHURST
BISHOP
BIG PINE
CHOWCHILLA
LOS BANOS
AUBERRY
MADERA
FRESNO
MENDOTA
SAN JOAQUIN
REEDLEY
RIVERDALE
VISALIA
LEMOORE STATION
AVENAL
PORTERVILLE
khnx Comb Att Table Page 1 Mon 23:25Z 20-May-02
khnx Composite Refl (dBZ) Mon 23:25Z 20-May-02

Figure 16

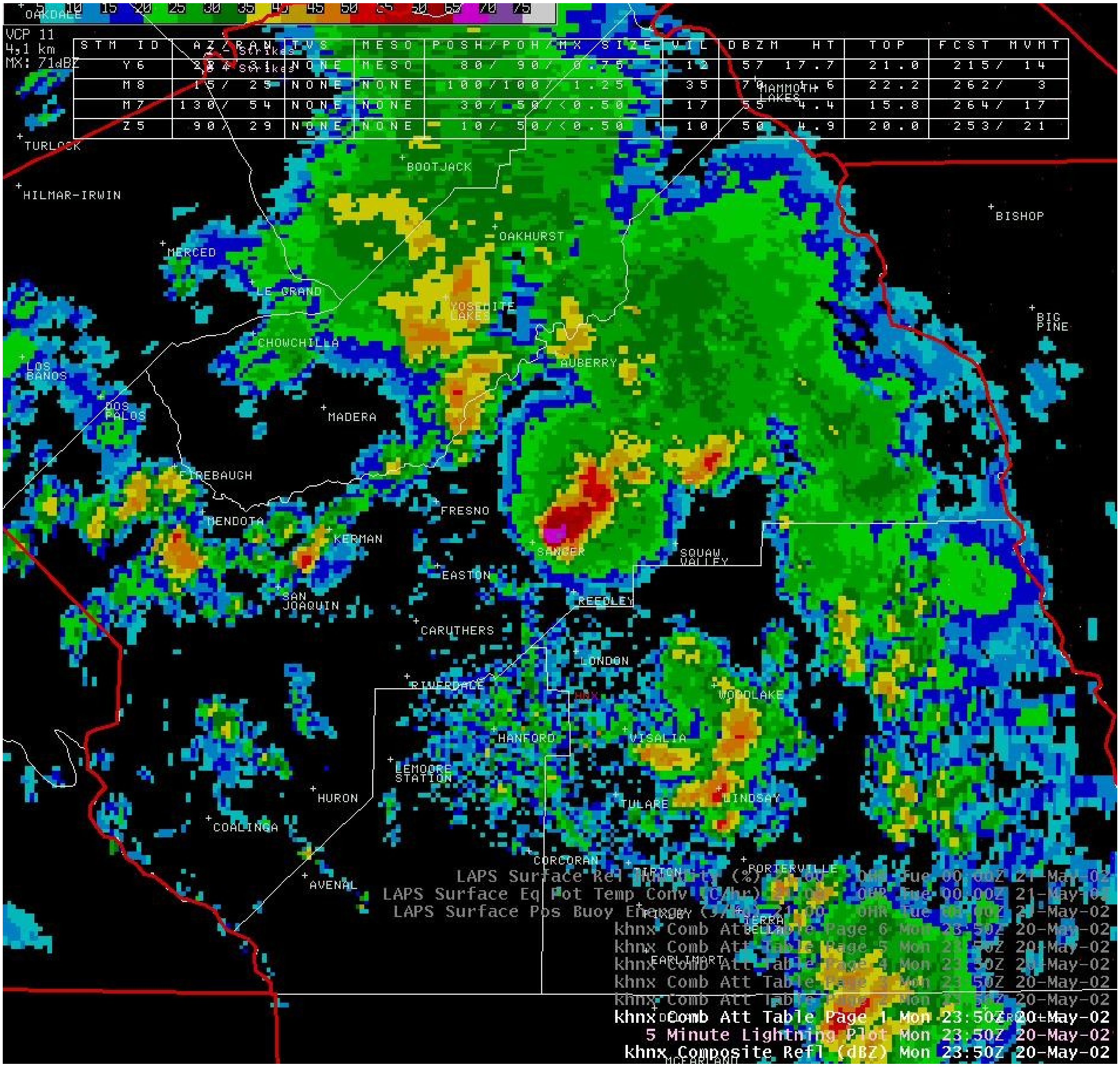
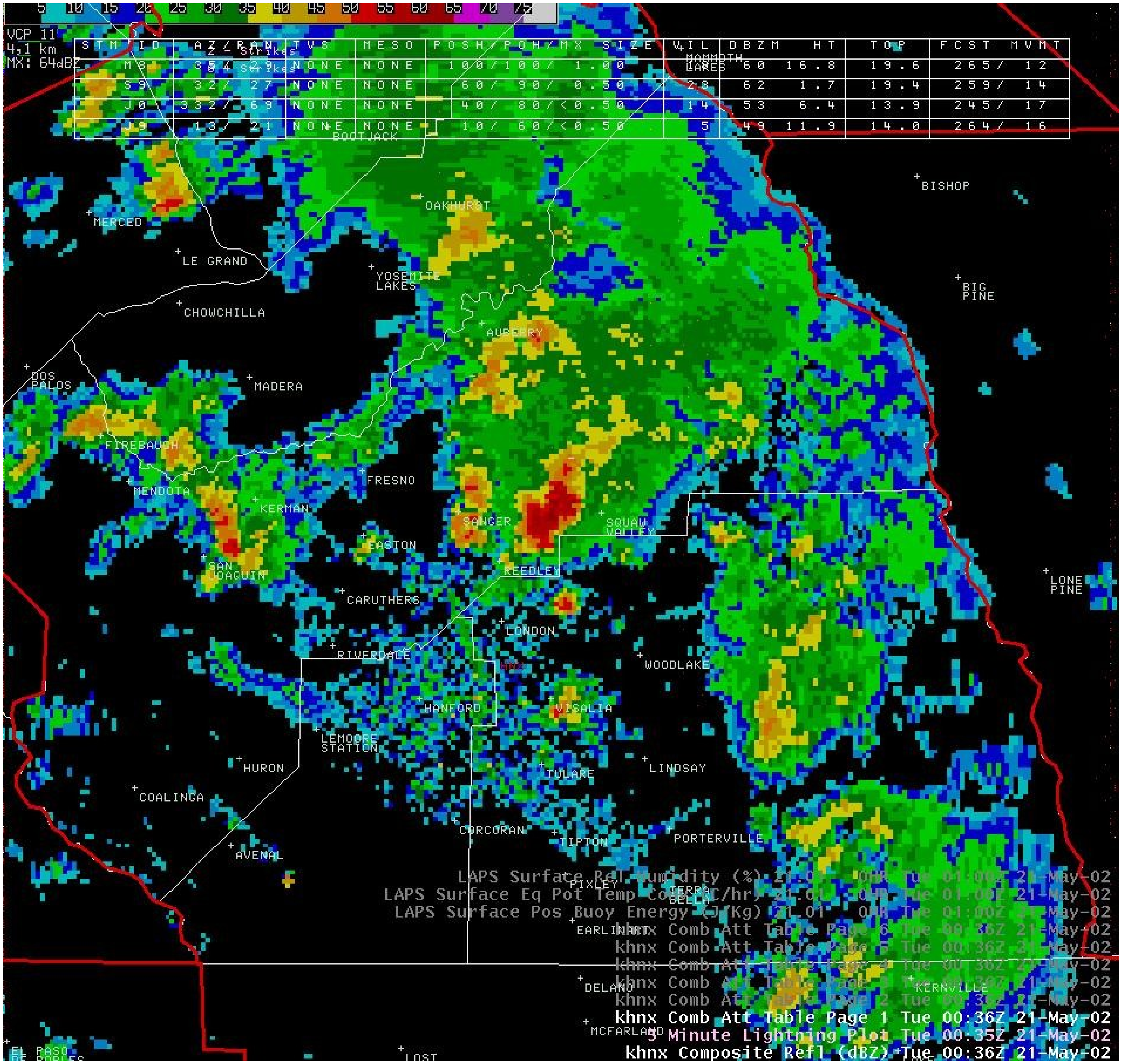

VCP 11
4,1 km
MX: 71dBZ
STM ID AZ/RAN TVS MESO POSH/POH/MX SIZE VIL DBZM HT TOP FCST MVMT
Y6 NONE MESO 80/ 90/ 0.75 12 57 17.7 21.0 215/ 14
M8 15/ 25 NONE NONE 100/100/ 1.25 35 22.2 262/ 3
M7 130/ 54 NONE NONE 30/ 50/<0.50 17 15.8 264/ 17
Z5 90/ 29 NONE NONE 10/ 50/<0.50 10 50 4.9 20.0 253/ 21
OAKDALE
TURLOCK
HILMAR-IRWIN
BOOTJACK
MAMMOTH LAKES
BISHOP
OAKHURST
MERCED
LE GRAND
YOSEMITE LAKES
CHOWCHILLA
BIG PINE
AUBERRY
LOS BANOS
DOS PALOS
MADERA
FIREBAUGH
FRESNO
MENDOTA
KERMAN
SANGER
SQUAW VALLEY
EASTON
REEDLEY
SAN JOAQUIN
CARUTHERS
LONDON
RIVERDALE
WOODLAKE
HANFORD
VISALIA
LEMOORE STATION
HURON
TULARE
LINDSAY
COALINGA
CORCORAN
PORTERVILLE
AVENAL
LAPS Surface Pos Buoy Energy
khnx Comb Att Table Page 4 Mon 23:50Z 20-May-02
khnx Comb Att Table Page 3 Mon 23:50Z 20-May-02
khnx Comb Att Table Page 1 Mon 23:50Z 20-May-02
5 Minute Lightning Plot Mon 23:50Z 20-May-02
khnx Composite Refl (dBZ) Mon 23:50Z 20-May-02

Figure 17


5 10 15 20 25 30 35 40 45 50 55 60 65 70 75
VCP 11
4.1 km
MX: 64dBZ
STM ID | AZ/RAN | TVS | MESO | POSH/POH/MX SIZE | VIL | DBZM | HT | TOP | FCST MVMT
M8 | 354/29 | NONE | NONE | 100/100/ 1.00 | | 60 | 16.8 | 19.6 | 265/ 12
S9 | 32/ 27 | NONE | NONE | 60/ 90/ 0.50 | 28 | 62 | 1.7 | 19.4 | 259/ 14
J0 | 332/ 69 | NONE | NONE | 40/ 80/<0.50 | 14 | 53 | 6.4 | 13.9 | 245/ 17
J9 | 13/ 21 | NONE | NONE | 10/ 60/<0.50 | 5 | 49 | 11.9 | 14.0 | 264/ 16
MAMMOTH LAKES
BOOTJACK
BISHOP
OAKHURST
MERCED
LE GRAND
YOSEMITE LAKES
BIG PINE
CHOWCHILLA
AUBERRY
DOS PALOS
MADERA
FIREBAUGH
FRESNO
MENDOTA
KERMAN
SANGER
SQUAW VALLEY
EASTON
SAN JOAQUIN
REEDLEY
LONE PINE
CARUTHERS
LONDON
RIVERDALE
WOODLAKE
HANFORD
VISALIA
LEMOORE STATION
HURON
LINDSAY
TULARE
COALINGA
CORCORAN
TIPTON
PORTERVILLE
AVENAL
PIXLEY
TERRA BELLA
EARLIMART
DELANO
KERNVILLE
MCFARLAND
EL PASO DE ROBLES
LOST
LAPS Surface Rel Humidity (%) 21.01 0HR Tue 01:00Z 21-May-02
LAPS Surface Eq Pot Temp Conv (C/hr) 21.01 0HR Tue 01:00Z 21-May-02
LAPS Surface Pos Buoy Energy (J/Kg) 21.01 0HR Tue 01:00Z 21-May-02
khnx Comb Att Table Page 6 Tue 00:36Z 21-May-02
khnx Comb Att Table Page 5 Tue 00:36Z 21-May-02
khnx Comb Att Table Page 4 Tue 00:36Z 21-May-02
khnx Comb Att Table Page 3 Tue 00:36Z 21-May-02
khnx Comb Att Table Page 2 Tue 00:36Z 21-May-02
khnx Comb Att Table Page 1 Tue 00:36Z 21-May-02
5 Minute Lightning Plot Tue 00:35Z 21-May-02
khnx Composite Refl (dBZ) Tue 00:36Z 21-May-02