Microbursts over South-Central Arizona on 22 August 2003

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Introduction

During the evening of 22 August 2003, powerful microbursts struck north-central Pinal County and extreme southeast Maricopa County, Arizona. Greatest damage occurred in Queen Creek, a small community in the far southeast portion of the Greater Phoenix metropolitan area, as well as the new Johnson Ranch subdivision, located several miles southeast of Queen Creek. Winds estimated at 80-100 mph blew down more than 200 power poles, destroyed many outbuildings (a horse was killed when one outbuilding collapsed), smashed windshields and windows on numerous vehicles, damaged or destroyed many roofs of homes, uprooted hundreds of mature trees and destroyed farm irrigation equipment. Fortunately, no serious human injuries were reported. This TA-Lite will provide a brief synoptic overview, describe storm development and evolution, and end with a discussion/conclusions section.

Synoptic Situation

The large-scale weather pattern over much of the United States was dominated by a ridge of high pressure in the mid-troposphere, with its western extremity over east-central Arizona (Fig. 1). Examination of 1200 UTC soundings over southern Arizona indicated that, in the 700-400 hPa layer, 20-35 kt southerly winds existed over Yuma, 10-15 kt southerly wind existed over Phoenix, and 15-20 kt southeasterly winds existed over Tucson. Unstable, moist conditions existed over south central Arizona; the 1200 UTC Phoenix sounding indicated that mixed-layer (sfc-700 hPa) CAPE was ~1150 j/kg, while surface-700 hPa mean mixing ratio was 11.3 g/kg (Fig. 2). Surface dew points over south central Arizona remained in the 60-65 F range during the day, 4-6 degrees above the climatological average. GOES precipitable water images, soundings, and GPS-IPW sensors indicated that a moisture ridge, with precipitable water between 1.5 and 1.75", was oriented north-south across western and central Arizona. Noticeably drier air existed over southern California and over far eastern Arizona (Fig. 3).

A short wave trough moved northeast across southern California and southern Nevada on 22 August, while an easterly wave progressed slowly west across northern and central Mexico. At the southern end of the easterly wave, a tropical disturbance (soon to develop into Hurricane Ignacio) was taking shape just south of the entrance to the Gulf of California. The easterly wave was expected to enhance thunderstorm development over far southern Arizona, with more significant storms expected over and south of the state of Sonora, Mexico, during the evening. No well-defined diffluent or divergent flow existed over south central Arizona at and above 300 hPa during the day on 22 August 2003; however, a 300-200 hPa anticyclone center, which existed near the Arizona-New Mexico border at 1200 UTC, was forecast by the eta and GFS to drift slowly southwest and be situated over southern Arizona during the night of 22-23 August.

Given the presence of relatively large instability, southerly winds in the 700-400 hPa layer, and no apparent upper level forcing mechanism, thunderstorms were a possibility over much of the Phoenix CWA during the upcoming evening. The afternoon zone forecast prepared on 22 August for south-central Arizona, including northern Pinal County and the Greater Phoenix area, called for a 30% chance of evening showers and thunderstorms, with the possibility of blowing dust, for the evening/night of 22-23 August 2003 (the entire Phoenix CWA was forecast to have a 20-30 percent chance for storms overnight, with highest POP over south central Arizona). Outflow from storms over southern Arizona was expected to move north and trigger isolated to scattered storms over southwest and south-central Arizona. The morning HWO had highlighted the possibility of locally heavy rainfall with any storms, but made no mention of the possibility of damaging wind.

The large-scale weather pattern had changed very little by 0000 UTC 23 Aug 2003 (Fig. 4). The 0000 UTC Phoenix sounding (Fig. 5) revealed drying above the 850 hPa level, with precipitable water lowering by nearly two tenths of an inch in 12 hours, which led to a sharp reduction in surface-700 hPa based CAPE (from > 1000 j/kg to < 200 j/kg), even though surface-based CAPE was quite large (> 1700 j/kg). A special sounding taken at Phoenix at 0300 UTC (Fig. 6) indicated moistening had occurred, with precipitable water rising to 1.67". Surface-700 hPa based CAPE rose to > 900 j/kg, while the lifted index lowered to - 4 C. Rapid changes in moisture are typical over the lower desert of south central Arizona, even in environments characterized by weak flow aloft.

Storm Evolution During the Late Afternoon and Evening of 22 August 2003

Thunderstorm development occurred over the higher terrain of southern Gila County east of Phoenix during mid-afternoon of 22 August. Locally heavy rain (1-2 inches per hour) occurred over an unpopulated region of southern Gila County between 2300 UTC and 0100 UTC, and a small stream flood advisory was issued for that area at 0013 UTC 23 August (513 pm MST 22 August). Although these storms appeared to generate enough rain to produce a modest cold pool, no discernable outflow boundary (OB) was detected via the KIWA WSR-88D 0.5 degree base velocity products (however, the moistening observed on the 0300 UTC Phoenix sounding appears to have resulted as a consequence of atmospheric moistening just upstream from Phoenix due to the upstream convection).

A larger area of strong to severe thunderstorms developed near Tucson by late afternoon, evolved into a MCS, and propagated slowly toward the west and north between 2300Z and 0300Z (Figs. 7 8 9 10). The MCS generated a decent cold pool, with several outflow surges/segments noted on radar. The first OB pushed north and west from storms that affected the Tucson area, while a second OB moved north from storms over north-central Pima and far southwest Pinal Counties. The leading edges of the thunderstorm outflow boundaries were noted via the KIWA WSR-88D as they reached Pinal County (Figs.11-12).

Noting the degree of instability and low-level moisture on the 0300 UTC Phoenix sounding, as well as GOES-derived stability and precipitable water fields (Fig. 13), warning forecasters at WFO Phoenix expected the OB to trigger new storms over central and northern Pinal County, as well as western Maricopa County. New storm development occurred just prior to 0400Z over north-central Pinal County at what appeared to be intersecting OB segments, precisely where a pre-existing west-east oriented band of low-mid level cumuliform clouds existed. The interaction between the pre-existing cloud band and the intersecting outflows resulted in the rapid development of several severe multicell storms in a narrow corridor of north-central Pinal County and far southeast Maricopa County between 0350Z and 0500Z, primarily along the eastern periphery of the primary OB (Figs.14 15 16 17 18 19). At least three individual microbursts were observed on radar; the two strongest low-level divergent signatures occurred over north central Pinal County and extreme southeast Maricopa County, coincident with the most significant wind damage (Figs. 20-21). Since these storms developed very close to the KIWA WSR-88D, the KFSX and KEMX radars provided very useful information regarding storm development and intensity (primarily via VIL, LRM-middle and LRM-upper products).

Discussion and Conclusions

At least three intense microbursts struck a small portion of north-central Pinal and extreme southeast Maricopa Counties between 9 pm and 10 pm MST on 22 August 2003. The initial microburst-producing storm developed at the intersection of pre-existing low-middle level cumuliform clouds and intersecting thunderstorm OBs. Outflow associated with the first microburst interacted with the pre-existing OB to spawn a second storm, and the microburst produced by the second storm interacted with the OB to spawn a third storm, which quickly produced the most intense of the three microbursts, which affected the town of Queen Creek. Microburst "families" such as this have been observed prior to 22 August 2003, but the proximity of this event to the KIWA WSR-88D and the availability of WES provided a great opportunity for forecasters to examine the evolution of this event as it related to synoptic and mesoscale conditions.

Although severe thunderstorm development was triggered over a small portion of south-central Arizona, areal coverage of storms over the Phoenix CWA the night of 22-23 August 2003 was less than expected, and no thunderstorms occurred west of Phoenix. It appeared that meager upper level support, coupled with dry advection between 850 and 700 hPa, were key contributors to the paucity of storms over much of the CWA. Severe storm development was restricted to the area where a localized area of low level moistening (and resultant increase in CAPE and lowering of the LFC) was affected by colliding outflows from distant storms.

Figure Captions

Figure 1. 500 hPa heights overlain on water vapor image at 1200 UTC 22 August 2003.

Figure 2. Phoenix sounding taken at 1200 UTC 22 August 2003.

Figure 3. Four panel display of GOES-based fields at 2000 UTC 22 August 2003: clockwise from lower left, CAPE, precipitable water, lifted index, and sounder lifted index.

Figure 4. 500 hPa heights overlain on water vapor image at 0000 UTC 23 August 2003.

Figure 5. Phoenix sounding taken at 0000 UTC 23 August 2003.

Figure 6. Phoenix sounding taken at 0300 UTC 23 August 2003.

Figure 7. Visible satellite image, overlain by metars and 15-minute cloud-to-ground lightning, valid 2200 UTC 22 August 2003.

Figure 8. Visible satellite image, overlain by metars and 15-minute cloud-to-ground lightning, valid 0000 UTC 23 August 2003.

Figure 9. Infrared satellite image, overlain by 1 hour cloud-to-ground lightning, valid 0000 UTC 23 August 2003.

Figure 10. Infrared satellite image, overlain by 1 hour cloud-to-ground lightning, valid at 0300 UTC 23 August 2003.

Figure 11. KIWA WSR-88D 0.5 degree 8-bit base velocity image, overlain by 5-minute cloud-to-ground lightning, valid at 0315 UTC 23 August 2003.

Figure 12. KIWA WSR-88D 0.5 degree 8-bit base velocity image, overlain by 5-minute cloud-to-ground lightning, valid at 0345 UTC 23 August 2003.

Figure 13. Four panel display of GOES-based fields at 0400 UTC 23 August 2003: clockwise from lower left, CAPE, precipitable water, lifted index, and sounder lifted index.

Figure 14. Four panel radar displays, valid at 0357 UTC 23 August 2003: clockwise from lower left, KFSX VIL, KIWA 0.5 degree 8-bit base velocity, KIWA 0.5 degree 8-bit base reflectivity, and KIWA 19.5 degree 8-bit base reflectivity.

Figure 15. Same as Figure 14, except valid at 0407 UTC 23 August 2003.

Figure 16. Same as Figure 14, except valid at 0417 UTC 23 August 2003.

Figure 17. Same as Figure 14, except valid at 0428 UTC 23 August 2003.

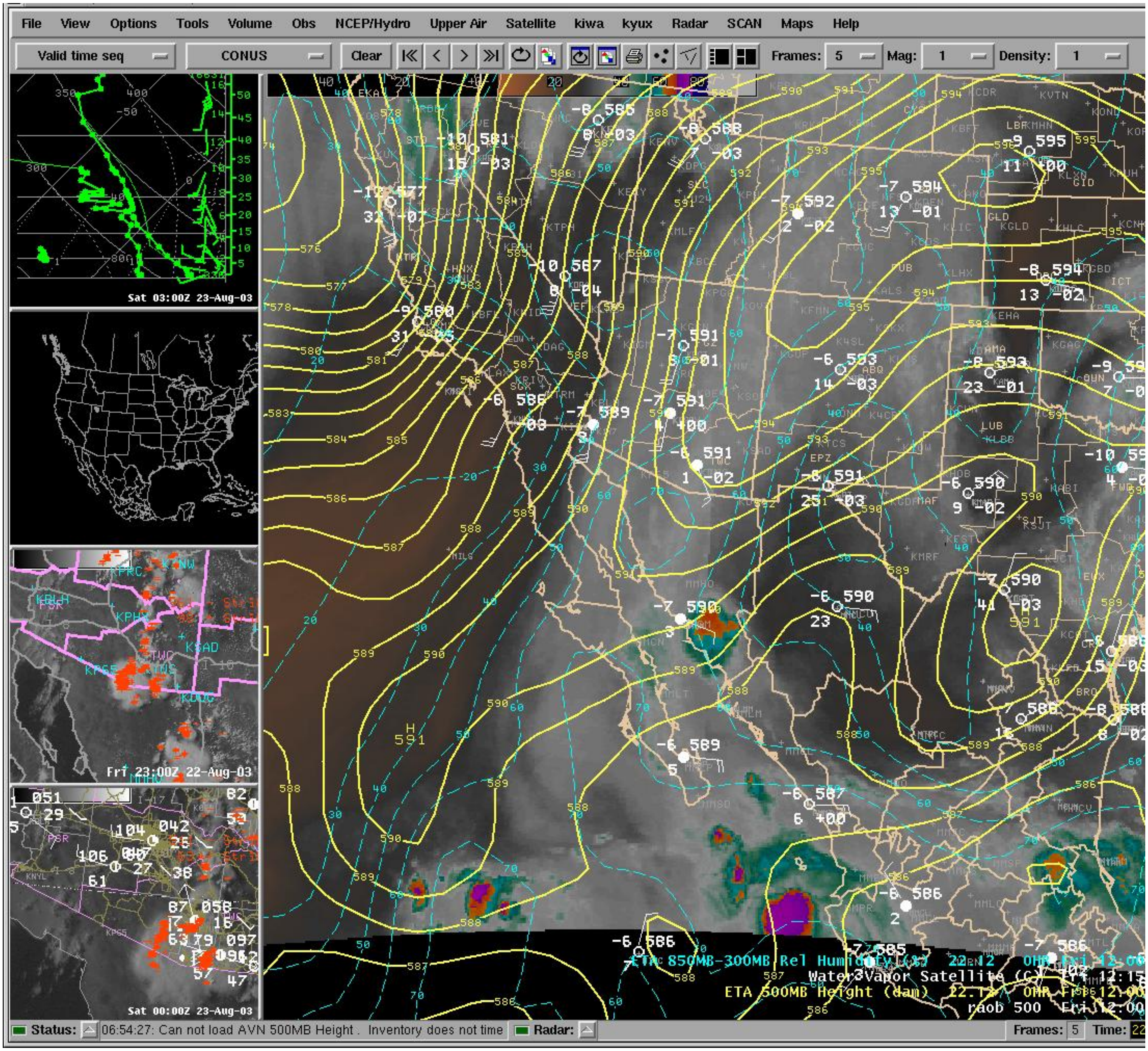
Figure 18. Same as Figure 14, except valid at 0438 UTC 23 August 2003.

Figure 19. Same as Figure 14, except valid at 0448 UTC 23 August 2003.

Figure 20. Microburst "footprint" near Magma, valid at 0422 UTC 23 August 2003. 85 knot radial velocity difference between peak inbound (57 knots) and peak outbound (28 knots) values.

Figure 21. Microburst "footprint" in Queen Creek, valid at 0443 UTC 23 August 2003. 103 knot radial velocity difference between peak inbound velocity (69 knots) and peak outbound velocity (34 knots).

Figure 1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Fri 23:00Z 22-Aug-03
Sat 00:00Z 23-Aug-03
ETA 850MB-300MB Rel Humidity (%)
Water Vapor Satellite
ETA 500MB Height (dam)
raob 500
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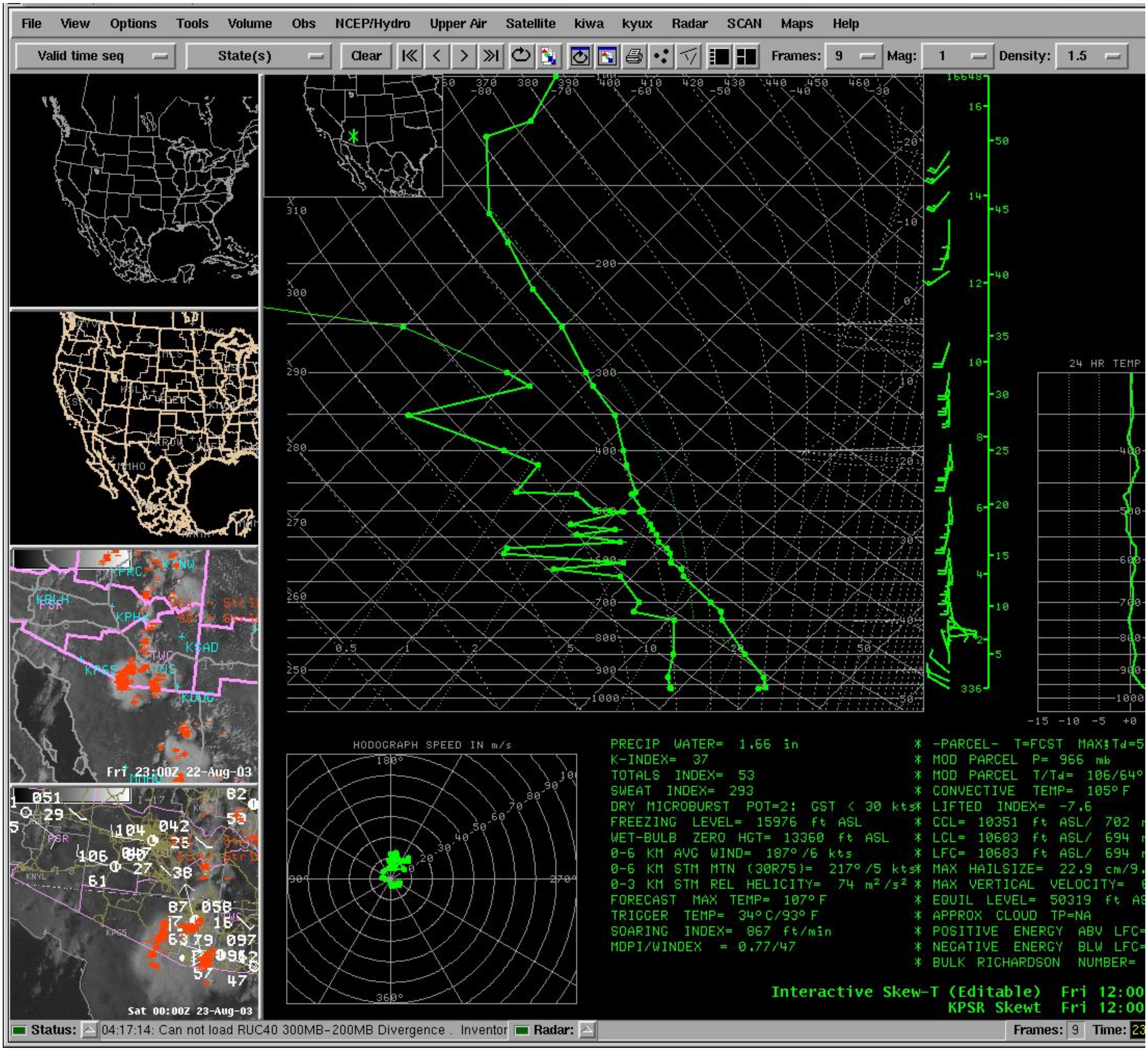
Time:

Figure 2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Clear
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HODOGRAPH SPEED IN m/s
24 HR TEMP
PRECIP WATER= 1.66 in
K-INDEX= 37
TOTALS INDEX= 53
SWEAT INDEX= 293
DRY MICROBURST POT=2: GST < 30 kts
FREEZING LEVEL= 15976 ft ASL
WET-BULB ZERO HGT= 13360 ft ASL
0-6 KM AVG WIND= 187° /6 kts
0-6 KM STM MTN (30R75)= 217° /5 kts
0-3 KM STM REL HELICITY= 74 m²/s²
FORECAST MAX TEMP= 107° F
TRIGGER TEMP= 34° C/93° F
SOARING INDEX= 867 ft/min
MDPI/WINDEX = 0.77/47
* -PARCEL- T=FCST
* MOD PARCEL P= 966 mb
* MOD PARCEL T/Td= 106/64°
* CONVECTIVE TEMP= 105° F
* LIFTED INDEX= -7.6
* CCL= 10351 ft ASL/ 702
* LCL= 10683 ft ASL/ 694
* LFC= 10683 ft ASL/ 694
* MAX HAILSIZE= 22.9 cm/9.
* MAX VERTICAL VELOCITY=
* EQUIL LEVEL= 50319 ft
* APPROX CLOUD TP=NA
* POSITIVE ENERGY ABV LFC=
* NEGATIVE ENERGY BLW LFC=
* BULK RICHARDSON NUMBER=
Interactive Skew-T (Editable) Fri 12:00
KPSR Skewt Fri 12:00
Fri 23:00Z 22-Aug-03
Sat 00:00Z 23-Aug-03
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Frames: 9
Time:

Figure 3

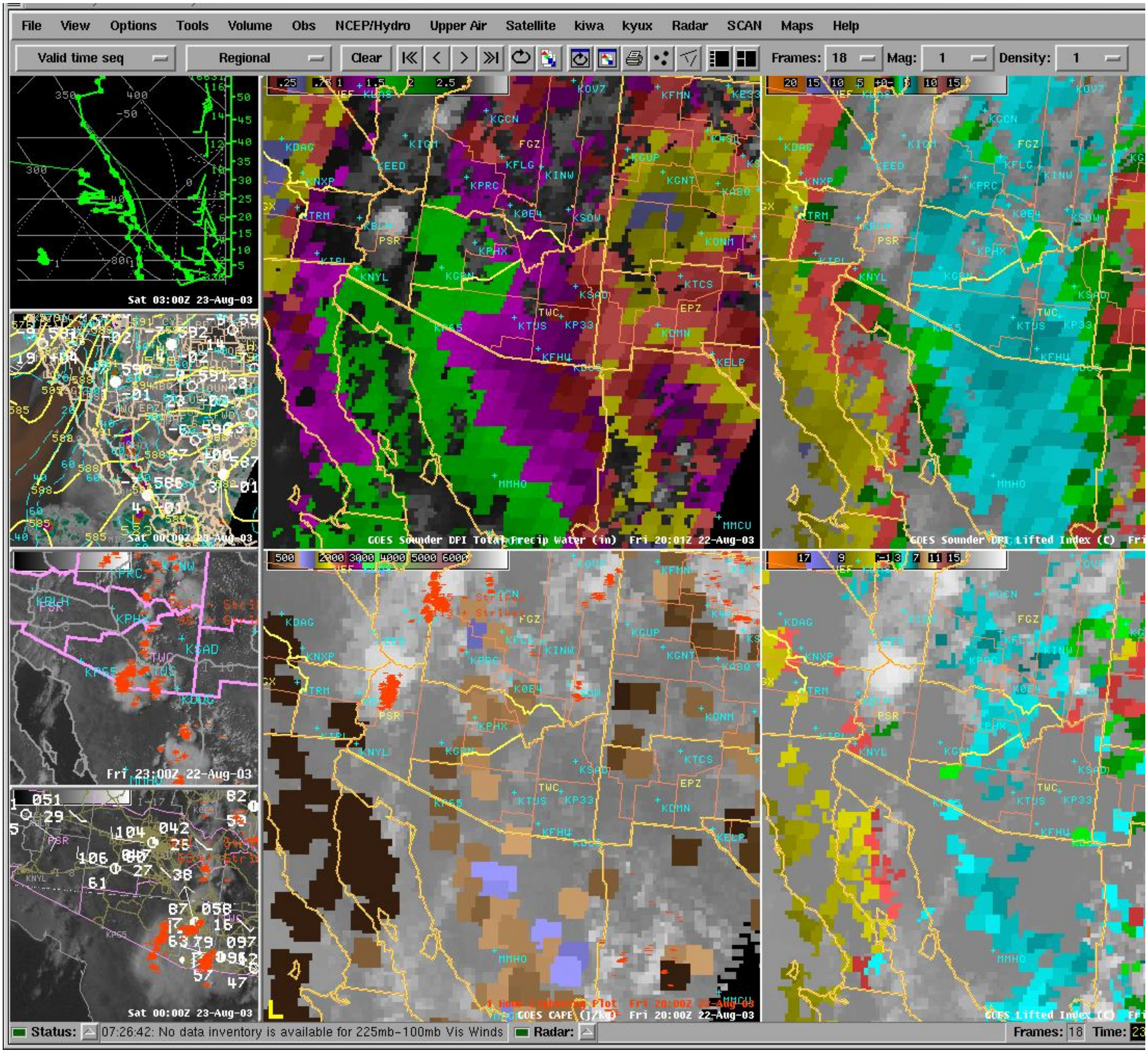
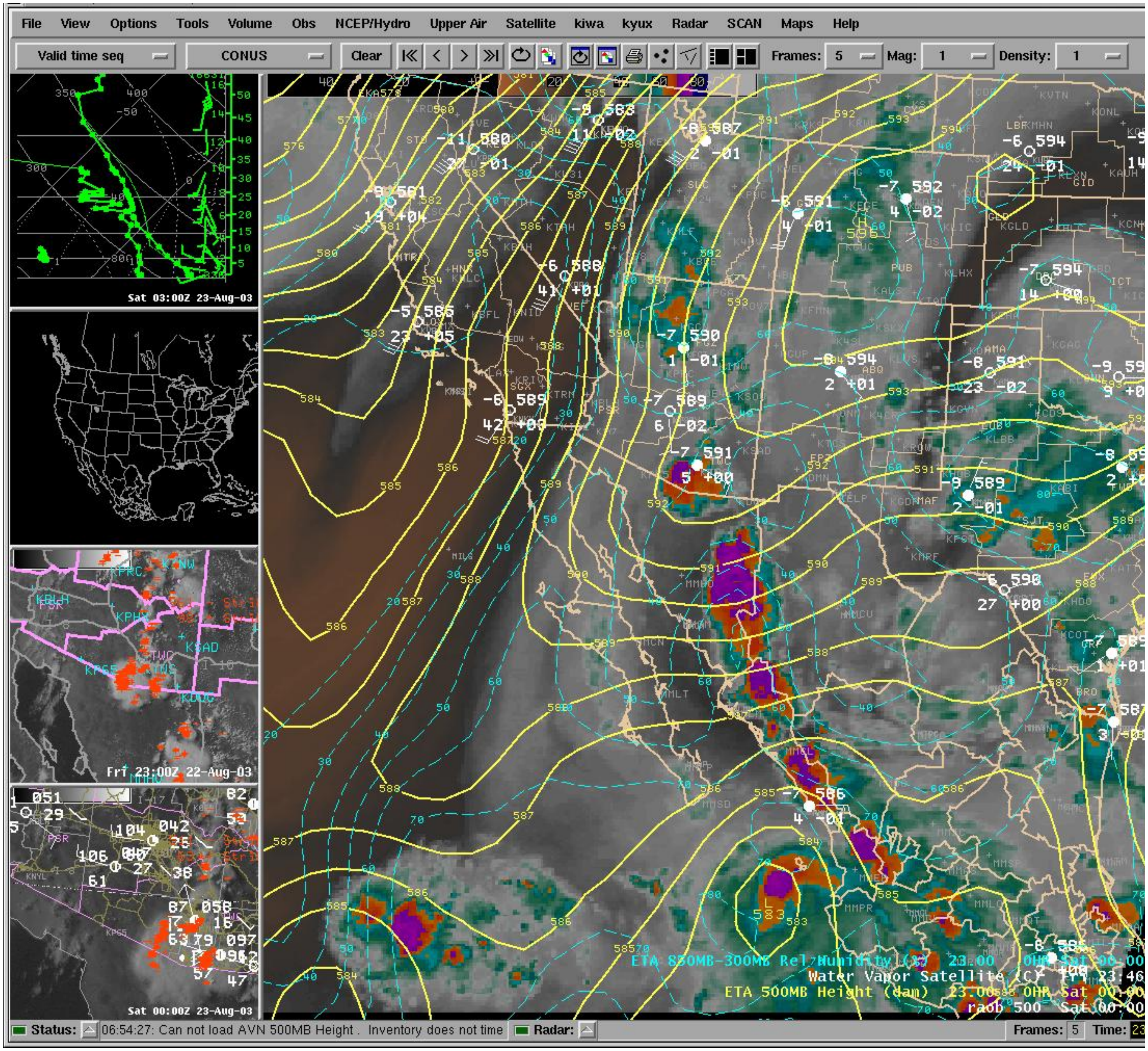


Figure 4



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Fri 23:00Z 22-Aug-03
Sat 00:00Z 23-Aug-03
ETA 850MB-300MB Rel Humidity (%) 23.00 0HR Sat 00:00
Water Vapor Satellite (C) Fri 23:46
ETA 500MB Height (dam) 23.00 0HR Sat 00:00
raob 500 Sat 00:00
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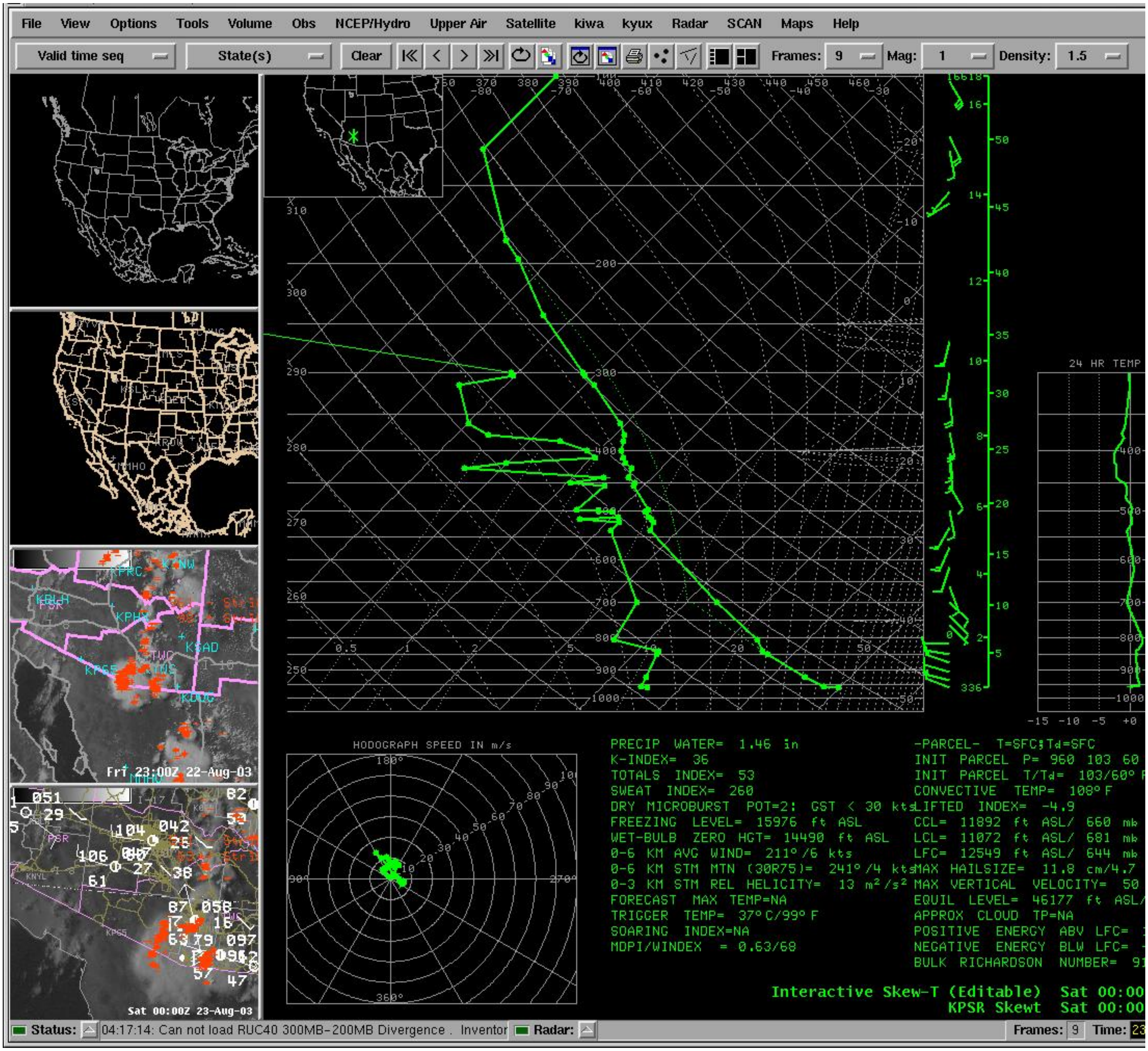
Frames: 5
Time:

Figure 5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State(s)
Clear
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Density: 1.5
24 HR TEMP
HODOGRAPH SPEED IN m/s
Fri 23:00Z 22-Aug-03
Sat 00:00Z 23-Aug-03
PRECIP WATER= 1.46 in
K-INDEX= 36
TOTALS INDEX= 53
SWEAT INDEX= 260
DRY MICROBURST POT=2: GST < 30 kts
FREEZING LEVEL= 15976 ft ASL
WET-BULB ZERO HGT= 14490 ft ASL
0-6 KM AVG WIND= 211°/6 kts
0-6 KM STM MTN (30R75)= 241°/4 kts
0-3 KM STM REL HELICITY= 13 m²/s²
FORECAST MAX TEMP=NA
TRIGGER TEMP= 37°C/99°F
SOARING INDEX=NA
MDPI/WINDEX = 0.63/68
-PARCEL- T=SFC;Td=SFC
INIT PARCEL P= 960 103 60
INIT PARCEL T/Td= 103/60°
CONVECTIVE TEMP= 108°F
LIFTED INDEX= -4.9
CCL= 11892 ft ASL/ 660 mb
LCL= 11072 ft ASL/ 681 mb
LFC= 12549 ft ASL/ 644 mb
MAX HAILSIZE= 11.8 cm/4.7
MAX VERTICAL VELOCITY= 50
EQUIL LEVEL= 46177 ft ASL/
APPROX CLOUD TP=NA
POSITIVE ENERGY ABV LFC=
NEGATIVE ENERGY BLW LFC=
BULK RICHARDSON NUMBER= 91
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KPSR Skewt Sat 00:00
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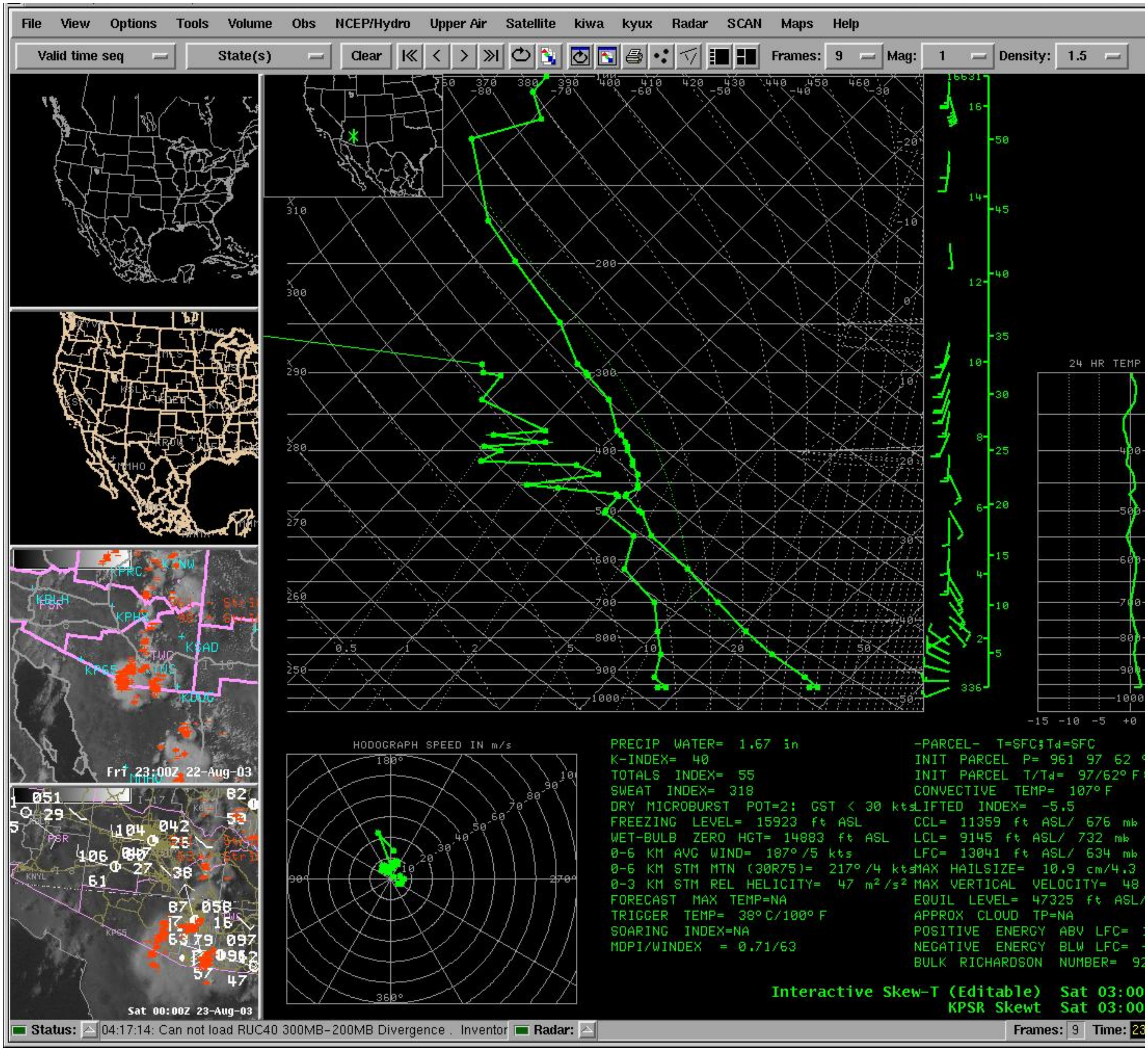
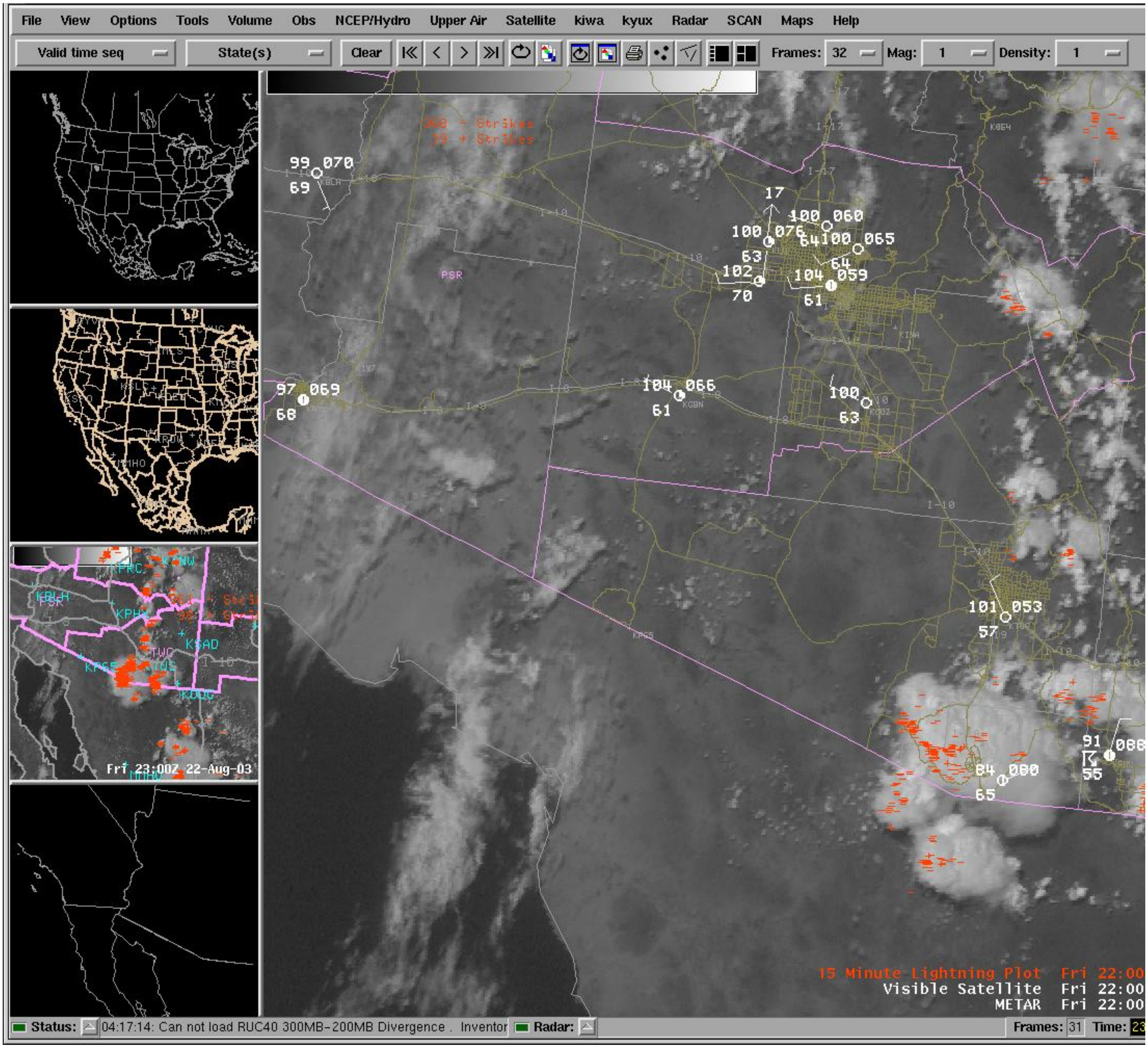
Radar:
Frames: 9 Time:

Figure 6



PRECIP WATER= 1.67 in
K-INDEX= 40
TOTALS INDEX= 55
SWEAT INDEX= 318
DRY MICROBURST POT=2: GST < 30 kts
FREEZING LEVEL= 15923 ft ASL
WET-BULB ZERO HGT= 14883 ft ASL
0-6 KM AVG WIND= 187° /5 kts
0-6 KM STM MTN (30R75)= 217° /4 kts
0-3 KM STM REL HELICITY= 47 m²/s²
FORECAST MAX TEMP=NA
TRIGGER TEMP= 38° C/100° F
SOARING INDEX=NA
MDPI/WINDEX = 0.71/63
-PARCEL- T=SFC;Td=SFC
CONVECTIVE TEMP= 107° F
LIFTED INDEX= -5.5
CCL= 11359 ft ASL/ 676 mb
LCL= 9145 ft ASL/ 732 mb
LFC= 13041 ft ASL/ 634 mb
EQUIL LEVEL= 47325 ft ASL
APPROX CLOUD TP=NA
HODOGRAPH SPEED IN m/s
Interactive Skew-T (Editable)
KPSR Skewt
Fri 23:00Z 22-Aug-03
Sat 00:00Z 23-Aug-03

Figure 7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15 Minute Lightning Plot Fri 22:00
Visible Satellite Fri 22:00
METAR Fri 22:00
Fri 23:00Z 22-Aug-03
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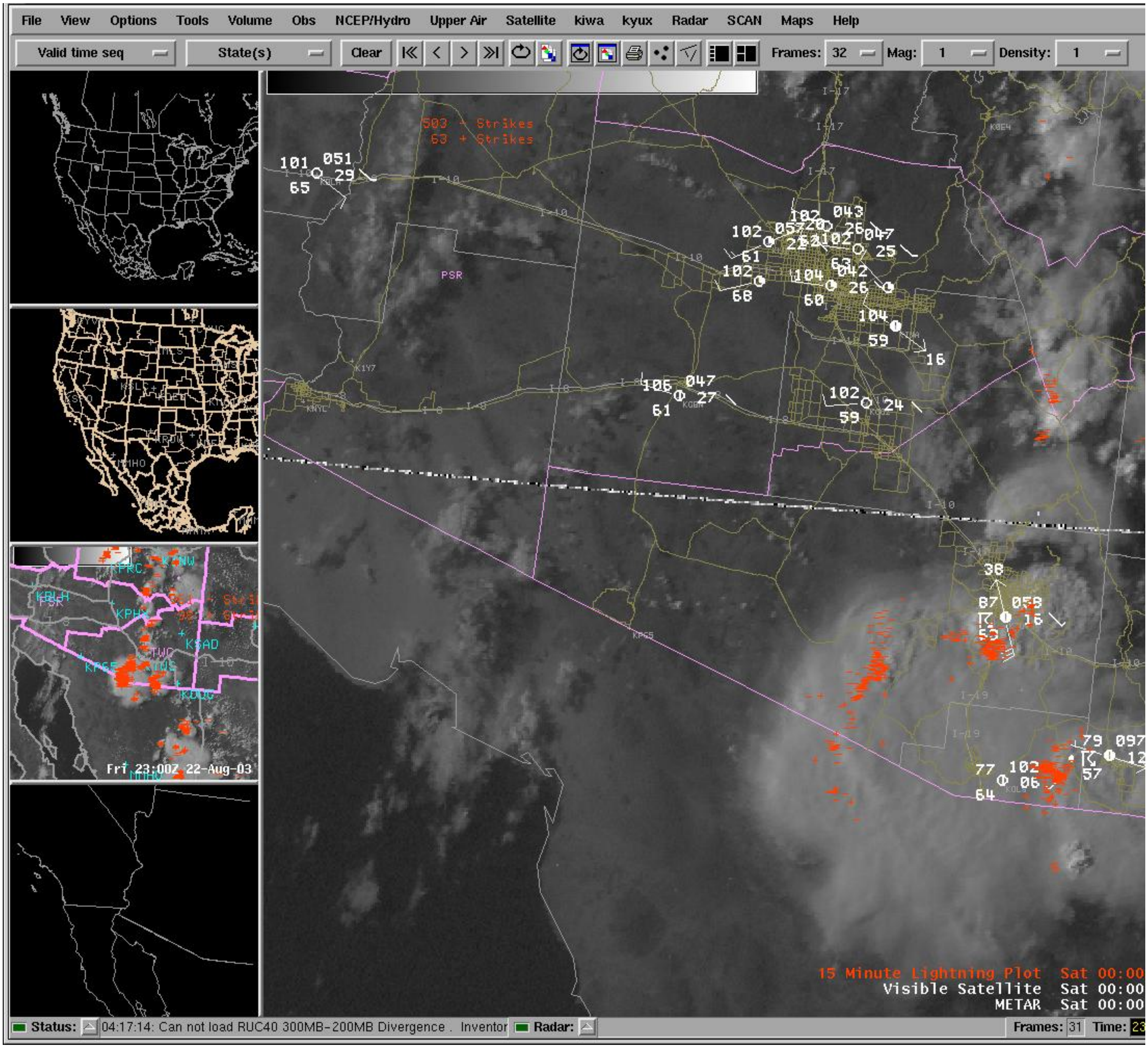
Radar:
Frames: 31
Time:

Figure 8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State(s)
Clear
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Density: 1
503 + Strikes
63 + Strikes
15 Minute Lightning Plot Sat 00:00
Visible Satellite Sat 00:00
METAR Sat 00:00
Fri 23:00Z 22-Aug-03
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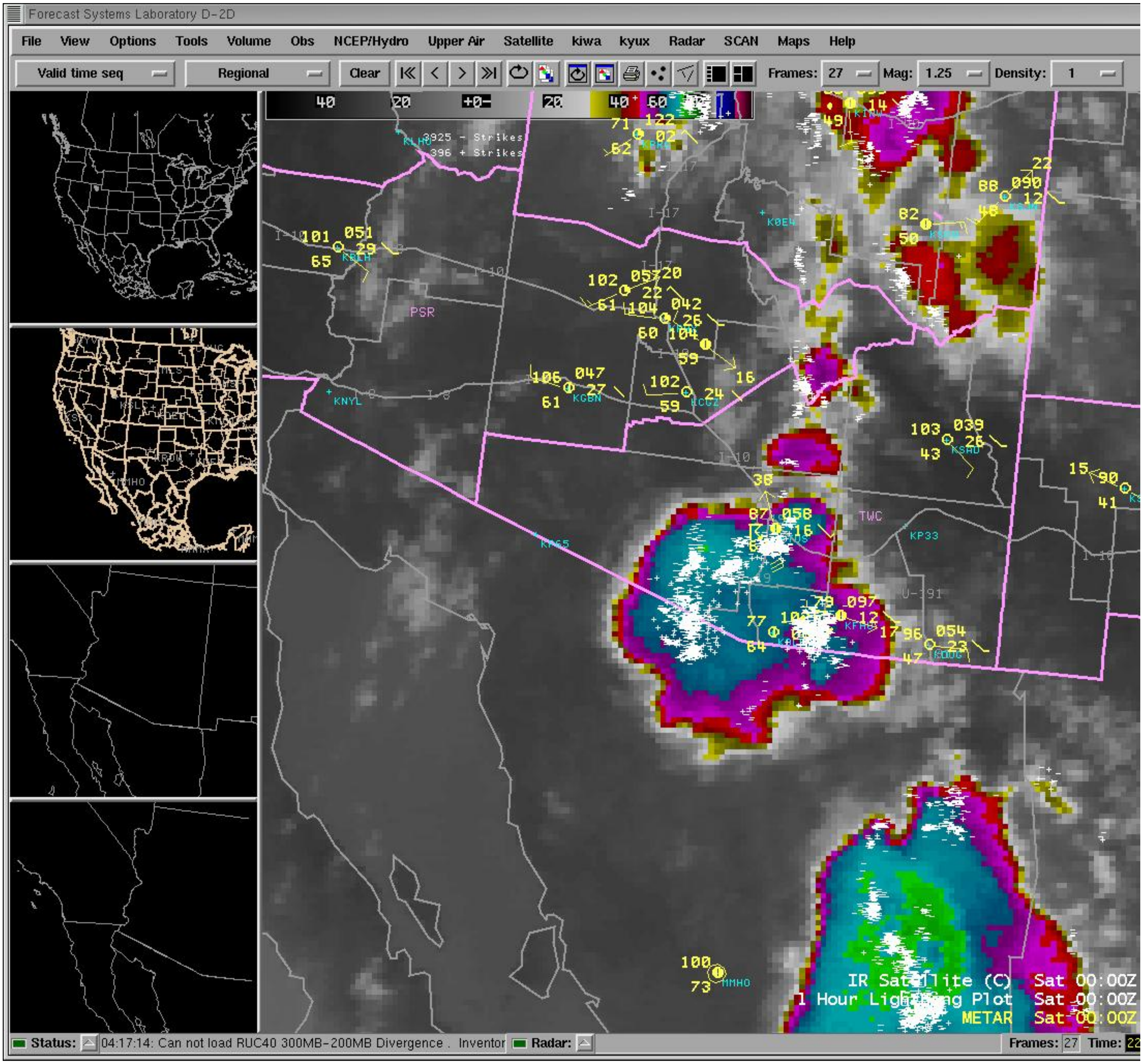
Radar:
Frames: 31
Time:

Figure 9



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Upper Air
Satellite
kiwa
kyux
Radar
SCAN
Maps
Help
Valid time seq
Regional
Clear
Frames: 27
Mag: 1.25
Density: 1
IR Satellite (C) Sat 00:00Z
1 Hour Lightning Plot Sat 00:00Z
METAR Sat 00:00Z
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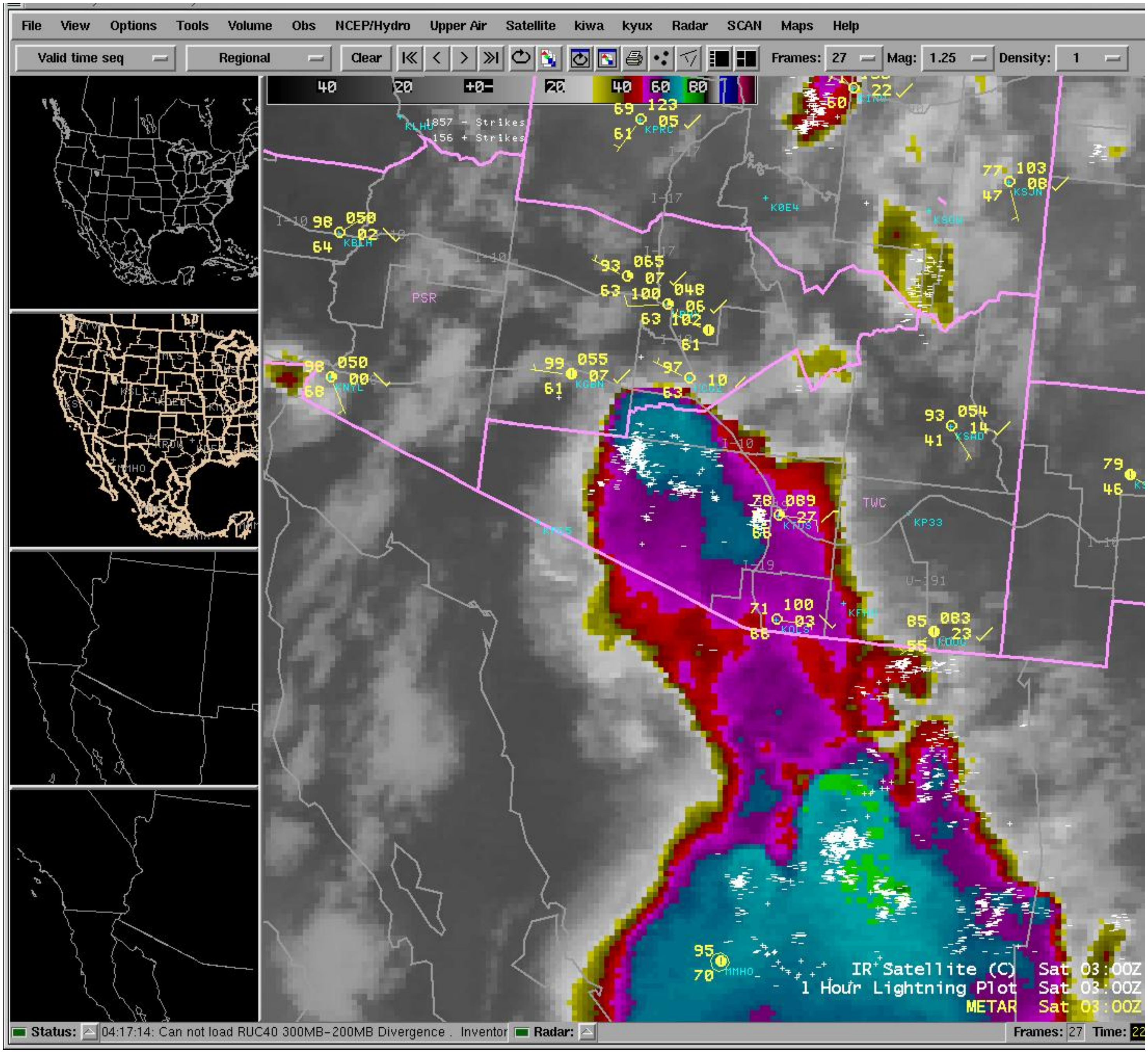
Radar:
Frames: 27
Time:

Figure 10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Valid time seq
Regional
Clear
Frames: 27
Mag: 1.25
Density: 1
1857 - Strikes
156 + Strikes
PSR
TWC
IR Satellite (C) Sat 03:00Z
1 Hour Lightning Plot Sat 03:00Z
METAR Sat 03:00Z
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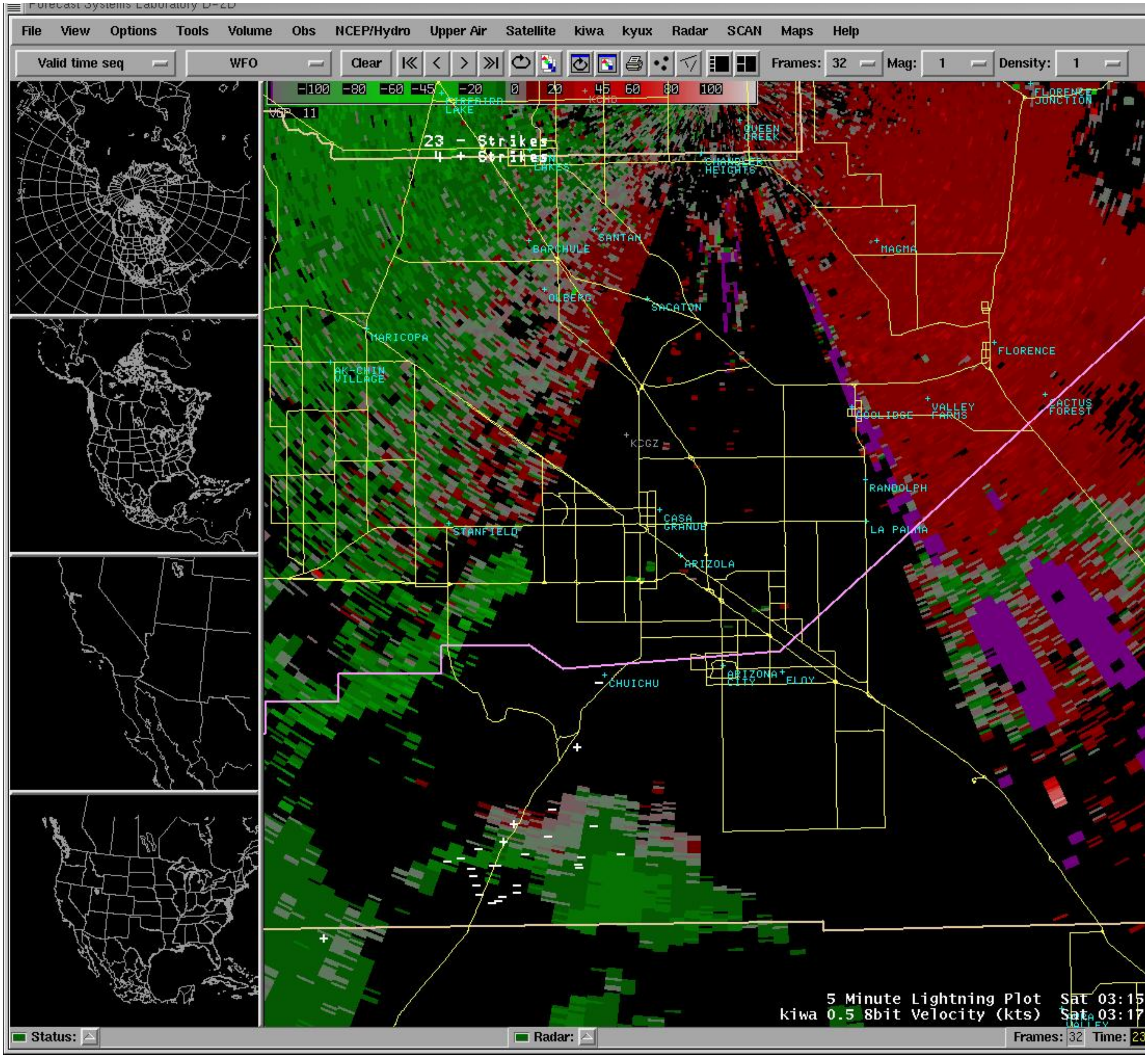
Radar:
Frames: 27
Time:

Figure 11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Valid time seq
WFO
Clear
Frames: 32
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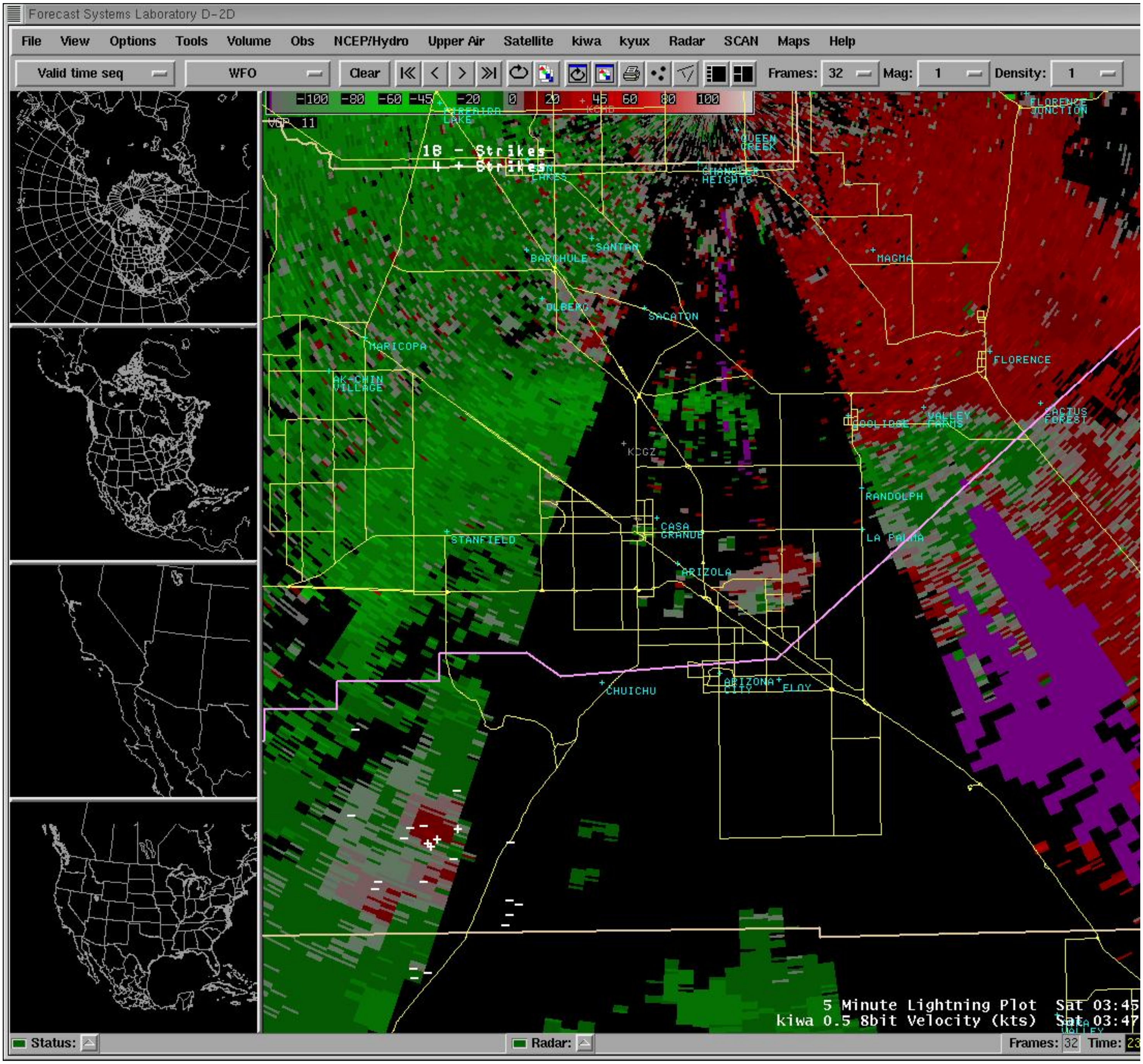
Density: 1
-100 -80 -60 -45 -20 0 20 45 60 80 100
23 - Strikes
4 + Strikes
QUEEN CREEK
CHANDLER HEIGHTS
FLORENCE JUNCTION
SANTAN
BAPCHULE
MAGMA
OLBERG
SACATON
MARICOPA
FLORENCE
AK-CHIN VILLAGE
COOLIDGE
VALLEY FARMS
CACTUS FOREST
KCGZ
RANDOLPH
CASA GRANDE
STANFIELD
LA PALMA
ARIZOLA
ARIZONA CITY
ELOY
CHUICHU
5 Minute Lightning Plot Sat 03:15
kiwa 0.5 8bit Velocity (kts) Sat 03:17
Status:
Radar:
Frames: 32 Time:

Figure 12


Forecast Systems Laboratory D-2D
16 - Strikes
4 + Strikes
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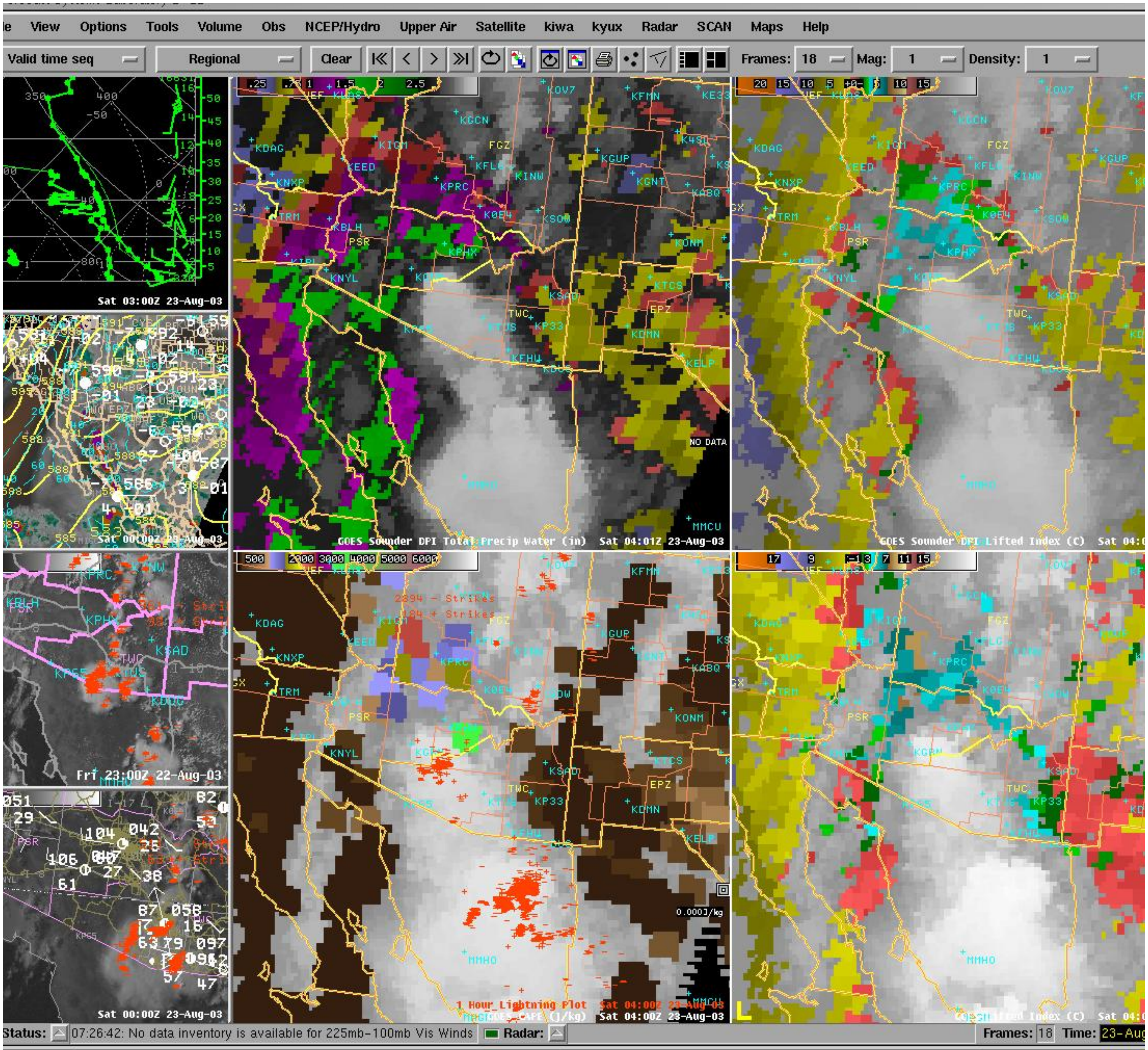
kiwa 0.5 8bit Velocity (kts) Sat 03:47

Figure 13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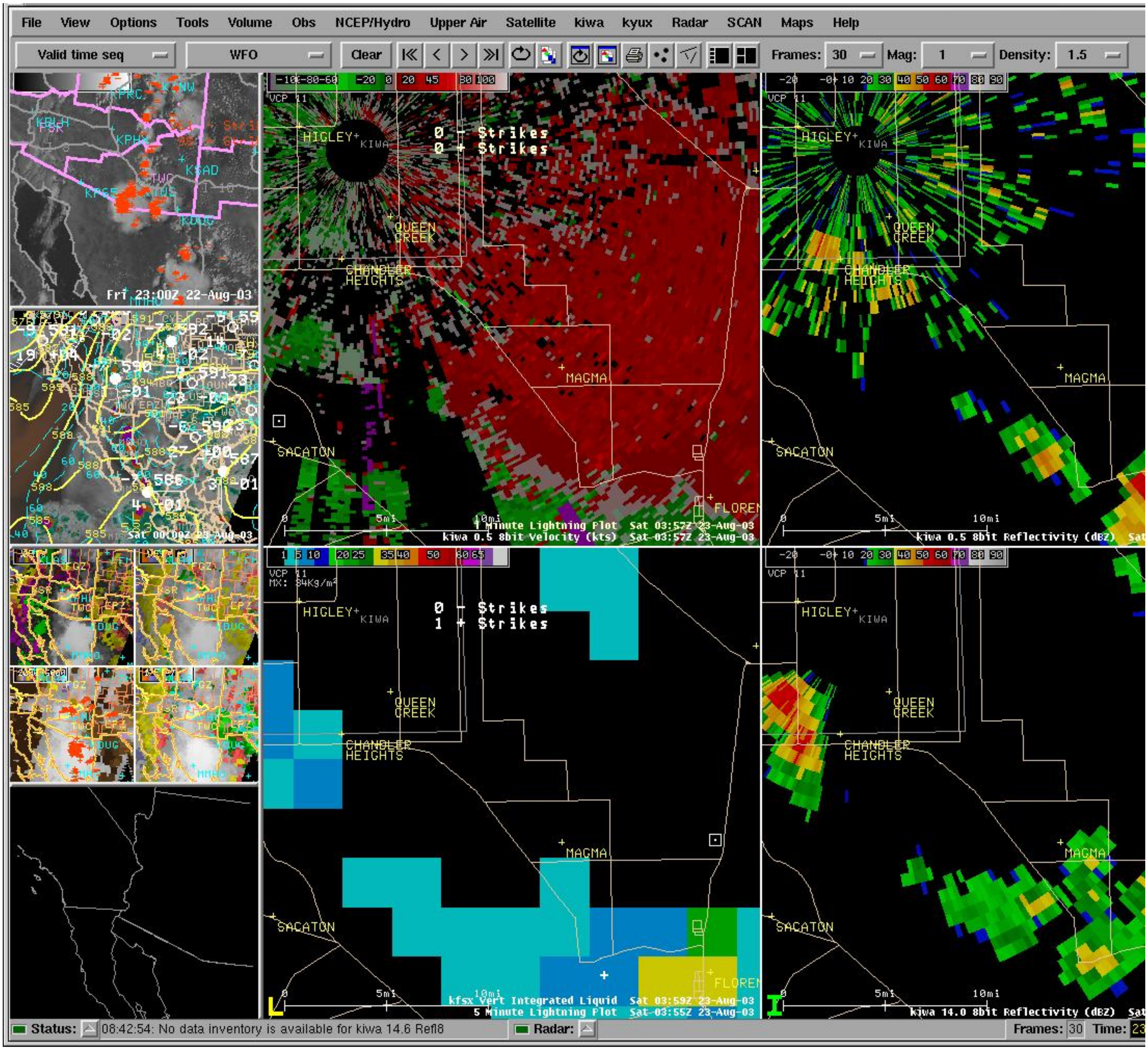
Valid time seq
Regional
Clear
Frames: 18 Mag: 1 Density: 1
Sat 03:00Z 23-Aug-03
Sat 00:00Z 23-Aug-03
Fri 23:00Z 22-Aug-03
Sat 00:00Z 23-Aug-03
GOES Sounder DPI Total Precip Water (in) Sat 04:01Z 23-Aug-03
GOES Sounder DPI Lifted Index (C)
NO DATA
1 Hour Lightning Plot
Sat 04:00Z 23-Aug-03
Status: 07:26:42: No data inventory is available for 225mb-100mb Vis Winds
Radar:
Frames: 18 Time:

Figure 14


File View Options Tools Volume Obs NCEP/Hydro Upper Air Satellite kiwa kyux Radar SCAN Maps Help
Valid time seq
WFO
Clear
Frames: 30 Mag: 1 Density: 1.5
0 - Strikes
0 + Strikes
HIGLEY
KIWA
QUEEN CREEK
CHANDLER HEIGHTS
MAGMA
SACATON
1 Minute Lightning Plot Sat 03:57Z 23-Aug-03
kiwa 0.5 8bit Velocity (kts) Sat 03:57Z 23-Aug-03
kiwa 0.5 8bit Reflectivity (dBZ)
0 - Strikes
1 + Strikes
kfsx Vert Integrated Liquid Sat 03:59Z 23-Aug-03
5 Minute Lightning Plot Sat 03:55Z 23-Aug-03
kiwa 14.0 8bit Reflectivity (dBZ)
Fri 23:00Z 22-Aug-03
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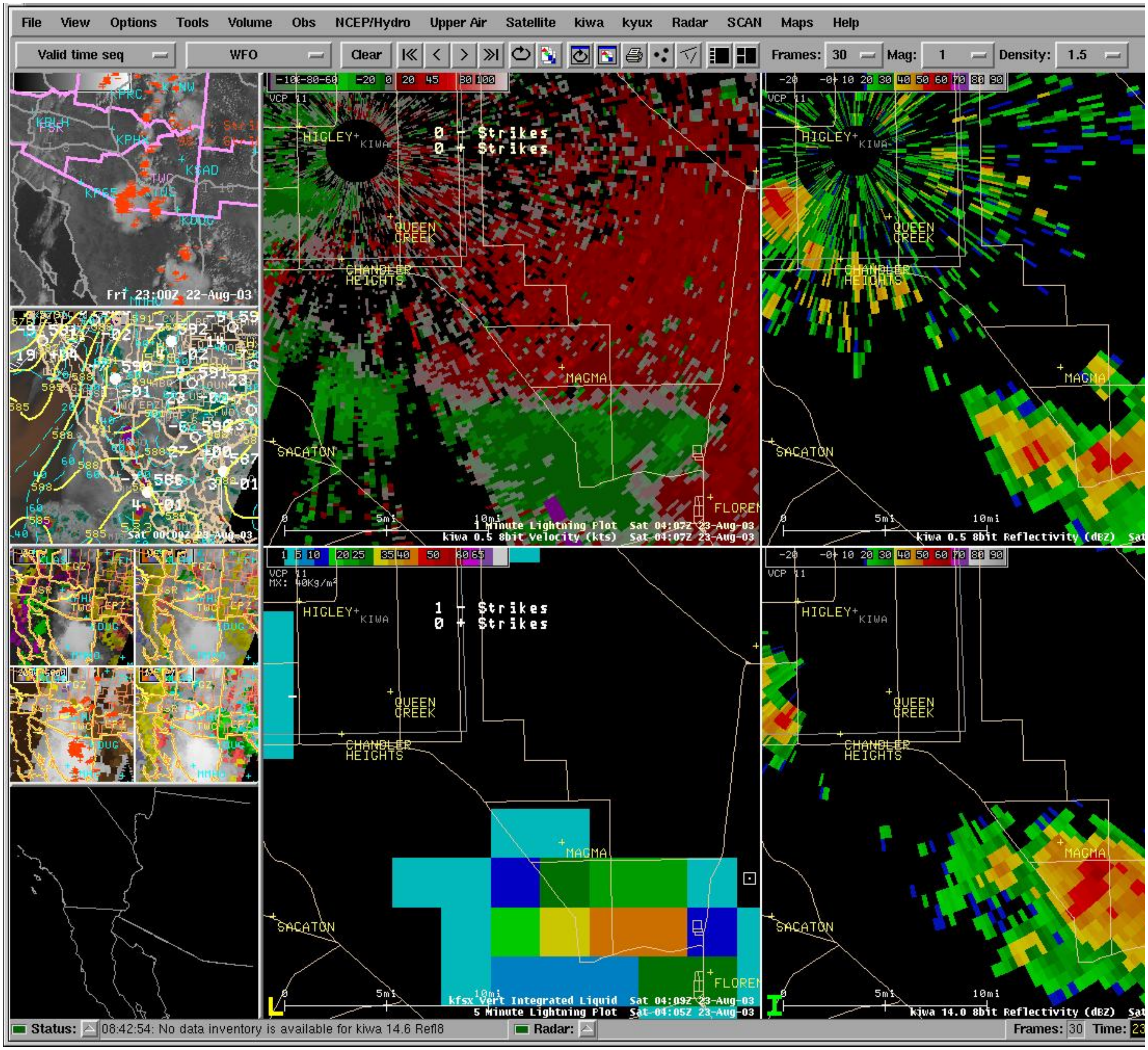
Radar:
Frames: 30 Time:

Figure 15


File View Options Tools Volume Obs NCEP/Hydro Upper Air Satellite kiwa kyux Radar SCAN Maps Help
Valid time seq
WFO
Clear
Frames: 30 Mag: 1 Density: 1.5
HIGLEY
KIWA
QUEEN CREEK
CHANDLER HEIGHTS
MAGMA
SACATON
FLOREN
0 - Strikes
0 + Strikes
1 - Strikes
0 + Strikes
1 Minute Lightning Plot Sat 04:07Z 23-Aug-03
kiwa 0.5 8bit Velocity (kts) Sat 04:07Z 23-Aug-03
kiwa 0.5 8bit Reflectivity (dBZ)
kfsx Vert Integrated Liquid Sat 04:09Z 23-Aug-03
5 Minute Lightning Plot Sat 04:05Z 23-Aug-03
kiwa 14.0 8bit Reflectivity (dBZ)
Fri 23:00Z 22-Aug-03
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Radar:
Frames: 30 Time:

Figure 16

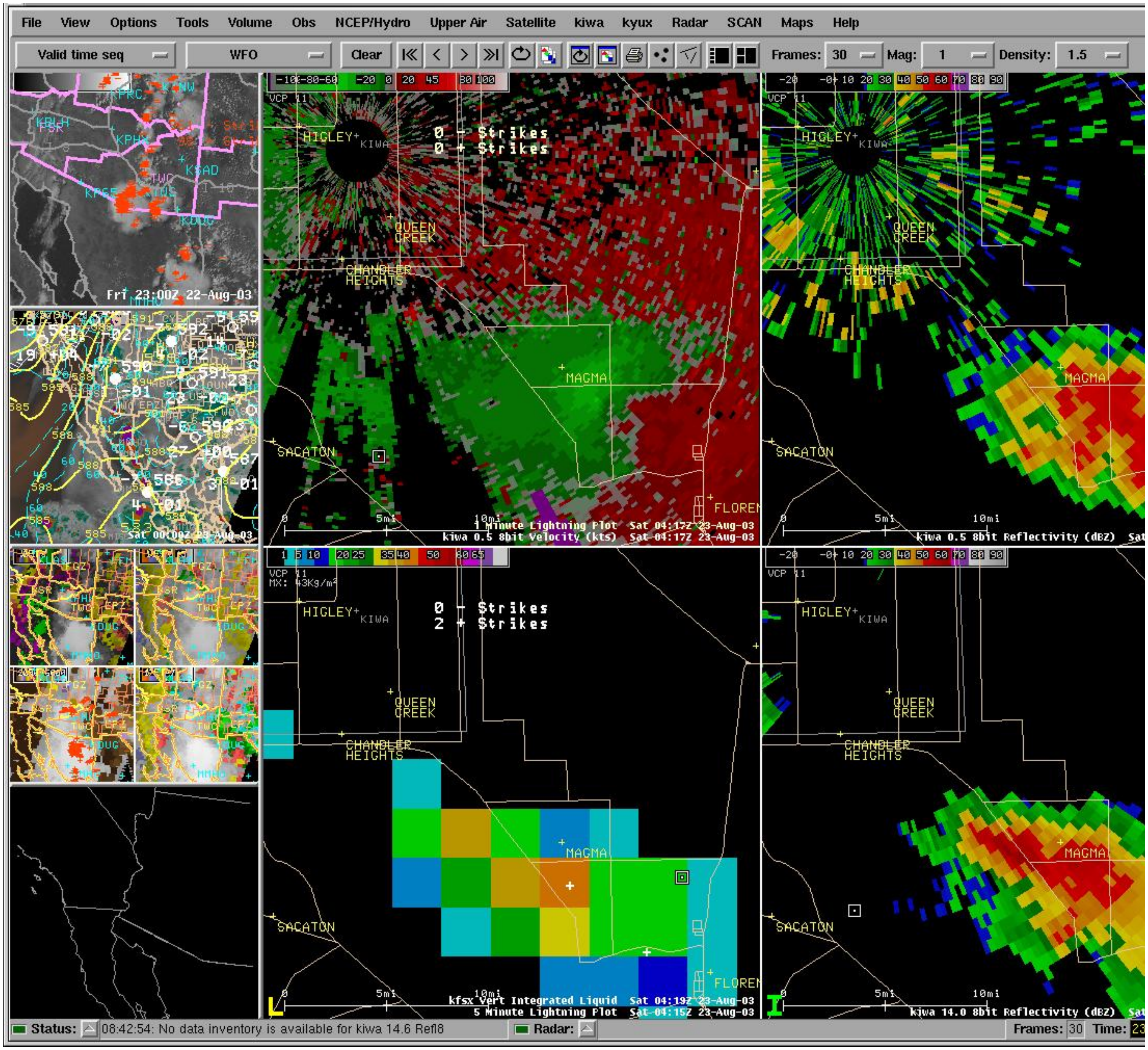


Figure 17

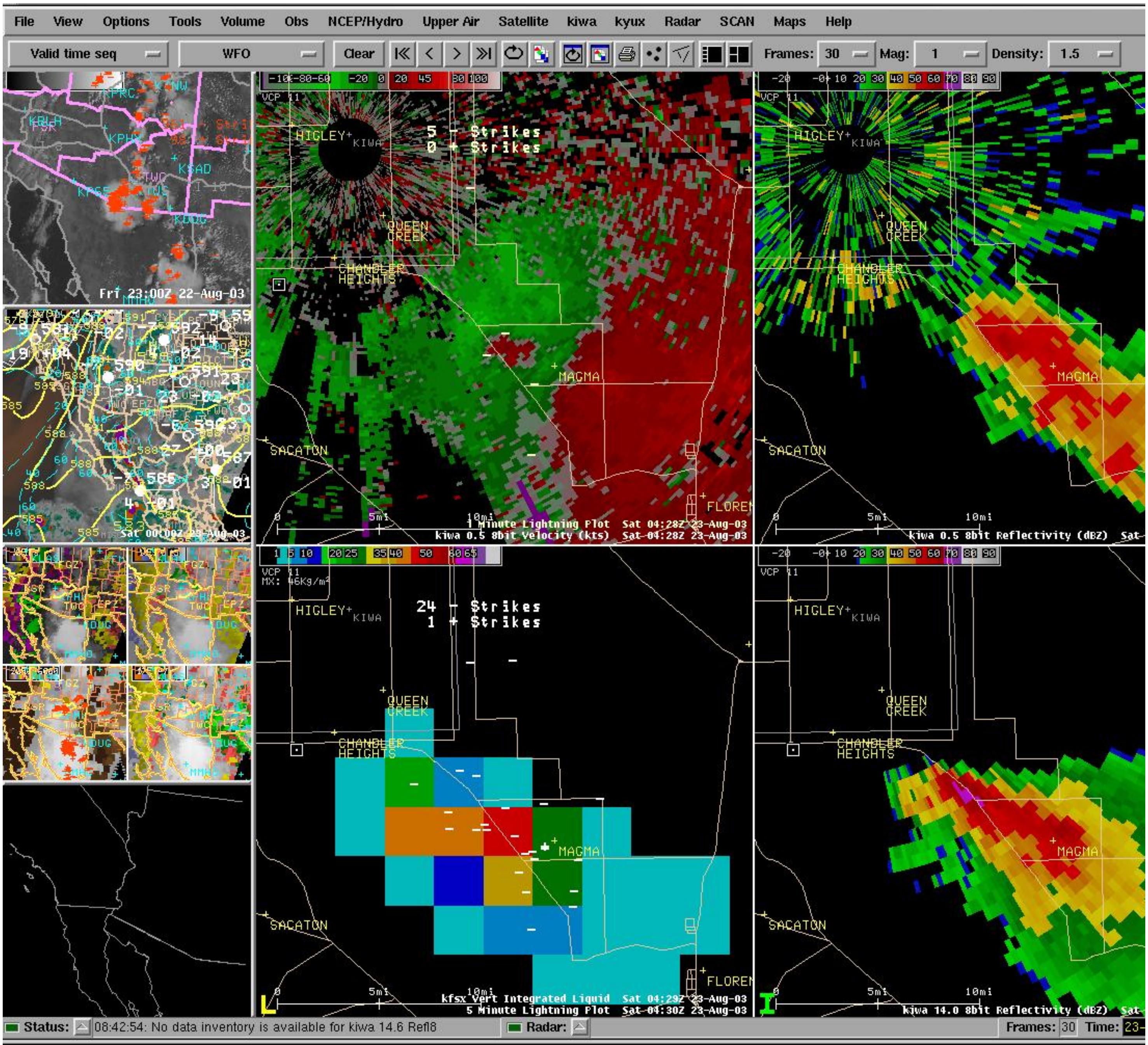

File View Options Tools Volume Obs NCEP/Hydro Upper Air Satellite kiwa kyux Radar SCAN Maps Help
Valid time seq
WFO
Clear
Frames: 30
Mag: 1
Density: 1.5
Fri 23:00Z 22-Aug-03
Sat 00:00Z 23-Aug-03
5 - Strikes
0 + Strikes
HIGLEY
KIWA
QUEEN CREEK
CHANDLER HEIGHTS
MAGMA
SACATON
FLOREN
1 Minute Lightning Plot Sat 04:28Z 23-Aug-03
kiwa 0.5 8bit Velocity (kts) Sat 04:28Z 23-Aug-03
kiwa 0.5 8bit Reflectivity (dBZ)
24 - Strikes
1 + Strikes
kfsx Vert Integrated Liquid Sat 04:29Z 23-Aug-03
5 Minute Lightning Plot Sat 04:30Z 23-Aug-03
kiwa 14.0 8bit Reflectivity (dBZ)
Status: 08:42:54: No data inventory is available for kiwa 14.6 Refl8
Radar:
Frames: 30 Time:

Figure 18

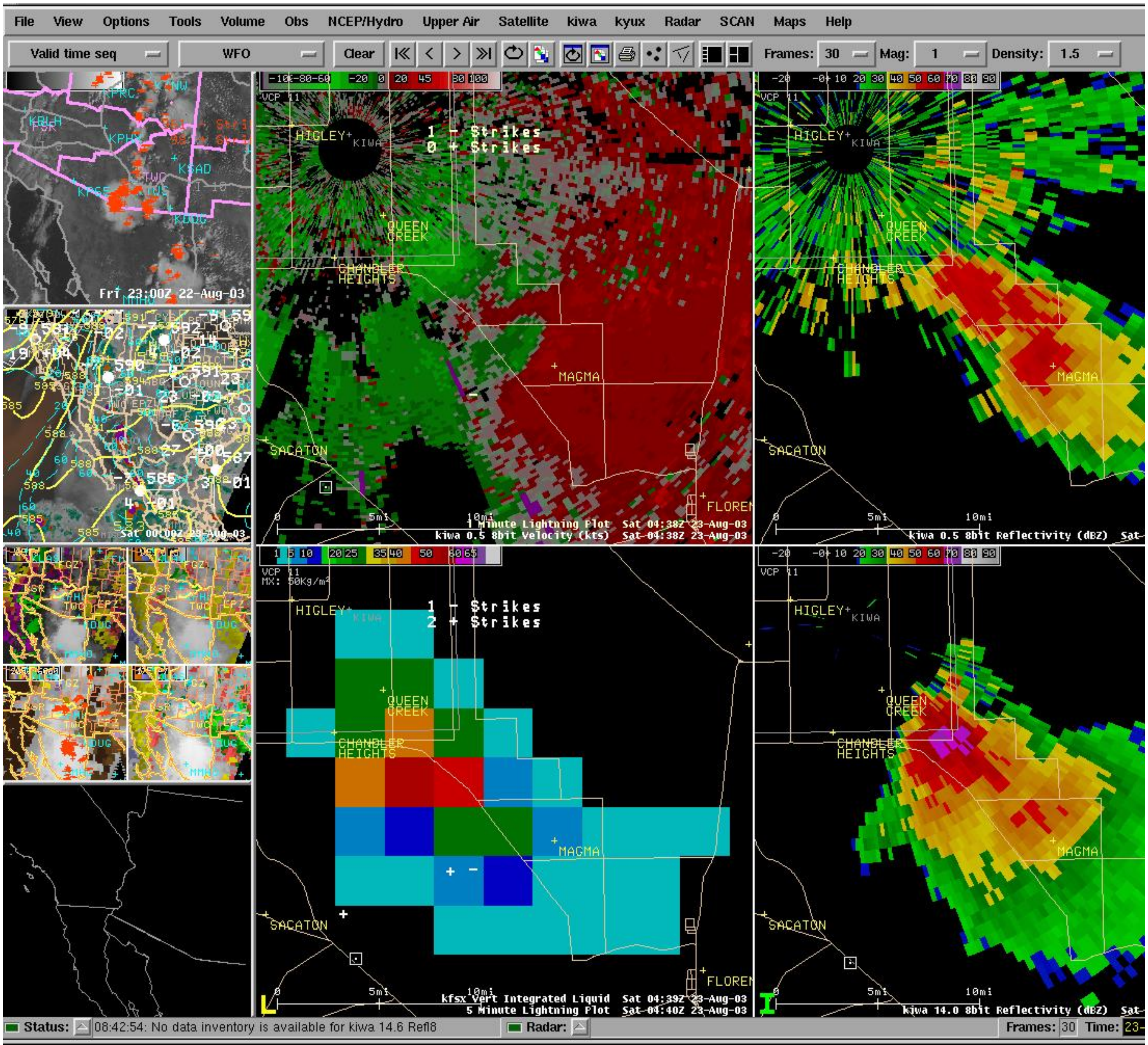

File View Options Tools Volume Obs NCEP/Hydro Upper Air Satellite kiwa kyux Radar SCAN Maps Help
Valid time seq
WFO
Clear
Frames: 30
Mag: 1
Density: 1.5
Fri 23:00Z 22-Aug-03
HIGLEY
KIWA
1 - Strikes
0 + Strikes
QUEEN CREEK
CHANDLER HEIGHTS
MAGMA
SACATON
FLOREN
1 Minute Lightning Plot Sat 04:38Z 23-Aug-03
kiwa 0.5 8bit Velocity (kts) Sat 04:38Z 23-Aug-03
kiwa 0.5 8bit Reflectivity (dBZ)
1 - Strikes
2 + Strikes
kfsx Vert Integrated Liquid Sat 04:39Z 23-Aug-03
5 Minute Lightning Plot Sat 04:40Z 23-Aug-03
kiwa 14.0 8bit Reflectivity (dBZ)
Status: 08:42:54: No data inventory is available for kiwa 14.6 Refl8
Radar:
Frames: 30
Time:

Figure 19

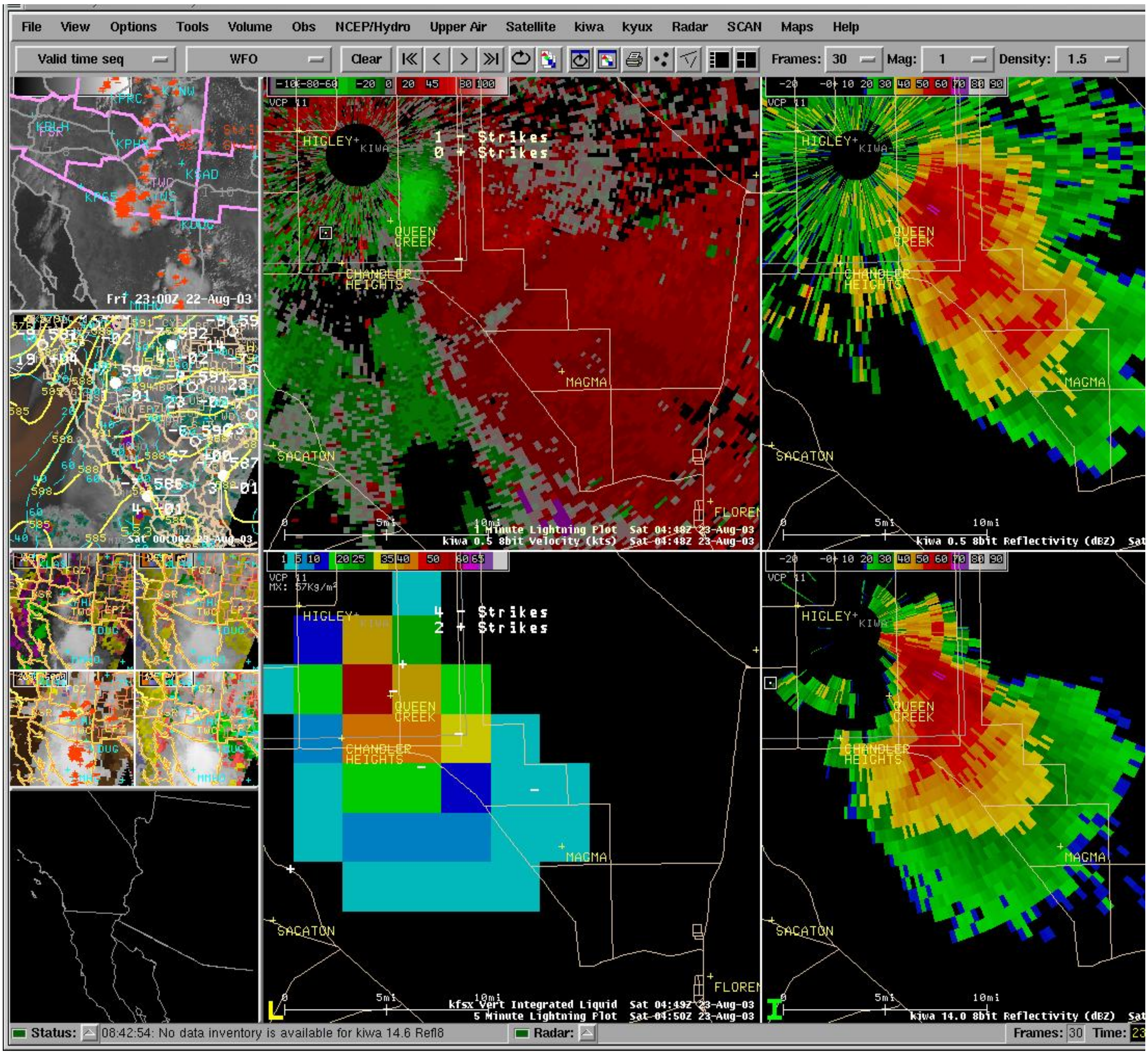

File View Options Tools Volume Obs NCEP/Hydro Upper Air Satellite kiwa kyux Radar SCAN Maps Help
Valid time seq
WFO
Clear
Frames: 30
Mag: 1
Density: 1.5
Fri 23:00Z 22-Aug-03
Sat 00:00Z 23-Aug-03
1 - Strikes
0 + Strikes
HIGLEY
QUEEN CREEK
CHANDLER HEIGHTS
MAGMA
SACATON
1 Minute Lightning Plot Sat 04:48Z 23-Aug-03
kiwa 0.5 8bit Velocity (kts) Sat 04:48Z 23-Aug-03
kiwa 0.5 8bit Reflectivity (dBZ)
4 - Strikes
2 + Strikes
kfsx Vert Integrated Liquid Sat 04:49Z 23-Aug-03
5 Minute Lightning Plot Sat 04:50Z 23-Aug-03
kiwa 14.0 8bit Reflectivity (dBZ)
Status: 08:42:54: No data inventory is available for kiwa 14.6 Refl8
Radar:
Frames: 30 Time:

Figure 20

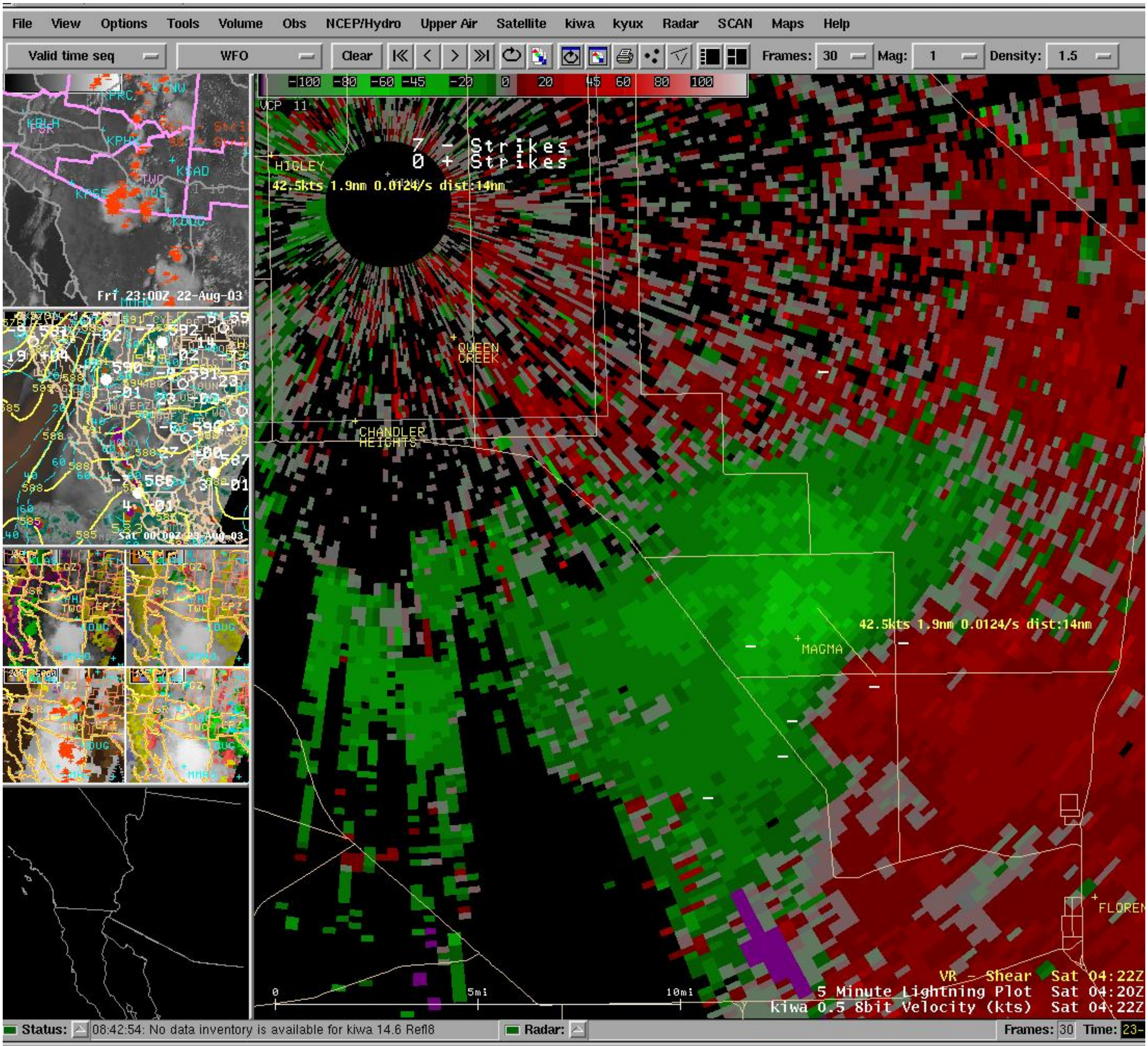
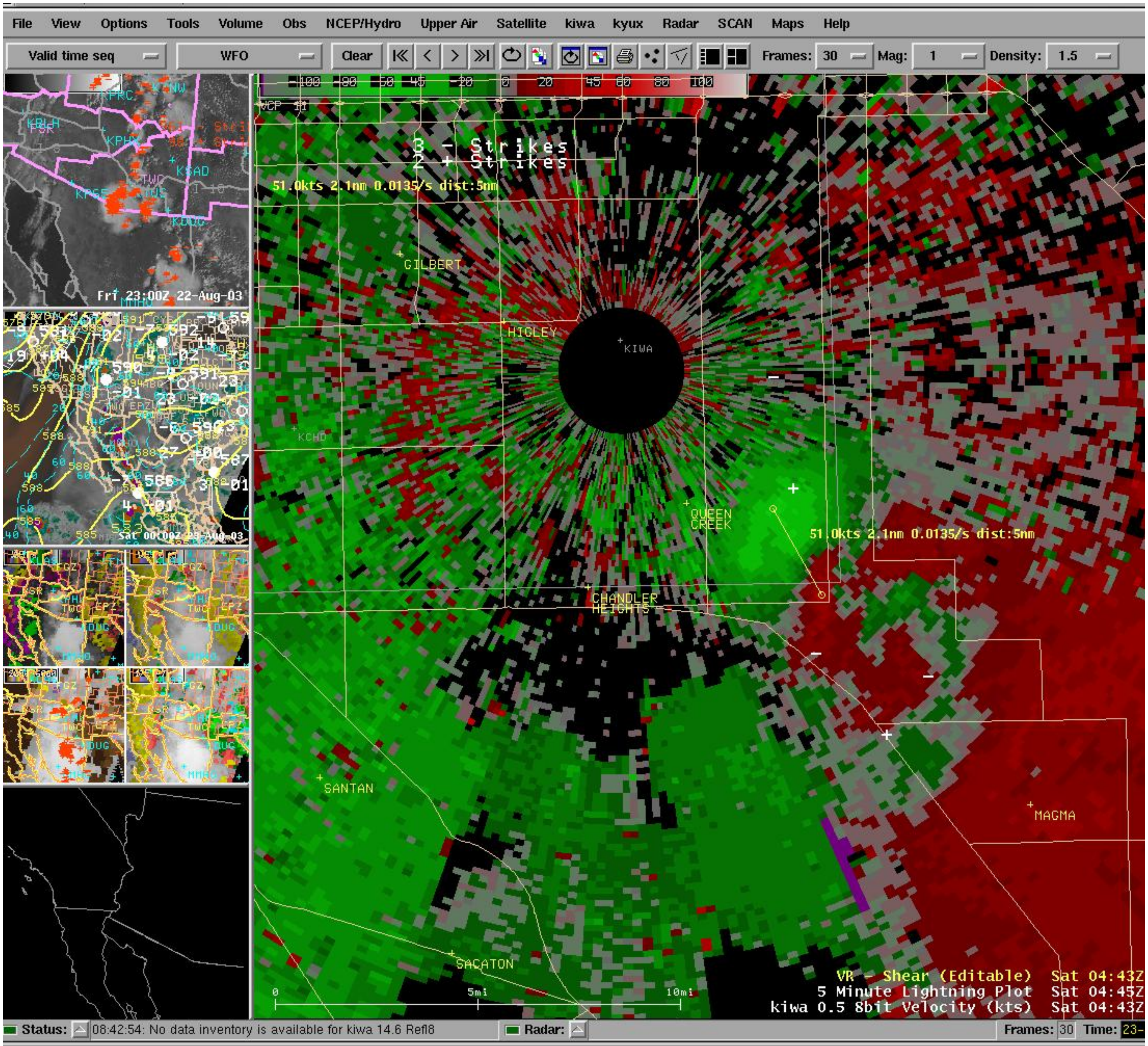

File View Options Tools Volume Obs NCEP/Hydro Upper Air Satellite kiwa kyux Radar SCAN Maps Help
Valid time seq
WFO
Clear
Frames: 30
Mag: 1
Density: 1.5
-100 -80 -60 -45 -20 0 20 45 60 80 100
VCP 11
7 - Strikes
0 + Strikes
HIGLEY
42.5kts 1.9nm 0.0124/s dist:14nm
QUEEN CREEK
CHANDLER HEIGHTS
MAGMA
FLOREN
0
5mi
10mi
VR - Shear Sat 04:22Z
5 Minute Lightning Plot Sat 04:20Z
kiwa 0.5 8bit Velocity (kts) Sat 04:22Z
Fri 23:00Z 22-Aug-03
Sat 00:00Z 23-Aug-03
Status: 08:42:54: No data inventory is available for kiwa 14.6 Refl8
Radar:
Frames: 30
Time:

Figure 21


File View Options Tools Volume Obs NCEP/Hydro Upper Air Satellite kiwa kyux Radar SCAN Maps Help
Valid time seq
WFO
Clear
Frames: 30
Mag: 1
Density: 1.5
3 - Strikes
2 + Strikes
51.0kts 2.1nm 0.0135/s dist:5nm
GILBERT
HIGLEY
KIWA
KCHD
QUEEN CREEK
CHANDLER HEIGHTS
SANTAN
MAGMA
SACATON
0
5mi
10mi
VR - Shear (Editable) Sat 04:43Z
5 Minute Lightning Plot Sat 04:45Z
kiwa 0.5 8bit Velocity (kts) Sat 04:43Z
Fri 23:00Z 22-Aug-03
Status: 08:42:54: No data inventory is available for kiwa 14.6 Refl8
Radar:
Frames: 30
Time:

End