Western Region Technical Attachment
No. 95-12
April 18, 1995

WSR-88D DETECTS MOISTURE DISCONTINUITY OVER SOUTHERN ARIZONA

Naeemah Cushmeer - NWSFO Los Angeles/Oxnard, CA

Background

On 12-13 July 1994, the Phoenix (PHX) WSR-88D (KIWA) detected a west-northwest to south-southwest oriented band of high reflectivity echoes over southern Arizona while operating in Clear Air Mode (Volume Coverage Pattern 32). This band was clearly seen on the Composite Reflectivity product (Fig. 1), and best seen at 0.5°. This feature, seen on the Base Reflectivity product (Fig. 2), moved east across the Phoenix metropolitan area between 2300 UTC 12 July 1994 and 0300 UTC 13 July 1994 before dissipating. A Reflectivity Cross Section constructed along the axis of the band at 0254 UTC, when it was over the Phoenix metropolitan area, showed that the phenomenon extended to near 10,000 feet MSL (Fig. 3). The band of high reflectivity echoes was not evident prior to 2300 UTC.

Discussion

There was a noticeable decrease in surface dew points across southern Arizona following the passage of the band with readings falling on average about five to seven degrees between 0000 UTC and 0300 UTC. This discussion will focus primarily on the changes in dew points that occurred in the Phoenix metropolitan area as the feature moved across.

Surface dew points across the northwest portion of the Phoenix metropolitan area fell from the lower 40s°F into the mid 30s°F between 0000 UTC and 0100 UTC. Dew points across the southeast portion of the Phoenix metropolitan area, however, fell only slightly (Fig. 4 Note: The isodrosotherm analysis was extrapolated due to lack of surface data). Between 0100 UTC and 0200 UTC, dew points across the southeast portion of the Phoenix metropolitan area fell, on average, about ten degrees, while across the northwest portion there was a slight decrease (Fig. 5). During the period from 0000 UTC and 0300 UTC, dew points fell about 12 degrees (Fig. 6). By 0400 UTC, surface dew points were in the upper 20s°F across much of the Phoenix metropolitan area.

A time-height cross section constructed for Phoenix (Fig. 7), based on the 1200 UTC NGM PCGRIDS data, indicated a decrease in relative humidity in the 12-hour period between 1200 UTC 12 July and 0000 UTC 13 July with the lowest humidity occurring about 0000 UTC or 12 hours after the initial analysis. The NGM also showed a weak ridge 500 mb (Fig. 8) over Arizona on the 0000 UTC 13 July initial analysis with a weak trough approaching western Arizona at 700 mb (Fig. 9 - Note: pocket of subsidence over west central Arizona). A weak east-west oriented trough was also noted at 850 mb across southern Utah (Fig. 10).

Summary and Conclusion

On 12-13 July 1994, surface dew points decreased across southern Arizona, in particular near the Phoenix metropolitan area, due to the passage of a weak trough.

Between 910 mb and 850 mb (Fig. 11), a layer of relatively moist air was noted on the 0000 UTC PHX sounding taken at Luke Air Force Base (LUF). This layer was detected by the WSR-88D as a moisture discontinuity. The WSR-88D was able to detect this moist layer while in Clear Air Mode due to refraction of the radar beam as it encountered the layer. Horizontal and vertical gradients in moisture are the major determinants of beam refraction and radar beam propagation. Although a few cumulus clouds were observed in the Phoenix area about 2300 UTC (Table 1), sky conditions between 0000 UTC and 0300 UTC were virtually clear. Weak convergence was likely occurring along the moisture discontinuity; and the return from this discontinuity, based on previous evidence, was probably caused by insects and birds.

Acknowledgements

The author thanks Doug Green (SOO, NWSFO Phoenix) for his thoughtful comments and assistance.

References

Battan, Louis J., 1962: *Radar Observes the Weather*, 120-123, Doubleday and Company, Inc., Garden City, New York.

Green, G.D., 1990: *Principles of Weather Radar*, 36,42-43,50, National Weather Service Operations Training Facility Module 1.

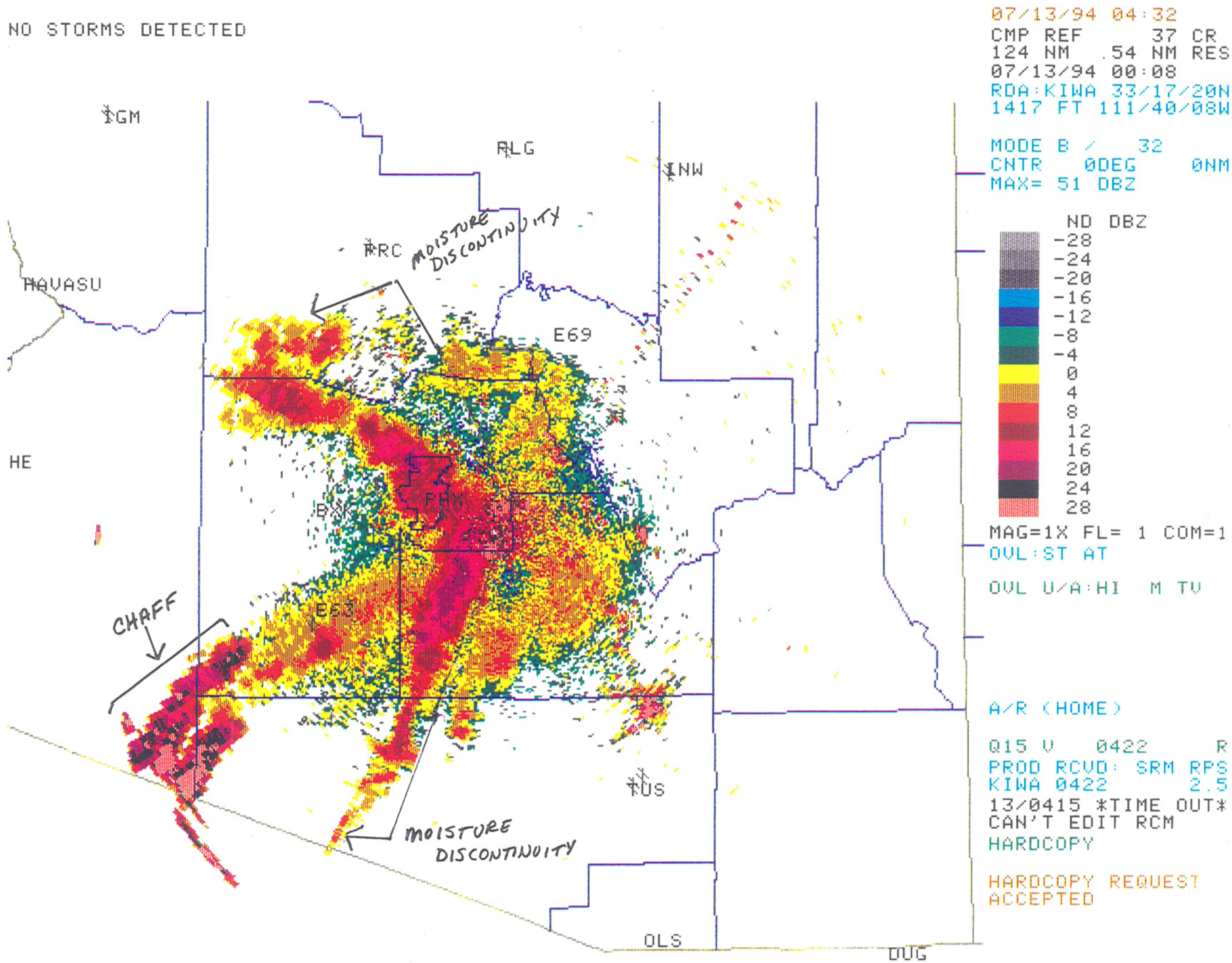
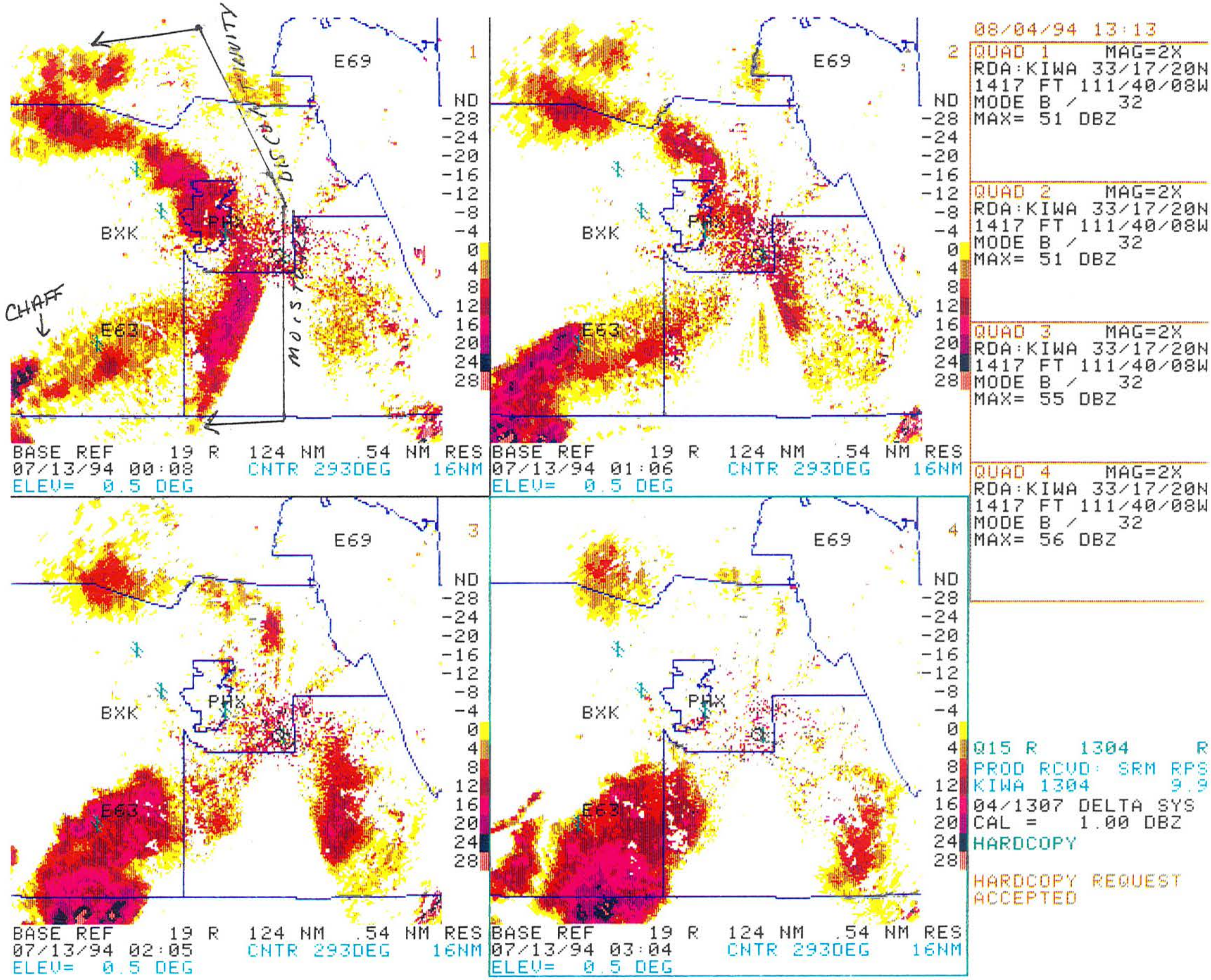

NO STORMS DETECTED
07/13/94 04:32
CMP REF 37 CR
124 NM .54 NM RES
07/13/94 00:08
RDA:KIWA 33/17/20N
1417 FT 111/40/08W
MODE B / 32
CNTR 0DEG 0NM
MAX= 51 DBZ
ND DBZ
-28
-24
-20
-16
-12
-8
-4
0
4
8
12
16
20
24
28
MAG=1X FL= 1 COM=1
OVL:ST AT
OVL U/A:HI M TV
A/R (HOME)
Q15 V 0422 R
PROD RCVD: SRM RPS
KIWA 0422 2.5
13/0415 *TIME OUT*
CAN'T EDIT RCM
HARDCOPY
HARDCOPY REQUEST
ACCEPTED
IGM
HAVASU
HE
RLG
INW
PRC
E69
FHX
E63
TUS
OLS
DUG
MOISTURE DISCONTINUITY
MOISTURE DISCONTINUITY
CHAFF

FIGURE 1



DISCONTINUITY
MOCS
CHAFF
E69
BXK
PHX
E63
ND
-28
-24
-20
-16
-12
-8
-4
0
4
8
12
16
20
24
28
BASE REF 19 R 124 NM .54 NM RES
07/13/94 00:08 CNTR 293DEG 16NM
ELEV= 0.5 DEG
BASE REF 19 R 124 NM .54 NM RES
07/13/94 01:06 CNTR 293DEG 16NM
ELEV= 0.5 DEG
BASE REF 19 R 124 NM .54 NM RES
07/13/94 02:05 CNTR 293DEG 16NM
ELEV= 0.5 DEG
BASE REF 19 R 124 NM .54 NM RES
07/13/94 03:04 CNTR 293DEG 16NM
ELEV= 0.5 DEG
08/04/94 13:13
QUAD 1 MAG=2X
RDA:KIWA 33/17/20N
1417 FT 111/40/08W
MODE B / 32
MAX= 51 DBZ
QUAD 2 MAG=2X
RDA:KIWA 33/17/20N
1417 FT 111/40/08W
MODE B / 32
MAX= 51 DBZ
QUAD 3 MAG=2X
RDA:KIWA 33/17/20N
1417 FT 111/40/08W
MODE B / 32
MAX= 55 DBZ
QUAD 4 MAG=2X
RDA:KIWA 33/17/20N
1417 FT 111/40/08W
MODE B / 32
MAX= 56 DBZ
Q15 R 1304 R
PROD RCVD: SRM RPS
KIWA 1304 9.9
04/1307 DELTA SYS
CAL = 1.00 DBZ
HARDCOPY
HARDCOPY REQUEST
ACCEPTED

FIGURE 2

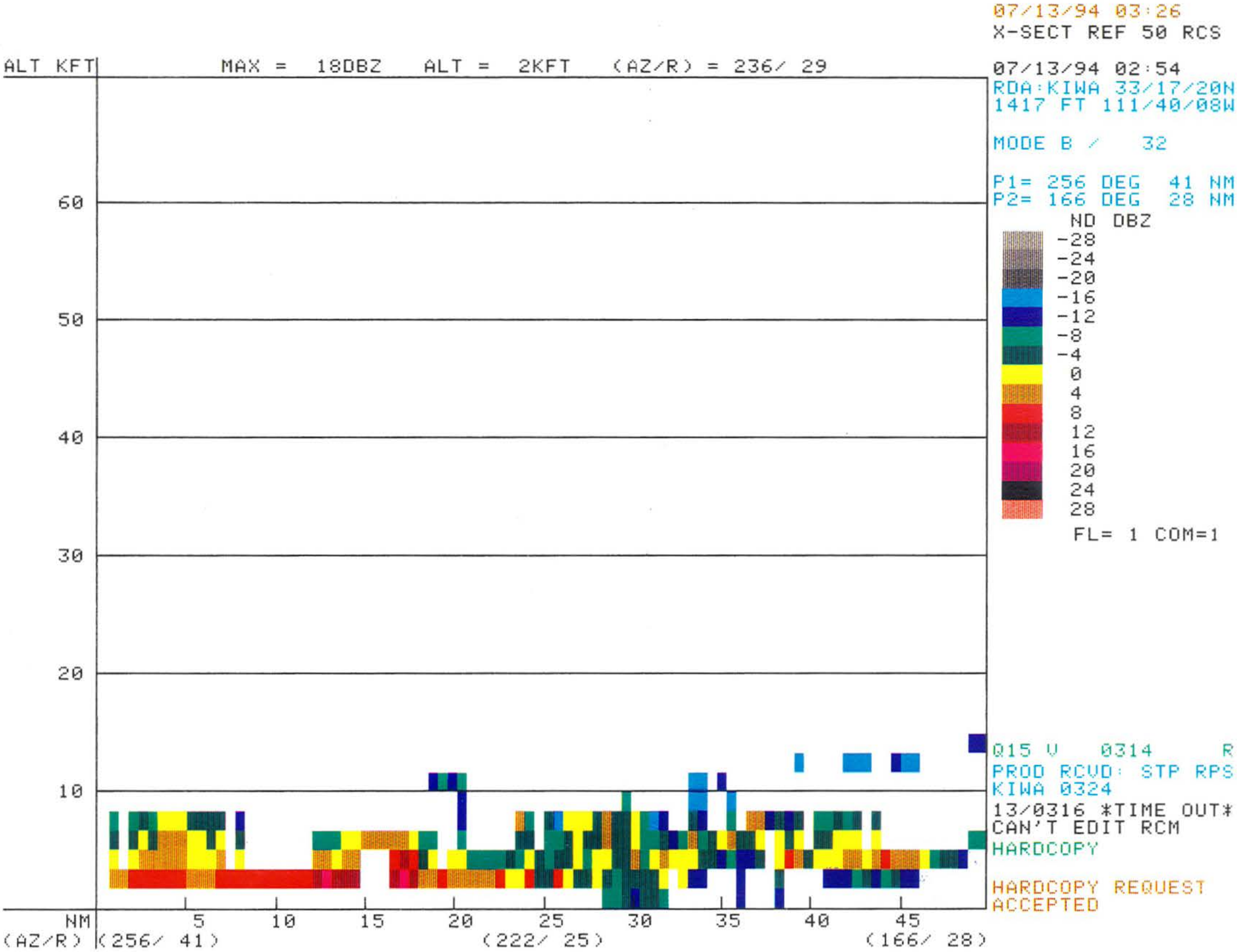

07/13/94 03:26
X-SECT REF 50 RCS
ALT KFT
MAX = 18DBZ ALT = 2KFT (AZ/R) = 236/ 29
07/13/94 02:54
RDA:KIWA 33/17/20N
1417 FT 111/40/08W
MODE B / 32
P1= 256 DEG 41 NM
P2= 166 DEG 28 NM
ND DBZ
-28
-24
-20
-16
-12
-8
-4
0
4
8
12
16
20
24
28
FL= 1 COM=1
60
50
40
30
20
10
Q15 V 0314 R
PROD RCVD: STP RPS
KIWA 0324
13/0316 *TIME OUT*
CAN'T EDIT RCM
HARDCOPY
HARDCOPY REQUEST
ACCEPTED
NM
5
10
15
20
25
30
35
40
45
(AZ/R)
(256/ 41)
(222/ 25)
(166/ 28)

FIGURE 3

0100 UTC
13 JUL 1994
SFC ANALYSIS

Isallodrosotherm (0000 UTC - 0100 UTC) °F

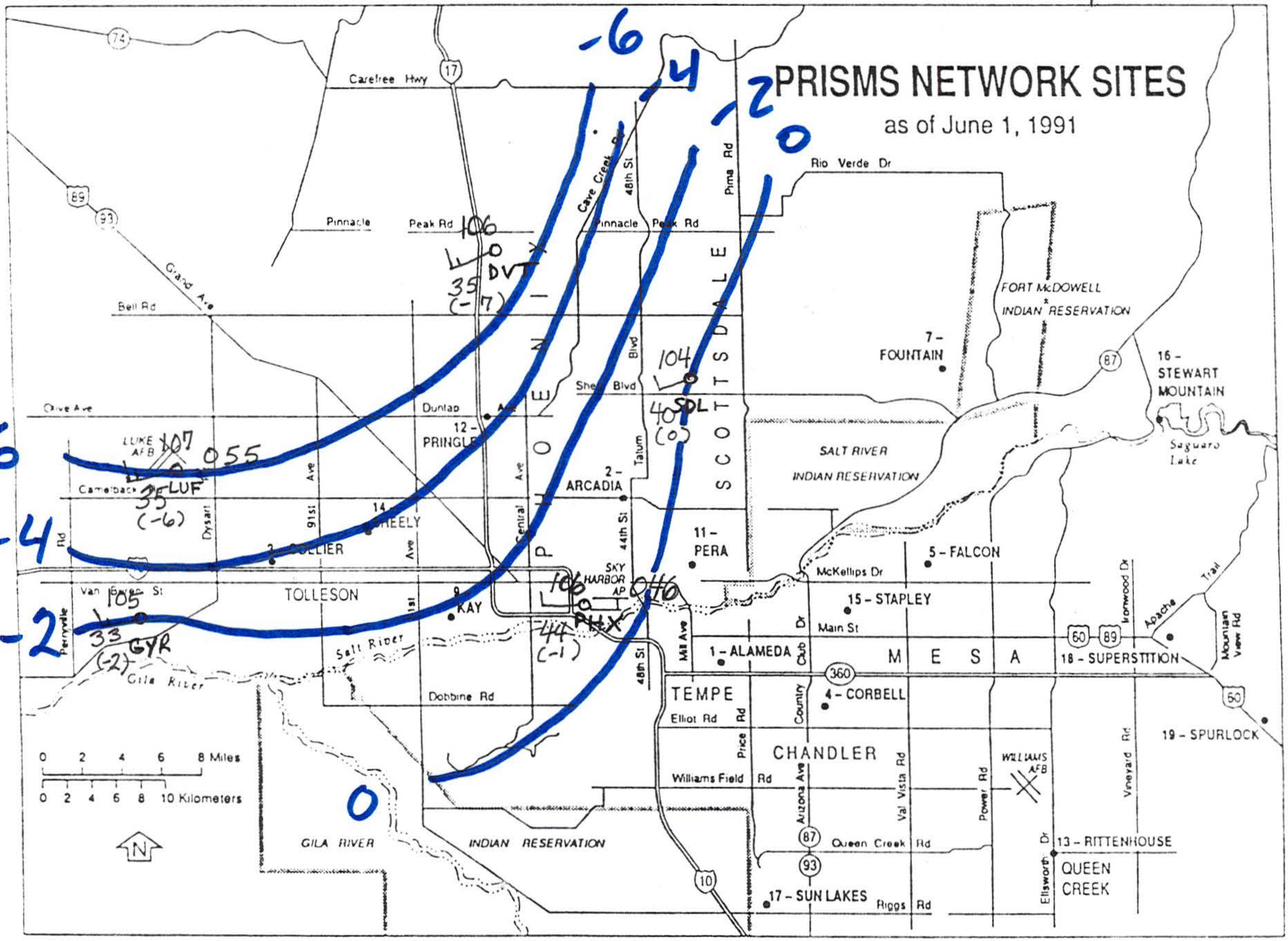


FIGURE 4

0200 UTC
13 JUL 1994
SFC ANALYSIS

ISALLODROSOTHERM
(0100 UTC – 0200 UTC)
F

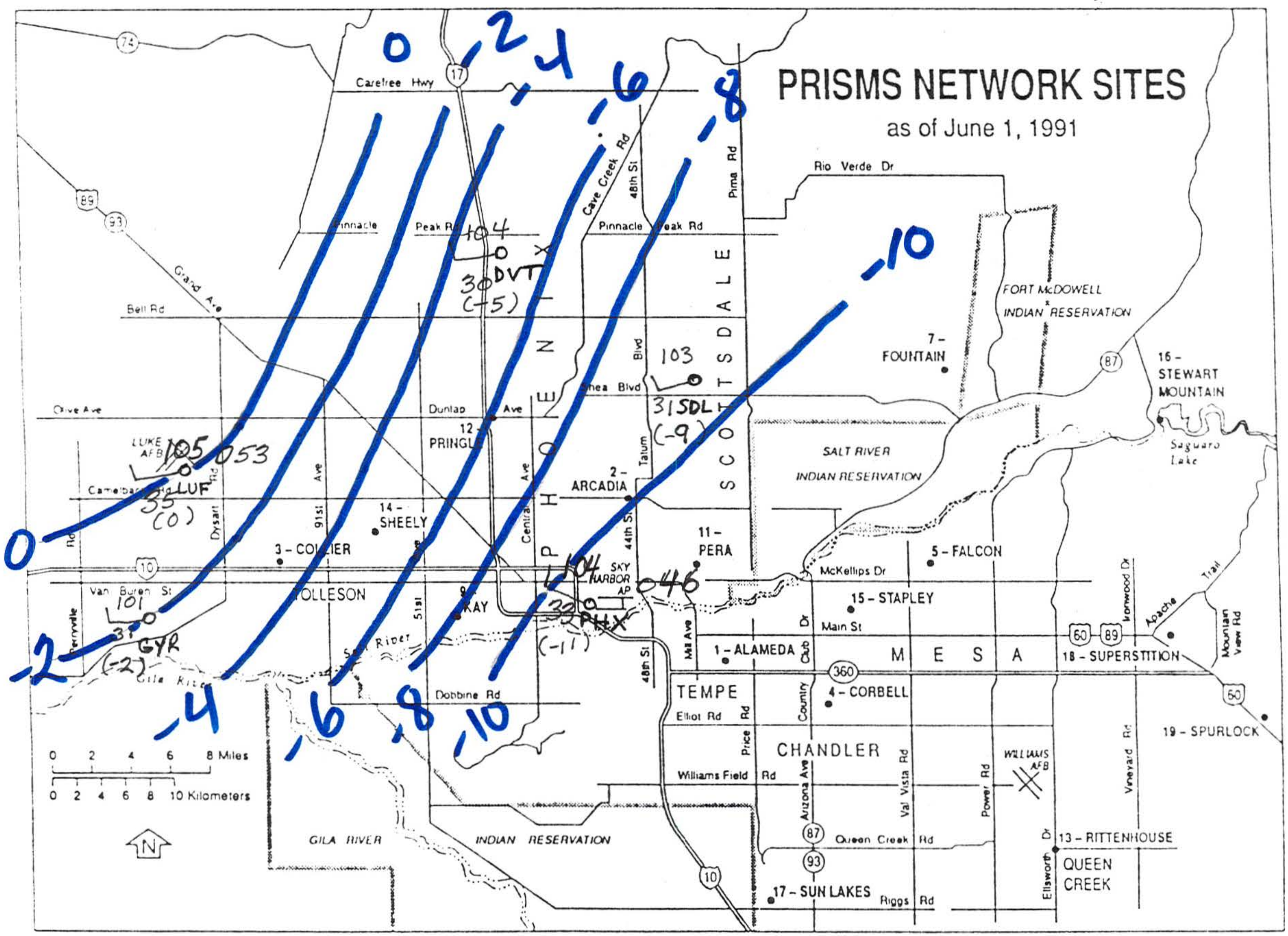


FIGURE 5

0300 UTC
13 JUL 1994
SFC ANALYSIS

ISALLODROSOTHERM
(0000 UTC − 0300 UTC)
°F

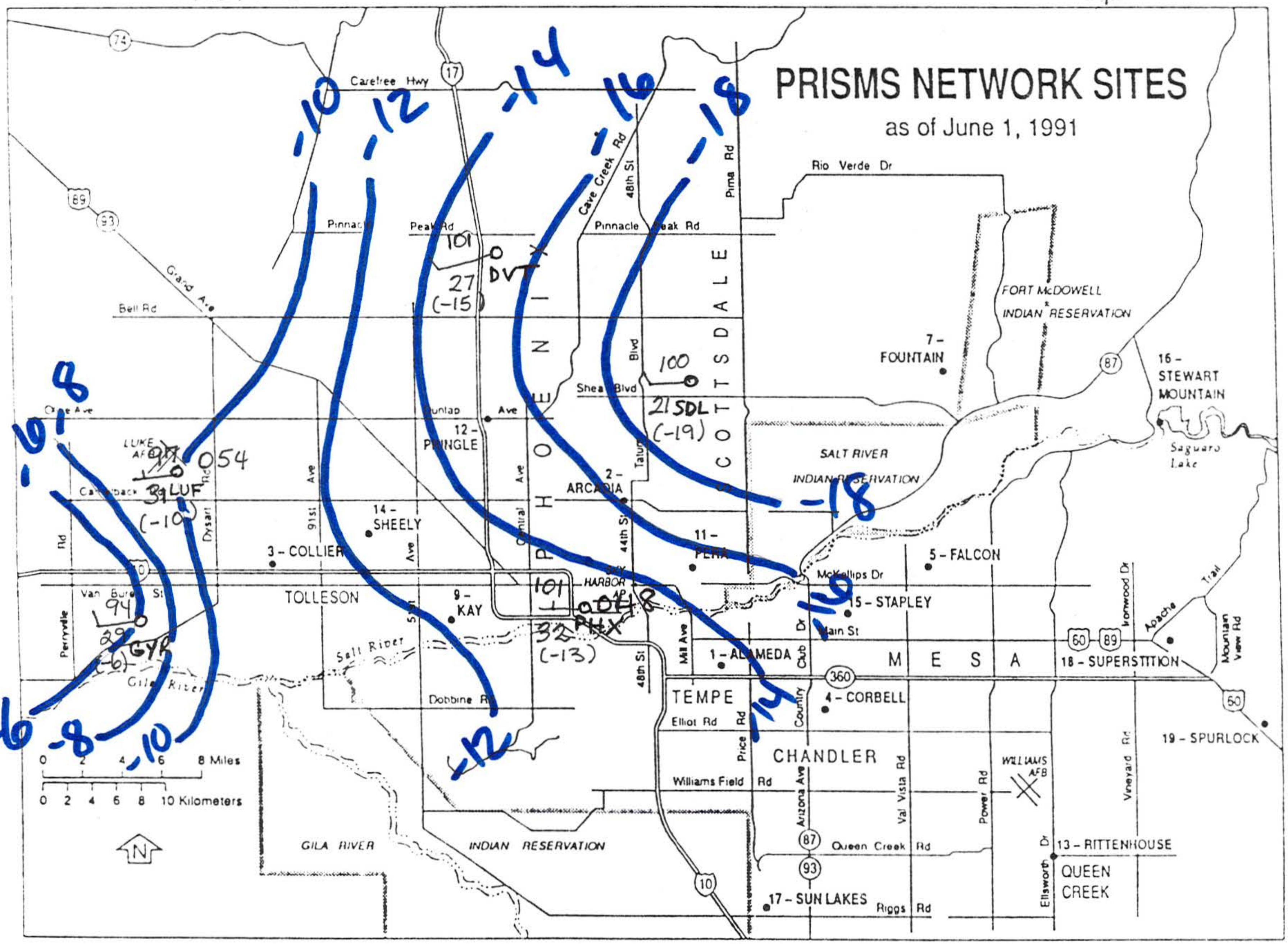


FIGURE 6

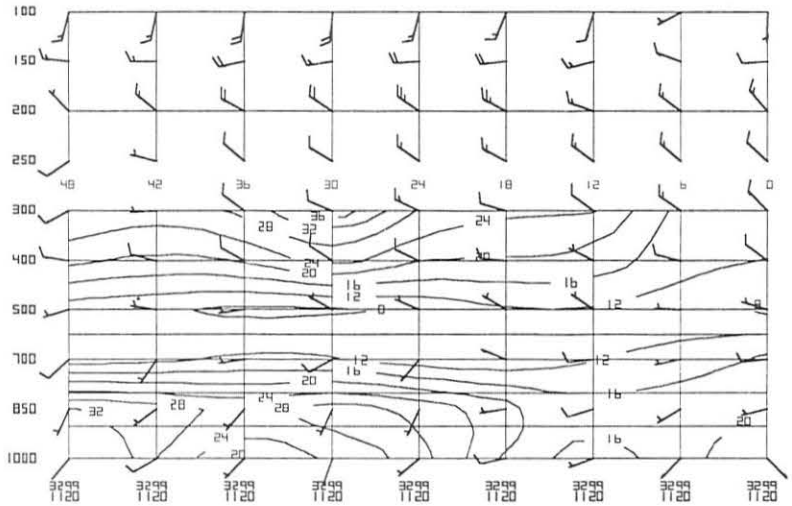


FIGURE 7. NGM 48-hr forecast relative humidity for PHX, valid 1200 UTC 12 July 1994 - 1200 UTC 14 July 1994.

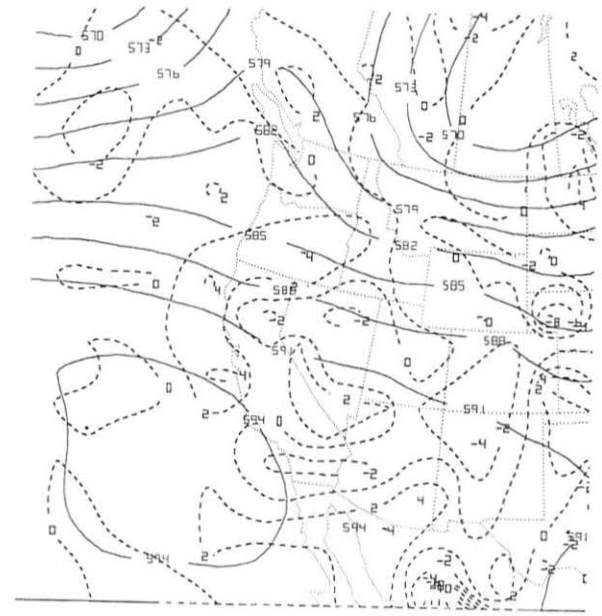


FIGURE 8. NGM 500-mb analysis, 0000 UTC 13 July 1994.

FIGURE 9. NGM 700-mb analysis, 0000 UTC 13 July 1994.

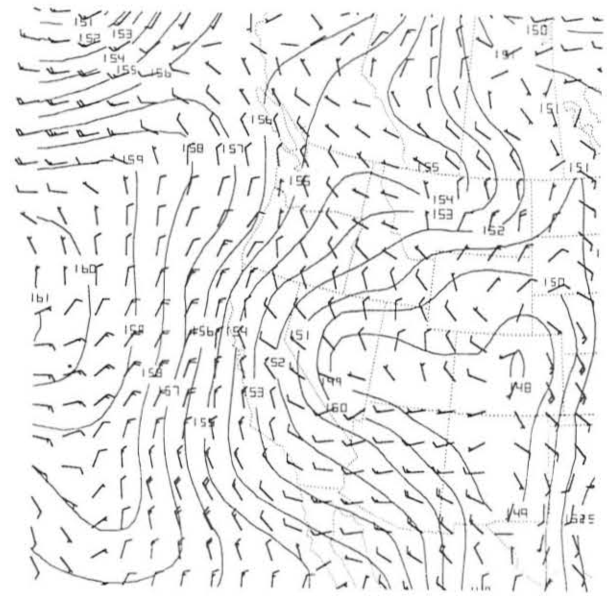


FIGURE 10. NGM 850-mb analysis, 0000 UTC 13 July 1994.

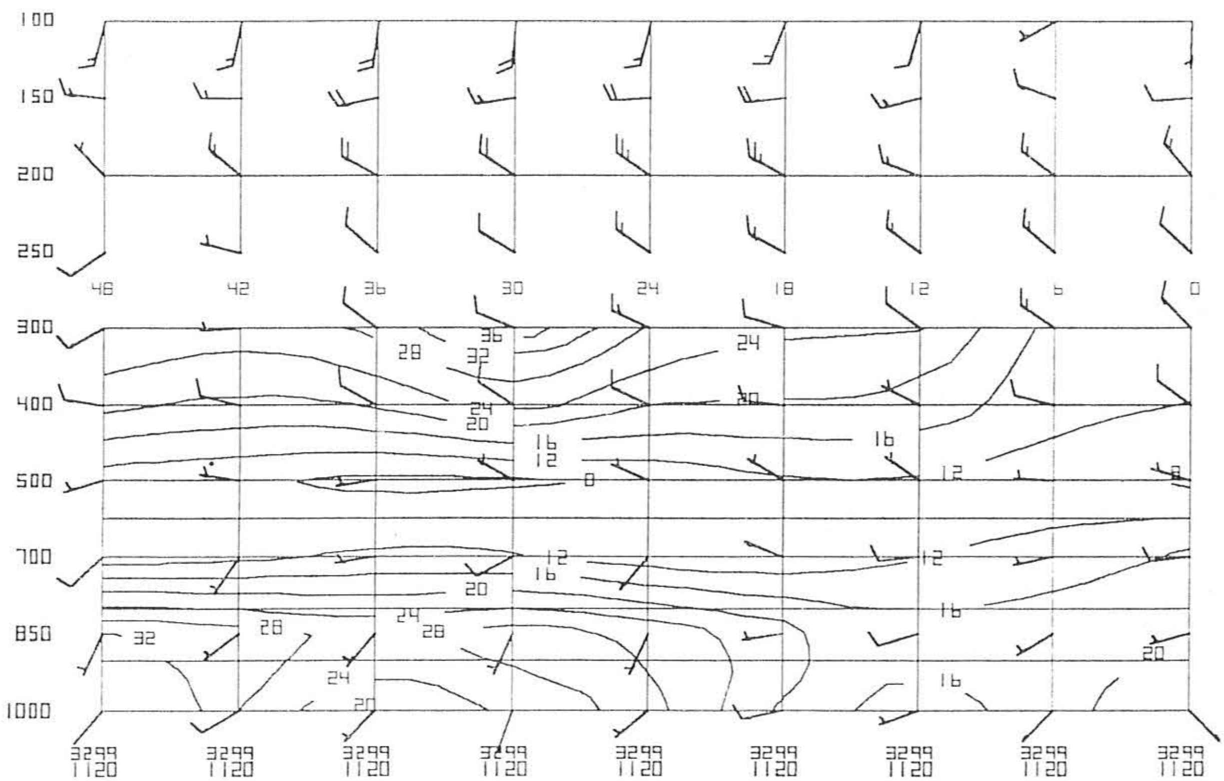


FIGURE 7. NGM 48-hr forecast relative humidity for PHX, valid 1200 UTC 12 July 1994 - 1200 UTC 14 July 1994.

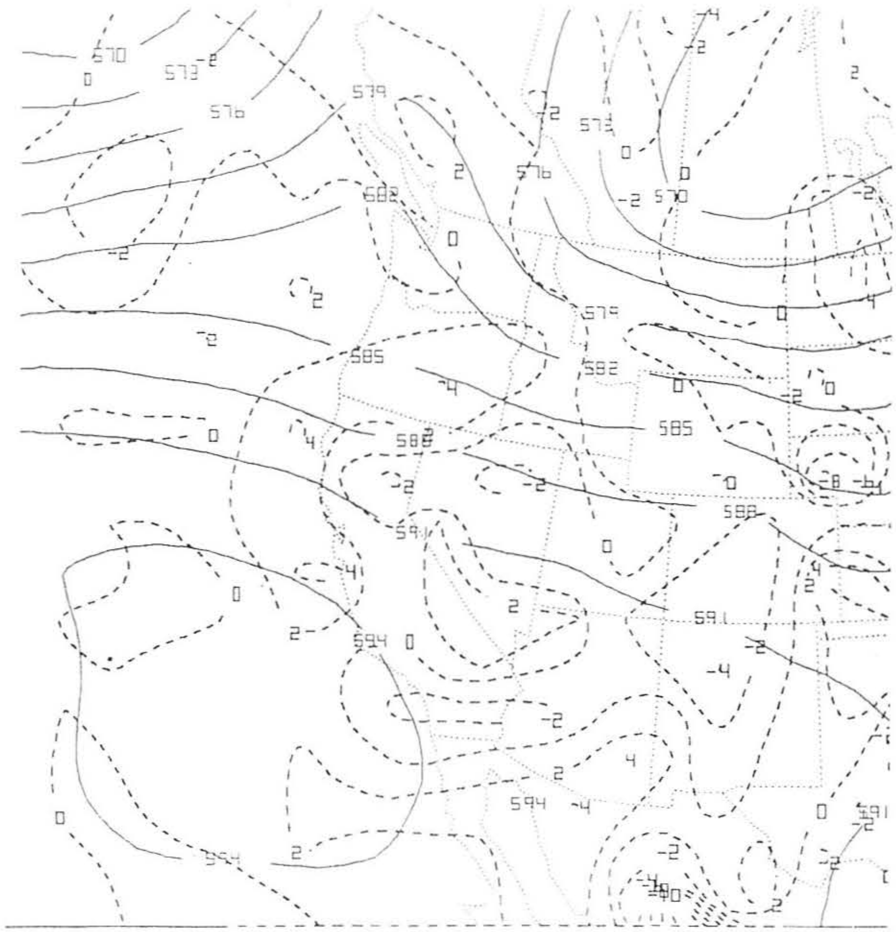


FIGURE 8. NGM 500-mb analysis, 0000 UTC 13 July 1994.

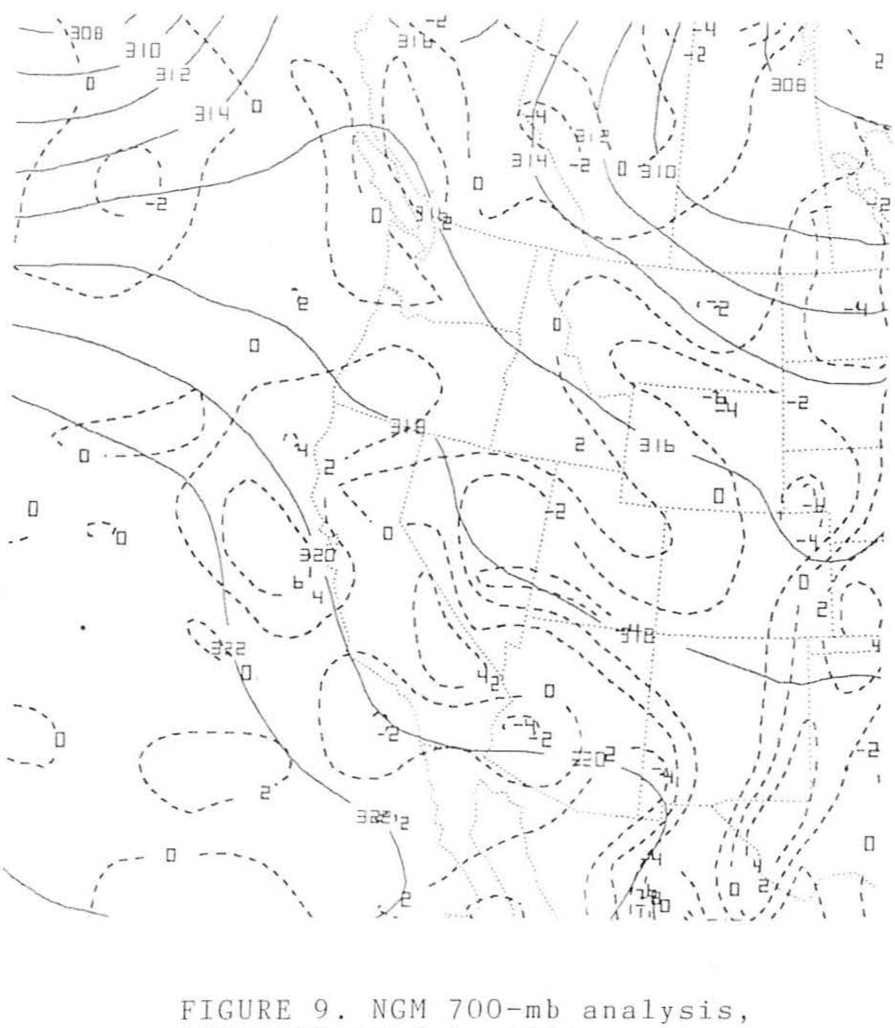


FIGURE 9. NGM 700-mb analysis, 0000 UTC 13 July 1994.

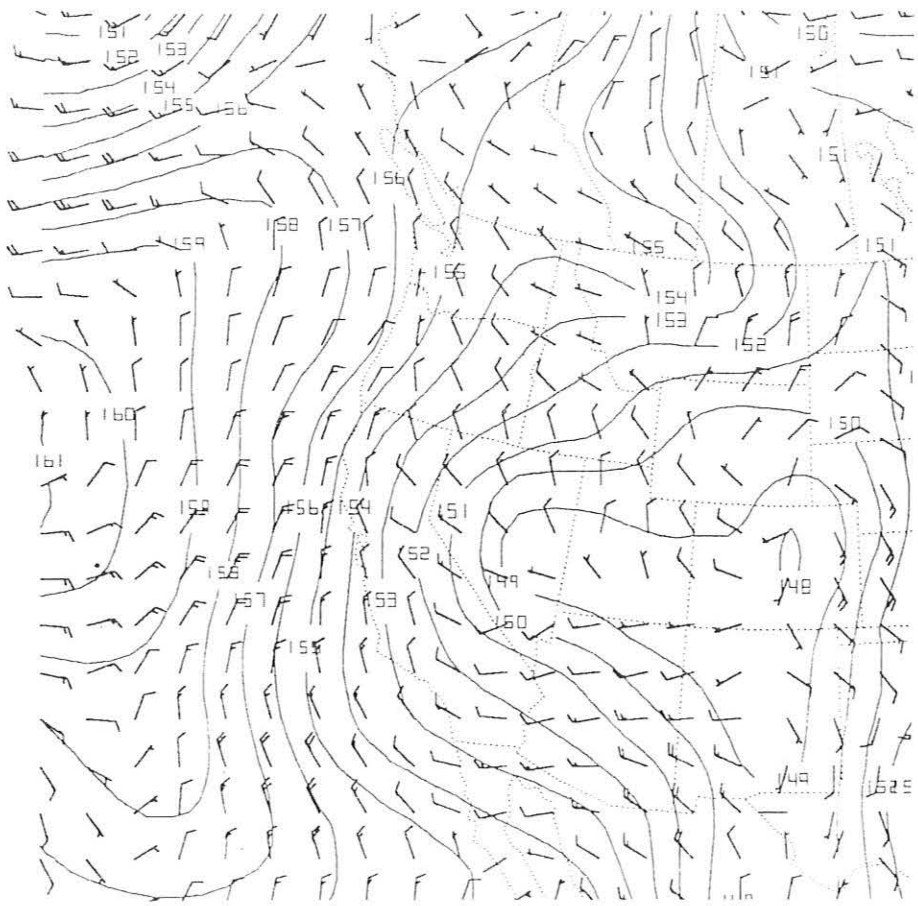


FIGURE 10. NGM 850-mb analysis, 0000 UTC 13 July 1994.

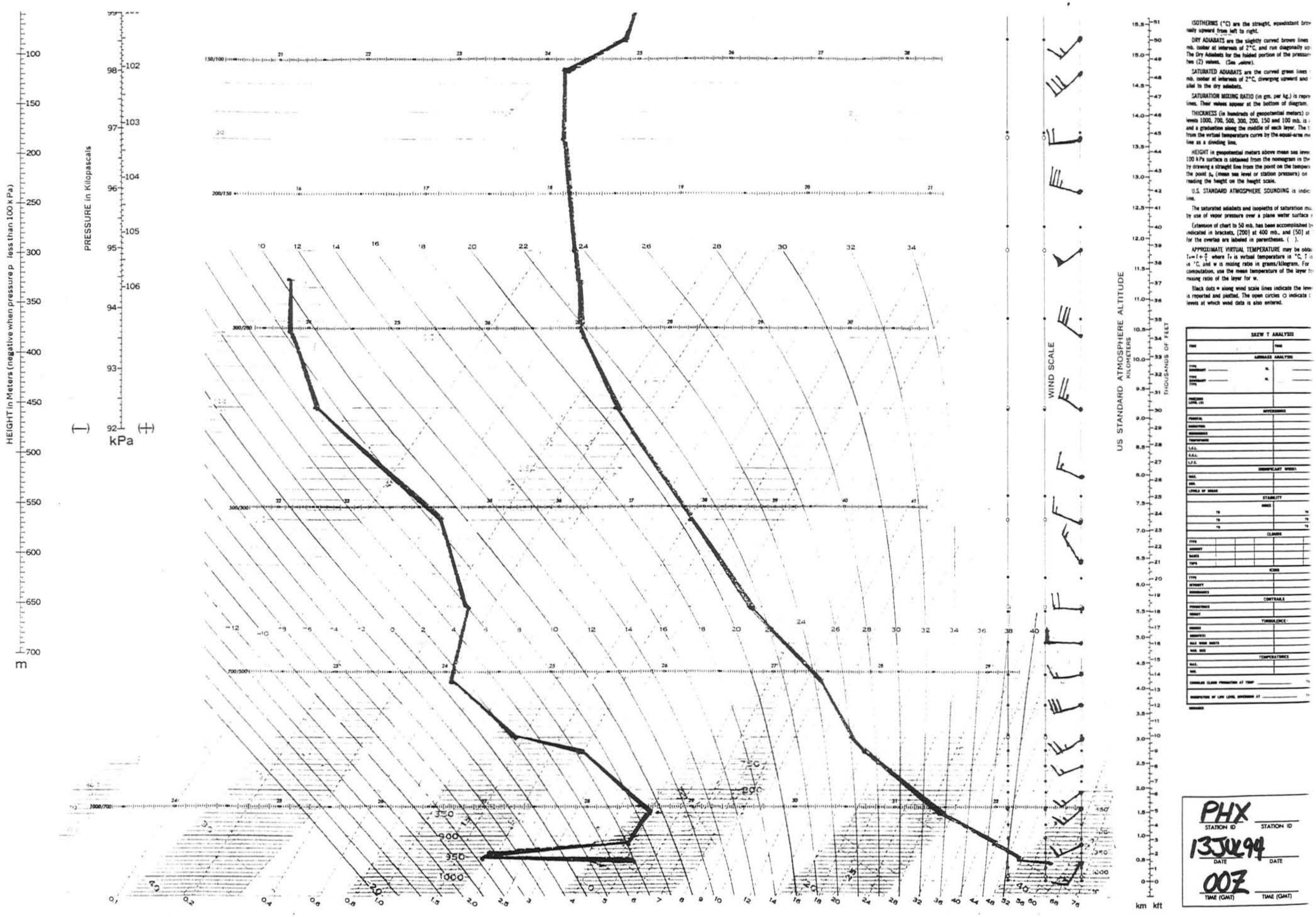

HEIGHT in Meters (negative when pressure p less than 100 k Pa)
PRESSURE in Kilopascals
kPa
WIND SCALE
US STANDARD ATMOSPHERE ALTITUDE
KILOMETERS
THOUSANDS OF FEET
km kft
SKEW T ANALYSIS
PHX
STATION ID
13JUL94
DATE
00Z
TIME (GMT)

FIGURE 11.

```
PHX SA 2256 AO2A CLR BLO 120 10+ 055/107/47/2708G16/976
LUF SA 2255 60 SCT 20 063/109/40/2116G23/978/WND 17V25=
SDL SA 2255 CLR 40 104/41/2306/983=
DVT SA 2254 CLR 35 105/43/2312/983
GYR SA 2245 CLR 60 109/40/2810/976=

PHX SA 2356 AO2A CLR BLO 120 10+ 050/106/45/3009/975/ 56024 10108
20081
LUF SA 2355 CLR 20 056/109/41/2418/976/ 725 RADAT 20167=
SDL SA 2345 CLR 40 104/40/2310/981=
DVT SA 2345 CLR 40 107/42/2608/981=
GYR SA 2350 CLR 40 108/35/2614/974=

PHX SA 0056 AO2A CLR BLO 120 10+ 046/106/44/2609/973
LUF SA 0055 CLR 20 055/107/35/2515/975=
SDL SA 0046 CLR 40 104/40/2408/980=
DVT SA 0052 CLR 40 106/35/2412/979=
GYR SA 0059 CLR 60 105/33/2715/973=

PHX SA 0156 AO2A CLR BLO 120 10+ 046/104/33/2911/973
LUF SA 0155 CLR 20 053/105/35/2511/975=
SDL SA 0145 CLR 40 103/31/2408/979=
DVT SA 0150 CLR 50 104/30/2611/979=
GYR SA 0150 CLR 40 101/31/2710/973=

PHX SA 0256 AO2A CLR BLO 120 10+ 048/101/32/2707/974 55001
LUF SA 0255 CLR 20 054/97/31/2507/975/ 502=
SDL SA 0246 CLR 40 100/21/2508/980=
DVT SA 0245 CLR 40 101/27/2508/979=
GYR SA 0247 CLR 40 94/29/2708/974=

PHX SA 0356 AO2A CLR BLO 120 10+ 053/99/29/2606/975
LUF SA 0355 CLR 20 058/91/26/2406/976=
SDL SA 0350 CLR 15 92/28/0000/982/LAST=
DVT SA 0345 CLR 30 95/26/0000/980/LAST=
GYR SA 0359 CLR 30 89/36/2705/974/LAST=
```

TABLE 1