# The Southern Idaho snow and rain event of 12/05/95. An important Idaho weather system well underforecast by the models.

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## 1. INTRODUCTION

On December 5th, 1995, a significant band of precipitation moved across a large portion of the Intermountain West. The areas most affected were South-Central Oregon...all of Southern Idaho...Northern Nevada and Northern Utah. Precipitation was mixed with mostly snow falling in Oregon and much of Southern Idaho...while a cluster of convective activity concentrated across the Northern sections of the Great Basin. This convection produced a widespread area of lightning activity along with severe wind gusts in the 60-70 mph range. In Idaho, moderate to heavy snow fell in a swath from the Western end of the Treasure valley, eastward across the Snake River Plain. A mixture of rain, sleet and snow fell over extreme Southern Oregon and the Magic Valley of Idaho. Water equivalents ranged generally from one-quarter to three-quarter inch amounts, with the heaviest QPF centered in the Southern Magic Valley of Idaho.

This was a significant storm for Idaho, and for the National Weather Service office in Boise in a couple respects. First, the event was well underforecast by the models, especially model output pops (MOS), and secondly the heavy snow across the lower elevations and valleys of Southern Idaho had a profound impact on travel conditions, with numerous accidents on area roads. It was one of the heaviest single event snowfalls in southwest Idaho in a couple years, and was the heaviest in Boise since January 1994. Heavy snowfalls in Southern Idaho are a relatively rare event, with most snows of 4 inches or greater confined to mountainous terrain. The event of December 5, 1995 was even more interesting considering the synoptic features that led to its development were well underdone by numerical models and graphical output. Of added interest, was the intensity of the convective instability along and south of the associated thermal boundary which was oriented east-west along the Idaho/Nevada border.

## 2. ANALYSIS AND OBSERVATIONS.

At 12z on the morning of December 5, 1995 the upper air analysis indicated a strong westerly flow at both 700 and 500 MB. (Fig. 6b). Within this flow was a weak short wave and associated PV max. At 12z this feature was well to the west just approaching the Southwest Oregon coast. At the jetstream level (300 mb) a strong max of 90-110kts was embedded in this general zonal flow pattern. Certainly, this was not a threatening pattern for the Intermountain region, but one that needed closer attention

as it related to the evolving surface features, satellite signatures and radar presentations.

On the surface chart at (18z), a significant thermal boundary existed as indicated by surface analysis and the analysis of potential temperature (fig 3). A developing surface low was seen over South-Central Oregon along the warm front with a second low center over Southwest Wyoming (fig 1). By mid morning on the 5th, weak warm air advection was occurring over Southwest Idaho and Eastern Oregon. At 21z, the Oregon low had apparently not changed in intensity but was now a broad area of low pressure along the thermal gradient and was moving eastward in response to deepening support aloft. By mid-afternoon (21z), the warm front had moved into southeast Oregon and Southwest Idaho as now a significant wave had developed (fig 2). At this time, the first lightning strike was observed in the warm air along the Nevada Oregon Border.

3. SATELLITE

Satellite analysis played a key role in verifying surface and upper air features that were not well defined on model ouput from the 00z run. On the 12z run of the 5th, subtle features were recognized, but not of the magnitude that would lead a person to issue a Winter Storm Warning or a Snow advisory just yet.

A strong baroclinic leaf feature was visible at 15z on the 5th. This signature was centered over Southwest Oregon and was moving rapidly eastward over the low level thermal gradient. This particular type feature is often associated with intensifying baroclinicity and hence precipitation intensity. By midday at 18z, the enhanced cloud band had taken on an S-SHAPED comma centered south of the Burns, Oregon vicinity. Snow over Southwest Idaho was reaching maximum intensity at this time, but still no evidence of strong convective activity was seen.

4. RADAR (KCBX-88D and KSFX-88D)

Radar played an important role in monitoring this event. In fact, it was critical in determining the intensity of the precipitation, and in conjunction with current observations, in ascertaining the types of precipitation that were falling.

It was the 88-D on this day, that allowed forecasters to later determine the need for snow advisories in Southern Idaho, especially since it was the first major snowfall of the year. In figure 7, (1708z) the first 30 dbz echoes were observed over Southwest Idaho. This was confirmed by moderate snow being reported in the Ontario/Weiser area. Another area of 30-40 dbz reflectivities were over the Mountain Home area. At this

time, only light snow was observed in the Boise area. In figure 8, (1801z) a west to east oriented band of snow of 30-40 dbz were clearly seen over much of extreme southwest Idaho. At this time, Boise was reporting moderate snow. To the south of Boise, a band of higher reflectivities was evident, possibly indicating the presence of freezing precipitation and rain in an area closer to the warm front. Figure 9 (1930z) represents the time corresponding to the maximum dbz levels and the most extensive coverage of these higher levels. This also corresponded with moderate to heavy snow being reported at both Boise and Mountain home. (Boise 4.5 inches, Mountain Home 6 inches.)

5. SOUNDING DATA

The 12z Boise raob provided important clues as to the temperature structure in the lower few thousand feet of the atmosphere. Figure 6b is attached. As seen on the profile at 12z, only the first couple thousand feet were above freezing, while the rest of the sounding remained below freezing, but with several inversions noted at different layers representing pockets of alternating cold and warm layers.

Of significance on the 12z raob, was the presence of a deep layer of dry air between 800mb and 600mb. Once the onset of precipitation in Southwest Idaho began, this dry layer above the surface undoubtedly played a key role in lowering the surface temperatures by evaporative cooling, a process that often times changes rain over to snow in the lowest levels. A Strong 300mb wind max of 100kt+ winds was also noted over Boise, probably adding a significant amount of lift to the developing synoptic pattern evolving over Southwest Idaho, Southeast Oregon and Northern Nevada.

By 00z on the 6th, (fig.6) the Boise sounding had shown significant changes from the 12z run. The profile was now nearly saturated at all levels with a strong inversion present up to near 9000 feet msl. Mid level winds had now backed to the southwest (240/60 kts), indicating the approaching short wave which had developed during the day, and lessening wind speeds at the jet level, indicating the exit of the speed max which was present earlier in the day (12z). All of the 00z sounding profile was below freezing showing the colder air mass behind the system.

6. CONCLUSIONS AND COMMENTS

This was a case that was probably not as complicated as one might believe. What did make forecasting the onset of the event difficult, was that model ouput was well underdone, although to its credit, the ETA model did have a readout of copious QPF amounts, but with surprisingly low pops indicated on both the ngm and avn MOS. The event had the classic signatures of moderate to heavy precipitation located in a narrow band 2.5

degrees latitude (100-200 miles) north of the warm front along an evolving surface wave. Local orograhics did not appear to enhance the precipitation in this case, as the event was mostly confined to the snake river valley of Idaho, typically in the 2000-4000 feet msl range with the heaviest precipitation falling in lower elevations. Evaporative cooling played an important part in lowering surface temperatures once precipiation began, then keeping them below freezing during the storm development. The exception was in the Magic Valley of Idaho, where a small pocket of warmer surface air was noted around an inverted trof, generally north of the tightest thermal gradient (fig 2). Mostly rain, or a mixture of precipitation fell in this region with the highest QPF amounts. (figure 6).

Later, in the early evening hours as the surface low was moving eastward along the thermal boundary, a small but significant area of convection developed over northern Nevada and Northern Utah. (Figure 5). This area of convective instability was responsible for severe wind gusts over Northeast Nevada, parts of extreme Southeast Idaho and Northern Utah. This amount of lightning activity is usually associated with a much stronger surface and upper level low, especially given the time of year in the cold season. (figure 5 and attachment 2).

The key to the forecasting and monitoring of this event was careful satellite interpretation, surface analysis and potential temperature analysis, in combination with current observations and WSR-88D composite reflectivity scans.

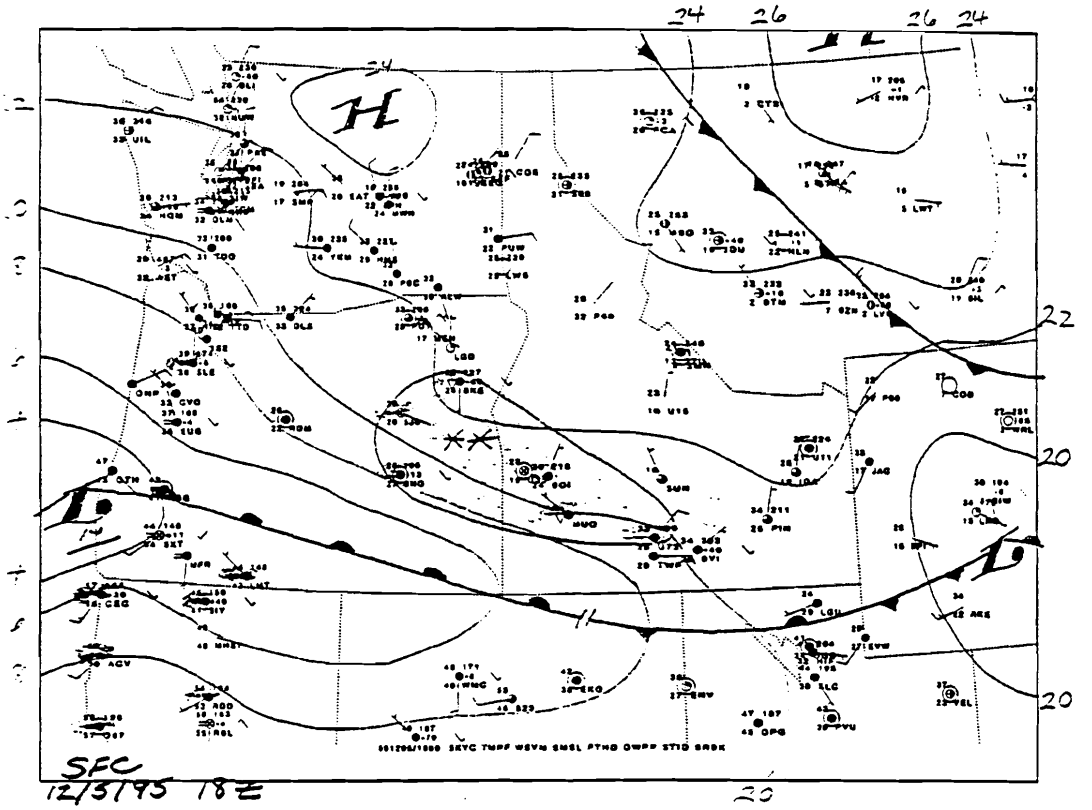



figure 1

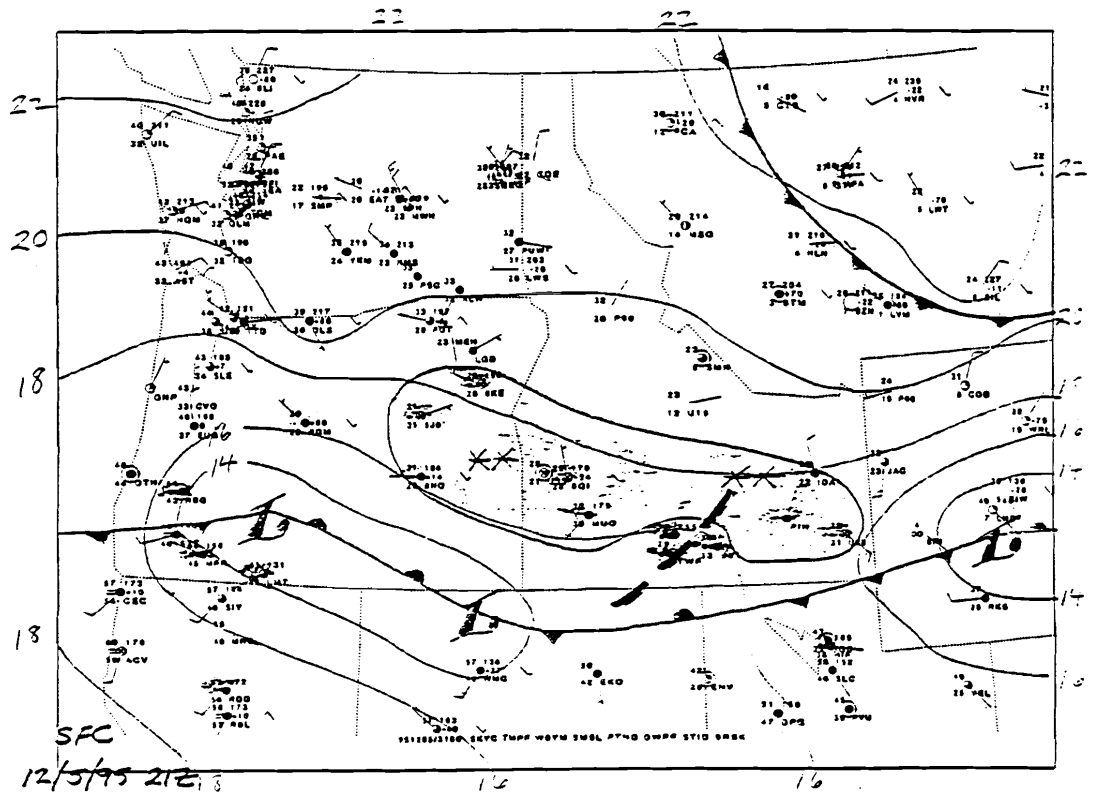



figure 2

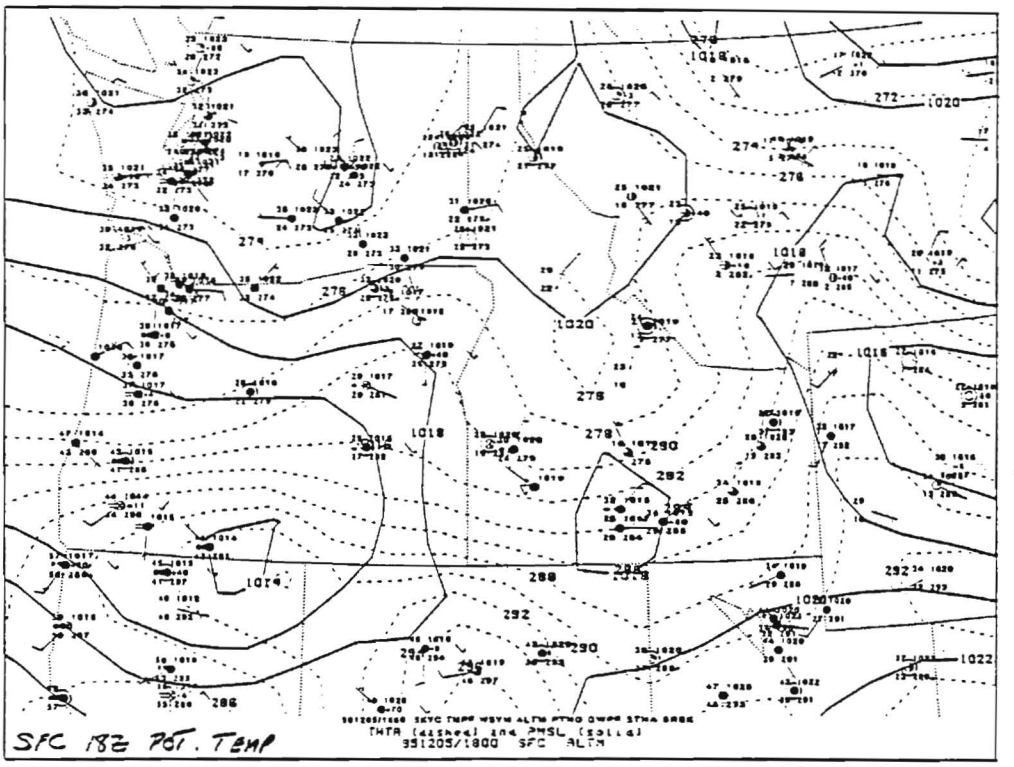



figure 3

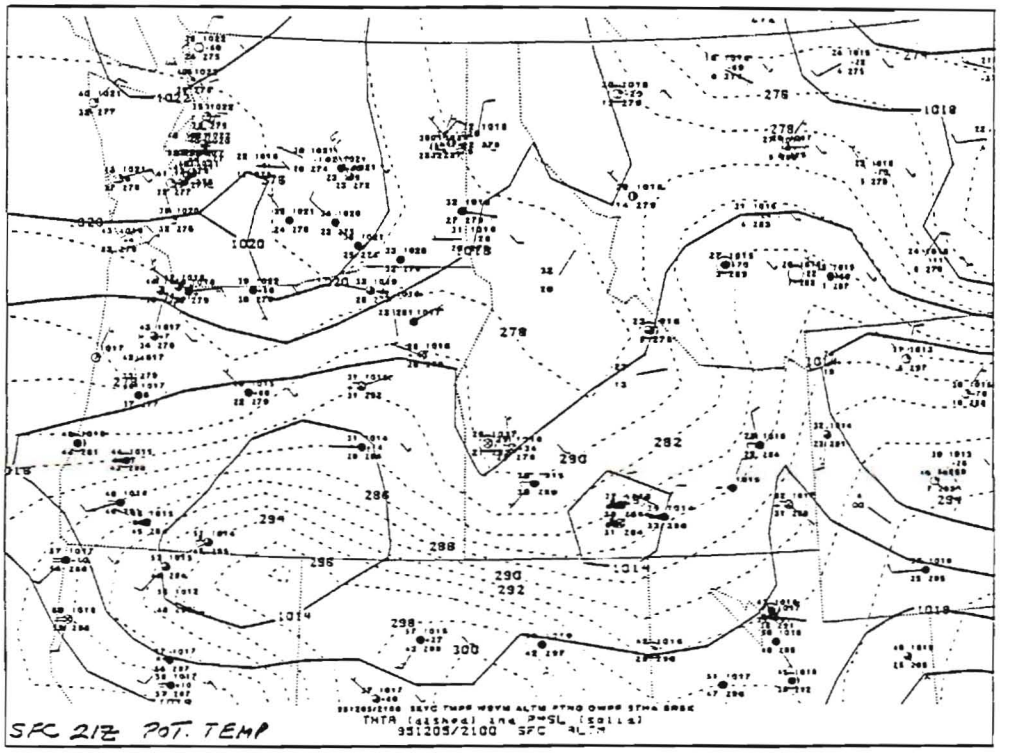



figure 4

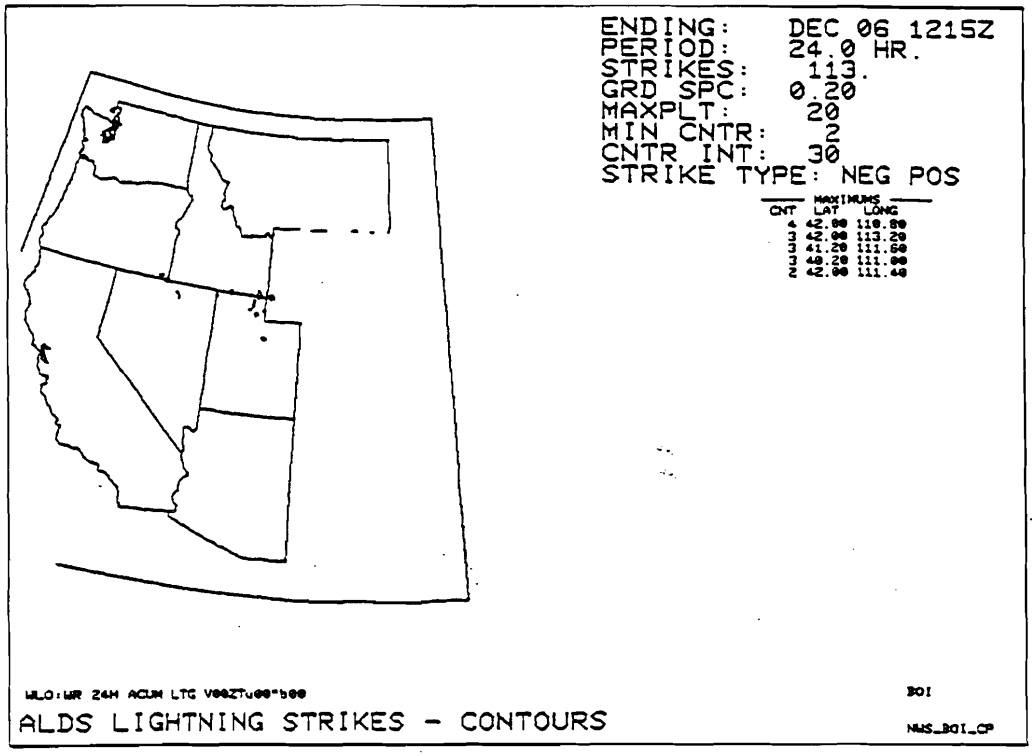



figure 5

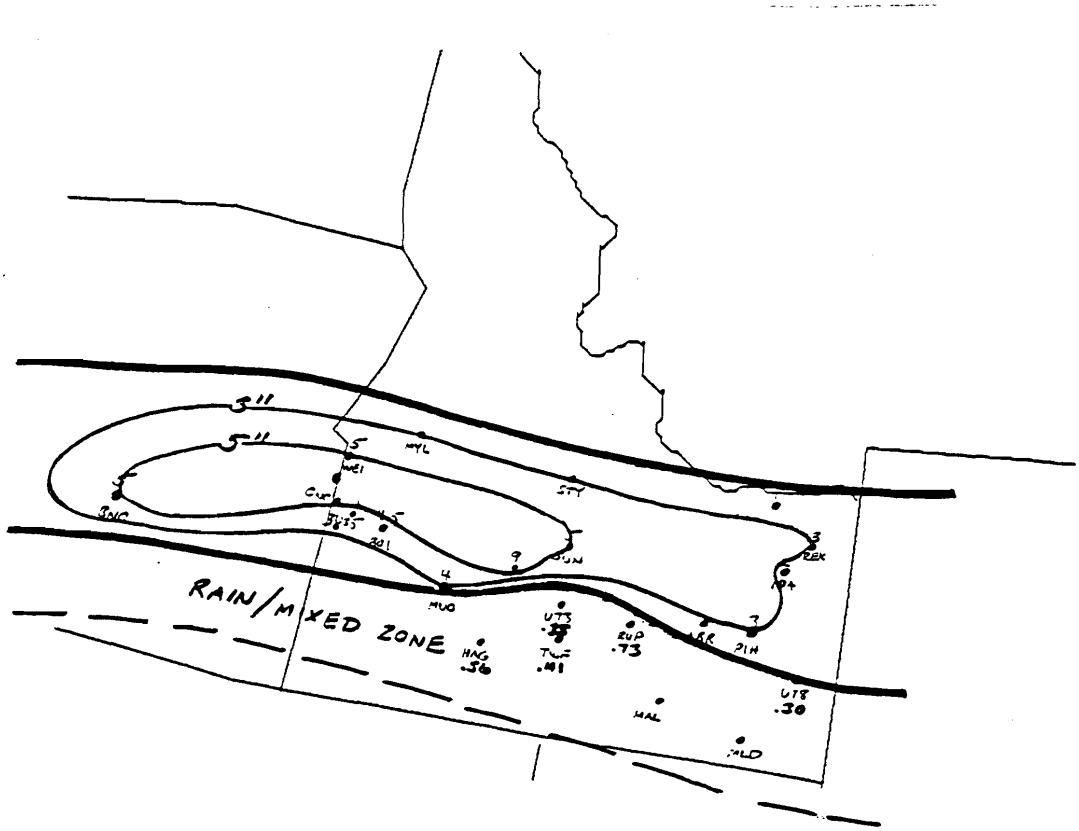
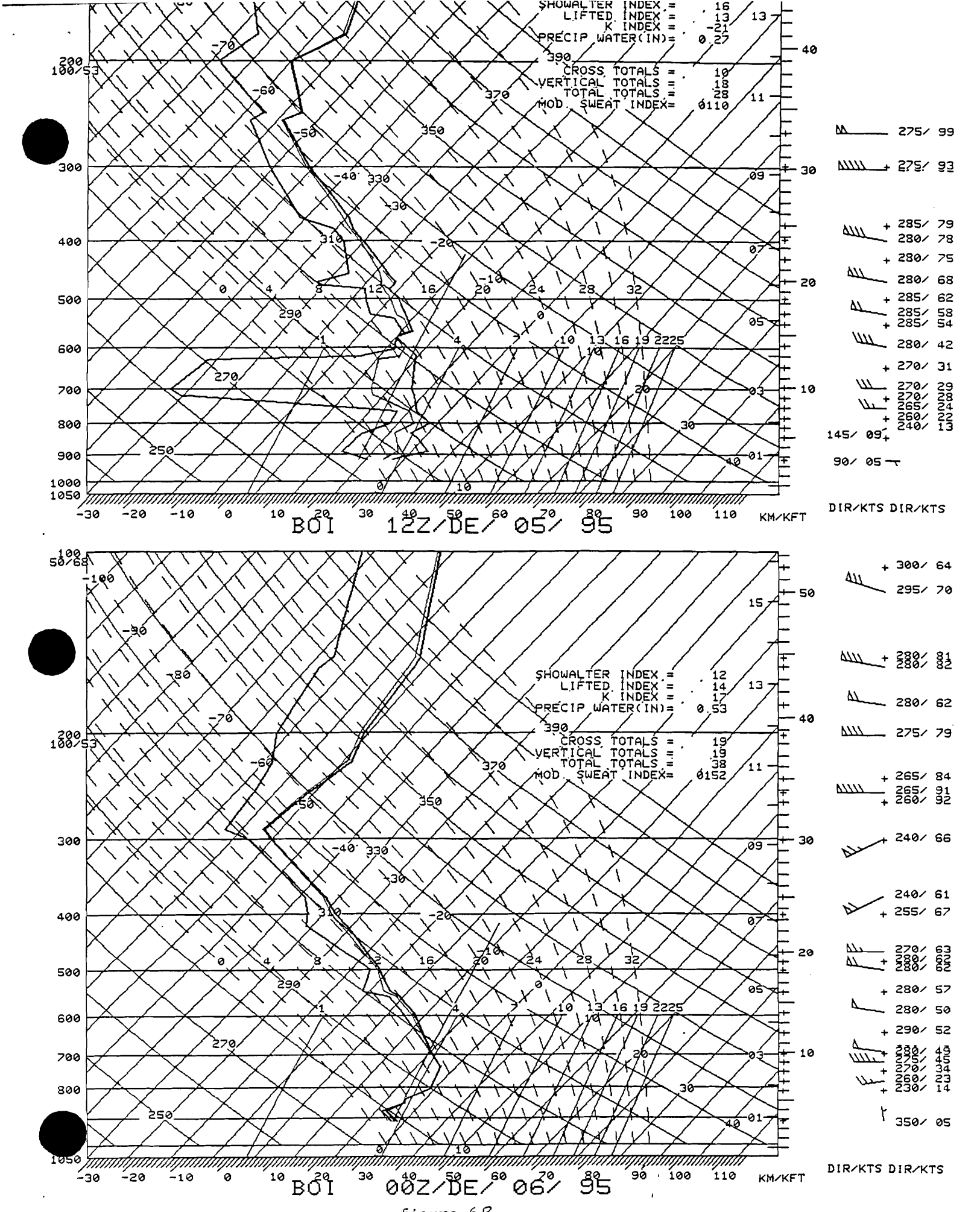



figure 6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VERTICAL TOTALS = 18
TOTAL TOTALS = 28
MOD. SWEAT INDEX= 0110
BOI 12Z/DE/ 05/ 95
KM/KFT
DIR/KTS DIR/KTS
SHOWALTER INDEX = 12
LIFTED INDEX = 14
K INDEX = 17
PRECIP WATER(IN)= 0.53
CROSS TOTALS = 19
VERTICAL TOTALS = 19
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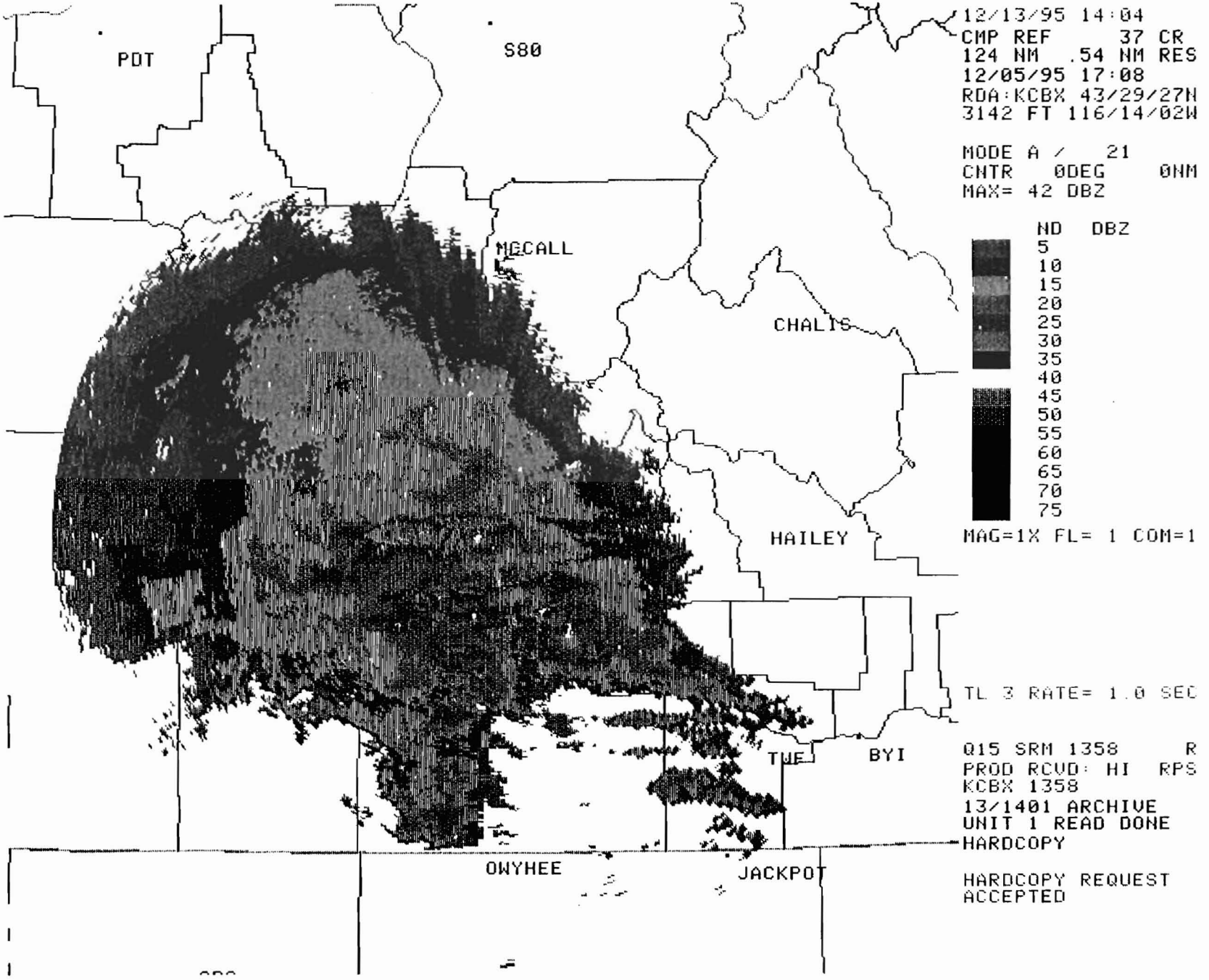
BOI 00Z/DE/ 06/ 95
KM/KFT
DIR/KTS DIR/KTS

figure 6B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MCCALL
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HAILEY
TWF
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JACKPOT
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124 NM .54 NM RES
12/05/95 17:08
RDA:KCBX 43/29/27N
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MODE A / 21
CNTR 0DEG 0NM
MAX= 42 DBZ
ND DBZ
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MAG=1X FL= 1 COM=1
TL 3 RATE= 1.0 SEC
Q15 SRM 1358 R
PROD RCVD: HI RPS
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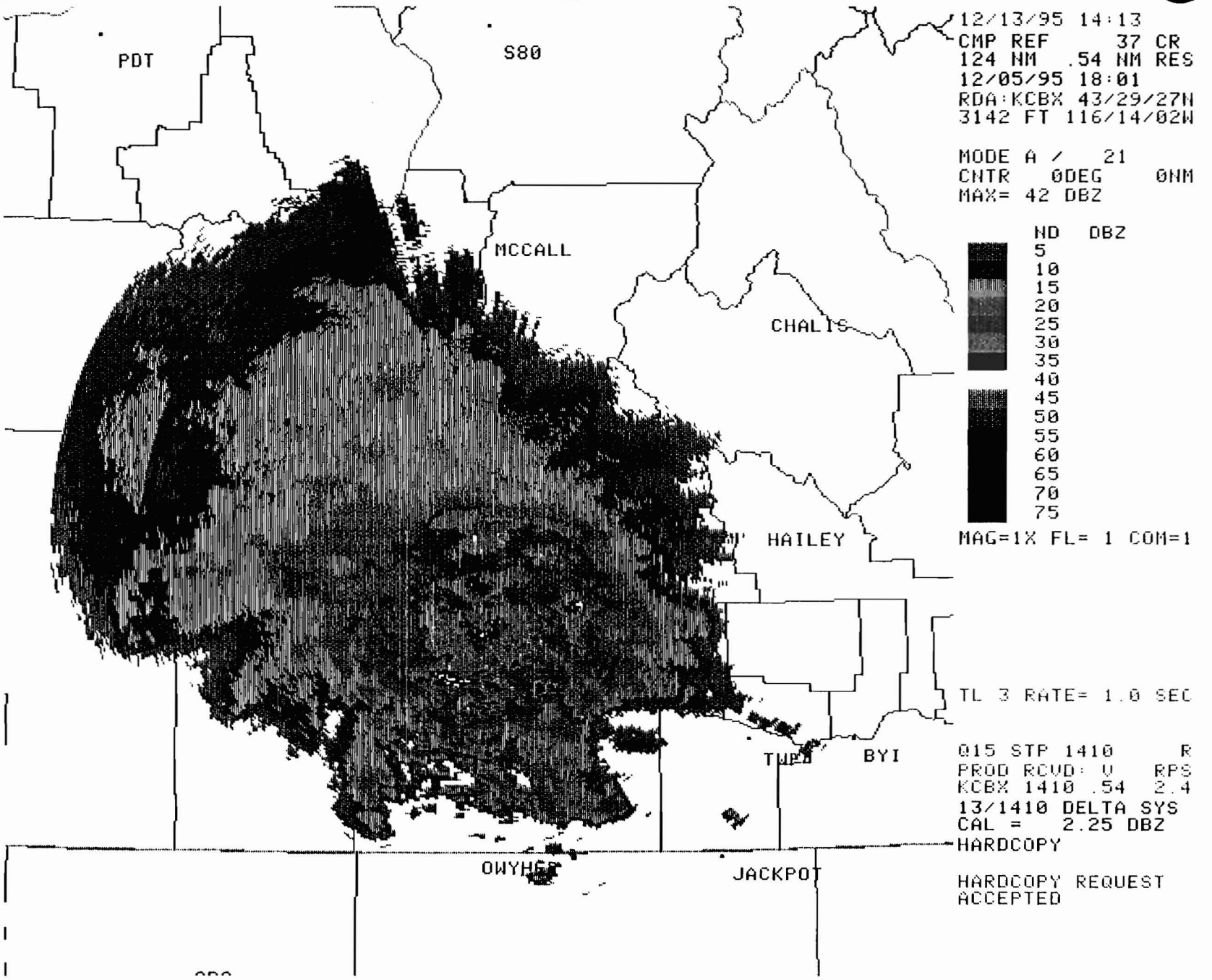
UNIT 1 READ DONE
HARDCOPY
HARDCOPY REQUEST
ACCEPTED

figure 7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3142 FT 116/14/02W
MODE A / 21
CNTR 0DEG 0NM
MAX= 42 DBZ
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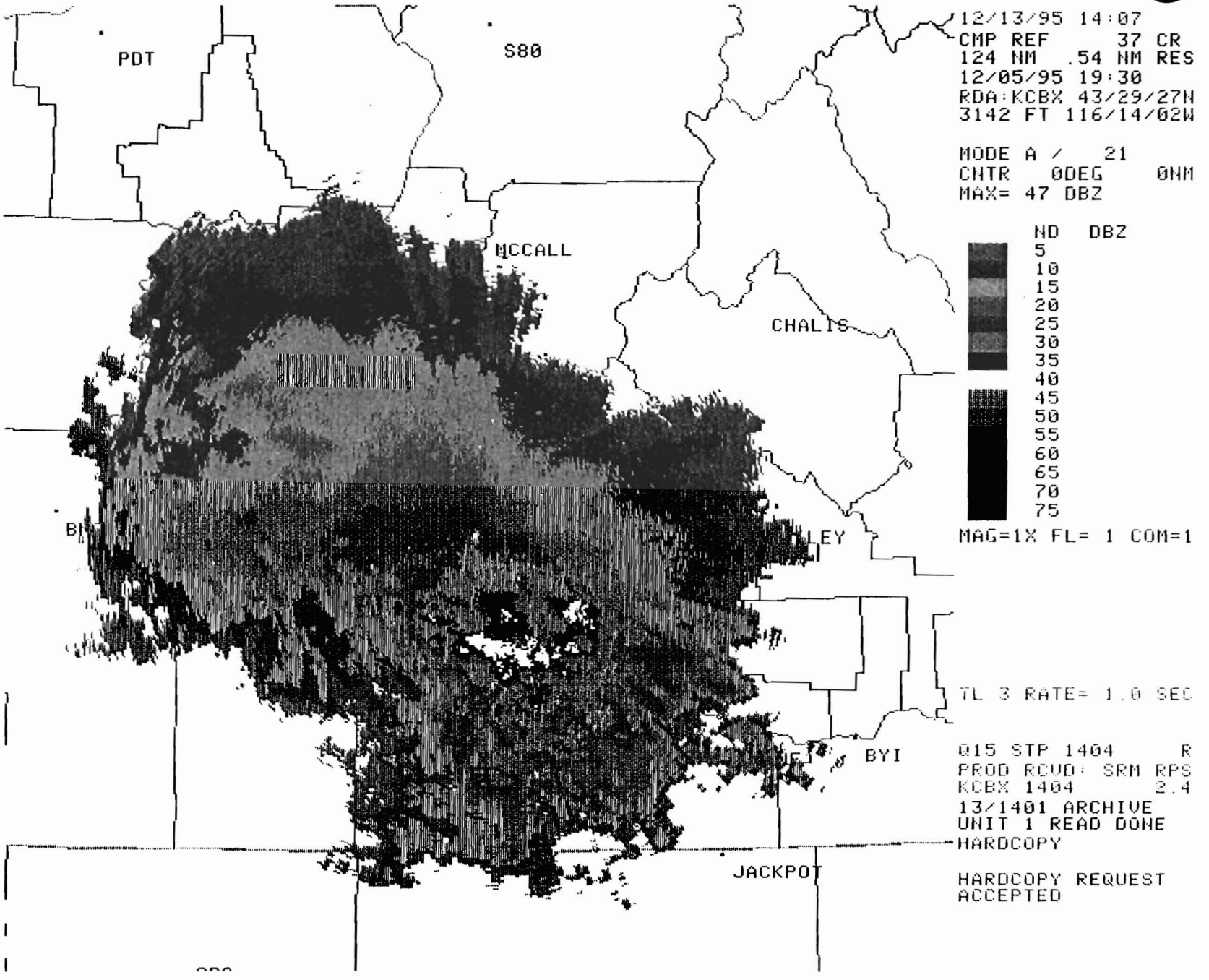
MAG=1X FL= 1 COM=1
TL 3 RATE= 1.0 SEC
Q15 STP 1410 R
PROD RCVD: V RPS
KCBX 1410 .54 2.4
13/1410 DELTA SYS
CAL = 2.25 DBZ
HARDCOPY
HARDCOPY REQUEST
ACCEPTED

figure 8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MODE A / 21
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MAG=1X FL= 1 COM=1
TL 3 RATE= 1.0 SEC
Q15 STP 1404 R
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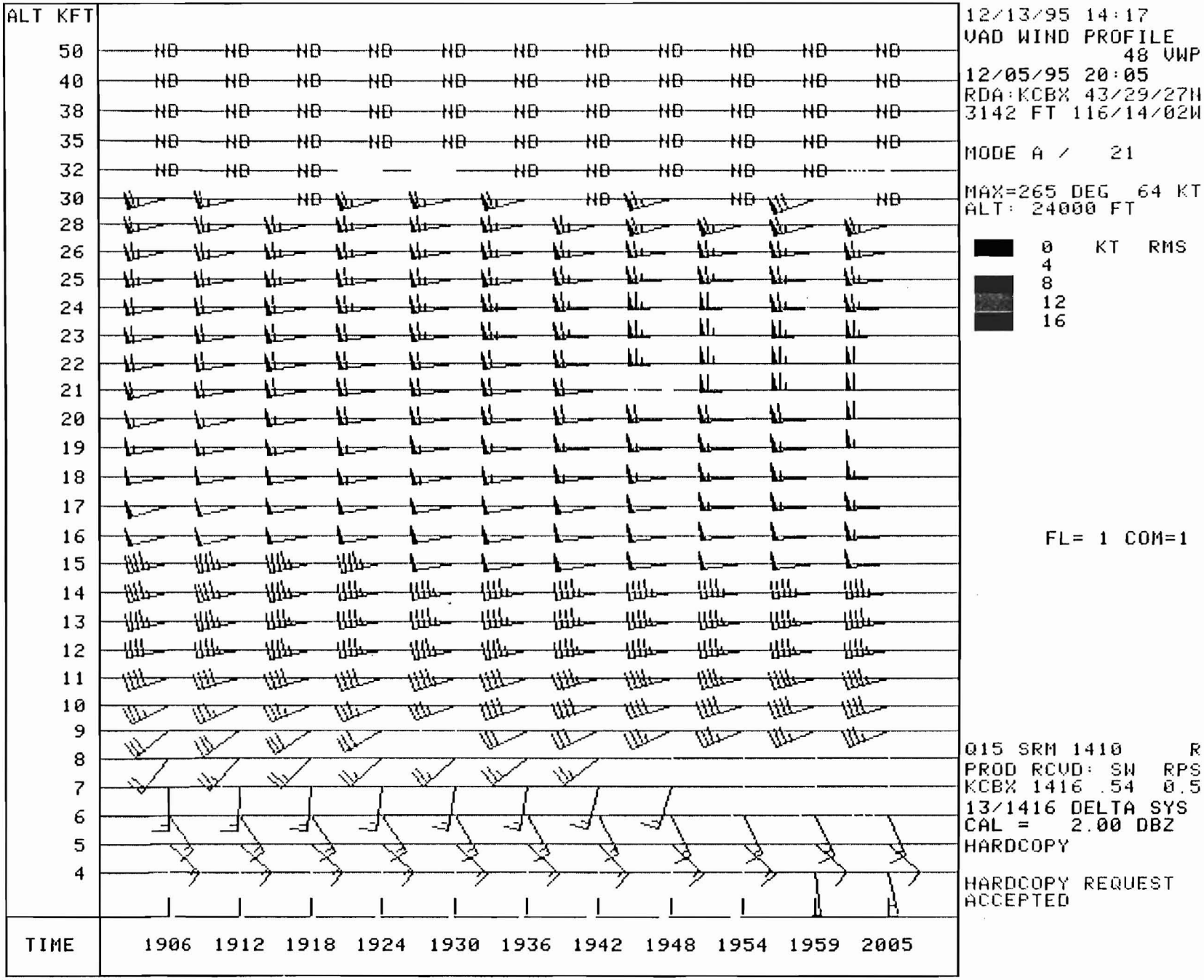
UNIT 1 READ DONE
HARDCOPY
HARDCOPY REQUEST
ACCEPTED

figure 9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TIME
1906 1912 1918 1924 1930 1936 1942 1948 1954 1959 2005
12/13/95 14:17
VAD WIND PROFILE
48 VWP
12/05/95 20:05
RDA:KCBX 43/29/27N
3142 FT 116/14/02W
MODE A / 21
MAX=265 DEG 64 KT
ALT: 24000 FT
0 KT RMS
4
8
12
16
FL= 1 COM=1
Q15 SRM 1410 R
PROD RCVD: SW RPS
KCBX 1416 .54 0.5
13/1416 DELTA SYS
CAL = 2.00 DBZ
HARDCOPY
HARDCOPY REQUEST
ACCEPTED

figure 10

NNNNZCZC BOIWSWBOI
FLUAA00 KBOI 052203
IDZ001>004-012-060300-

GS

SNOW ADVISORY
NATIONAL WEATHER SERVICE BOISE ID
300 PM MST TUE DEC 05 1995

...SNOW ADVISORY CONTINUED FOR THE TREASURE VALLEY EARLY THIS EVENING AND EXPANDED TO INCLUDE THE UPPER SNAKE HIGHLANDS...SOUTHEAST HIGHLANDS AND UPPER SNAKE RIVER VALLEY THIS EVENING...

THE NATIONAL WEATHER SERVICE HAS CONTINUED THE SNOW ADVISORY FOR THE TREASURE VALLEY EARLY THIS EVENING. ALREADY 3 TO 4 INCHES OF NEW SNOW HAS FALLEN IN THE BOISE AREA...WITH ANOTHER ONE INCH OR SO POSSIBLE BEFORE THE SNOW CHANGES TO RAIN LATER TONIGHT THEN ENDS.

THIS AREA OF PRECIPITAION HAS ALSO SPREAD EASTWARD ACROSS SOUTHERN IDAHO WITH SNOW NOW FALLING IN THE UPPER SNAKE RIVER VALLEY...THE SOUTHEAST HIGHLANDS AND THE UPPER SNAKE HIGHLANDS WHERE A SNOW ADVISORY IS NOW IN EFFECT THROUGH THIS EVENING.

ACCUMULATIONS ARE EXPECTED TO RANGE FROM 3 TO 5 INCHES IN THE HIGHER ELEVATIONS OF THE HIGHLANDS AND 2 TO 4 INCHES IN LOWER ELEVATIONS AND VALLEYS...WHICH INCLUDES THE CITIES OF IDAHO FALLS AND POCATELLO. LOCALLY HIGHER AMOUNTS ARE POSSIBLE ON THE HIGHEST PEAKS OF THE HIGHLANDS.

A MIXTURE OF RAIN AND SNOW IS FALLING IN THE MAGIC VALLEY OF IDAHO WITH SNOW IN NORTHERN SECTIONS OF THE VALLEY AND RAIN IN THE SOUTH AROUND THE TWIN FALLS AND BURLEY AREAS. MIXED PRECIPITATION IS EXPECTED TO CONTINUE IN THIS AREA WITH WARMER AIR IN THE REGION.

THIS WINTER WEATHER IS BEING CASUED BY AN AREA OF LOW PRESSURE MOVING EASTWARD ALONG A WARM FRONT WHICH IS LYING EAST-WEST ACROSS SOUTHERN IDAHO. WARMER AIR IS EXPECTED TO OVERRUN THE COLD AIR AT THE SURFACE NORTH OF THIS FRONT EVENTUALLY CHANGING THE SNOW TO RAIN OVERNIGHT IN MOST AREAS OF SOUTHERN IDAHO ESPECIALLY IN LOWER ELEVATIONS.

IF YOU ARE TRAVELING TONIGHT IN THE SNOW ADVISORY AREA...YOU SHOULD BE PREPARED FOR HAZARDOUS ROAD CONDITIONS WITH RAPIDLY CHANGING VISIBILITIES IN SNOW AND FOG. HEAVY ICE AND SLUSH BUILDUP WILL LIKELY PRODUCE DANGEROUS TRAVELING CONDITIONS. LISTEN FOR FURTHER UPDATES ON THIS WEATHER SYSTEM.

.END...NWSFO BOISE/GJS
NNNNZCZC BOIWSWBOI

attachment 1

NNNNZCZC BOINOWBOI
ETTAA00 KBOI 052340

SHORT TERM FORECAST
NATIONAL WEATHER SERVICE BOISE ID
440 PM MST TUE DEC 5 1995

IDZ001-060100
TREASURE VALLEY-
440 PM MST TUE DEC 5 1995

.NOW...
AT 430 PM DOPPLER RADAR SHOWED SNOW DECREASING IN THE WESTERN PART OF THE TREASURE VALLEY. THE EAST PART OF THE TREASURE VALLEY WAS STILL RECEIVING SNOW RAIN AND LOCAL SLEET. AT 410 PM MOUNTAIN HOME WAS REPORTING SLEET AFTER 6 INCHES OF SNOWFALL AND A SHORT PERIOD OF RAIN. LIGHT SNOW WAS STILL FALLING AT BOISE BUT WAS DECREASING AT NAMPA. LIGHT SNOW WAS ALSO STILL FALLING AT ONTARIO.

IDZ005-ORZ012-060130
SOUTHWEST HIGHLANDS-SOUTHEAST OREGON -
440 PM MST (340 PM PST) TUE DEC 5 1995

AT 415 PM MST (315 PM PST) LIGHTNING DETECTION EQUIPMENT INDICATED THUNDERSTORMS IN THE SOUTHEAST CORNER OF MALHEUR COUNTY OREGON AND THE SOUTHWEST CORNER OF IDAHO. THIS AREA IS A LITTLE EAST OF U.S. HIGHWAY 95 IN MALHEUR COUNTY...ABOUT 25 MILES NORTHEAST OF MCDERMITT NEVADA. THUNDERSHOWERS MAY OCCUR IN THIS AREA FOR SEVERAL MORE HOURS THIS EVENING.

$$

attachment 2

Southwest Idaho

| | water equivalent | | snow |
|---|---|---|---|
| 1. Mountain Home | .51 | | 6.0 inches |
| 2. Boise | .38 | | 4.5 inches |
| 3. Weiser | .38 | | 5.0 inches |
| 4. Caldwell | .27 | | 4.0 inches |
| 5. Emmett | .30 | | 3.0 inches |
| 6. Ontario | .27 | | 3.0 inches |
| 7. Parma | .25 | | 3.0 inches |
| 8. Homedale | mm | | 3.0 inches |

South-Central Idaho

| | | | |
|---|---|---|---|
| 1. Fairfield | .35 | | 6.0 inches |
| 2. Ketchum | .27 | | 5.0 inches |
| 3. Rupert | .73 | all rain | |
| 4. Hagerman | .56 | all rain | |
| 5. Kimberly | .41 | all rain | |
| 6. Twin Falls (ASOS) | .41 | all rain | |
| 7. Jerome | .35 | mixture (mostly rain) | |
| 8. Malta | .36 | mixture (mostly rain) | |

Eastern Idaho

| | | | |
|---|---|---|---|
| 1. Pocatello | .50 | some rain | 3.0 inches |
| 2. Aberdeen | .34 | | 3.0 inches |
| 3. St. Anthony | .12 | | 3.0 inches |
| 4. Rexburg (ASOS) | .26 | | 3.0 inches |
| 5. Soda Springs | .30 | some rain | 3.0 inches |
| 6. Idaho Falls | .19 | | 2.0 inches |
| 7. Spencer | .05 | | 1.0 inch |

Precipitation amounts from the DEC. 5, 1995 snow and rain event over Southern Idaho.