CRH SSD
SEPTEMBER 1988

CENTRAL REGION TECHNICAL ATTACHMENT 88-34

MEASUREMENT OF FORECAST SKILL ... A NECESSARY PART OF OUR JOB

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Measurement of forecast skill (MOFS) should be an important part of each forecaster's work routine. Its significance will likely increase further as we move toward implementation and use of new technology in the 1990's. Some of the products NWS forecasters spend a good part of shift work time preparing are the zone forecasts (ZFP's). They are the "heart" of the public forecast program. Because of their importance, a measurement of forecast skill for this product is highly desirable. Continuous tracking of the product's quality will assist in determining whether its quality is improving, staying the same, or deteriorating. It will also assist in improving our understanding of the atmosphere by answering the question of how good or poor the methodology used in product preparation was. In general, if the forecast's MOFS was high, the methodology and scientific thought processes were most likely on target. If the opposite occurs, then either something was missed, was assumed incorrectly, or wrong methodologies were employed. Of course, there is always the "right for the wrong reasons" scenario. Let's just look at that as "extra credit!"

The important message is that a routine MOFS program will increase our knowledge and understanding of the weather with an end result of improved forecasts to the users.

With the ability to overlay and enlarge various types of AFOS graphics, offices have an opportunity to maintain MOFS studies with a minimum amount of work. Given the variability of precipitation, especially during the summer months, a confirmation of occurrence in zone forecasts can be challenging. However, by combining cooperative observer data, GDDS, and AFOS radar graphics (90(R,S) with enlarged geographical overlays) useful MOFS information can be obtained.

Figures 1, 2, and 3 are representations of the AFOS graphics available to do MOFS work. Figure 1 shows all the zones in the whole Central Region, while Figure 2 is a 16:1 blow-up centered over Kansas. An example of AFOS graphics 90(R,S) overlayed on the detailed zone map is given in Figure 3. Note how specific radar echo areas and intensities can be referenced to a zone or zones. This allows a forecaster to analyze echo distribution at a level of detail similar to the detail of a zone forecast. This brings the geographical reference down to a more detailed scale, a map showing the zones broken into counties (Figure 4) can be used.

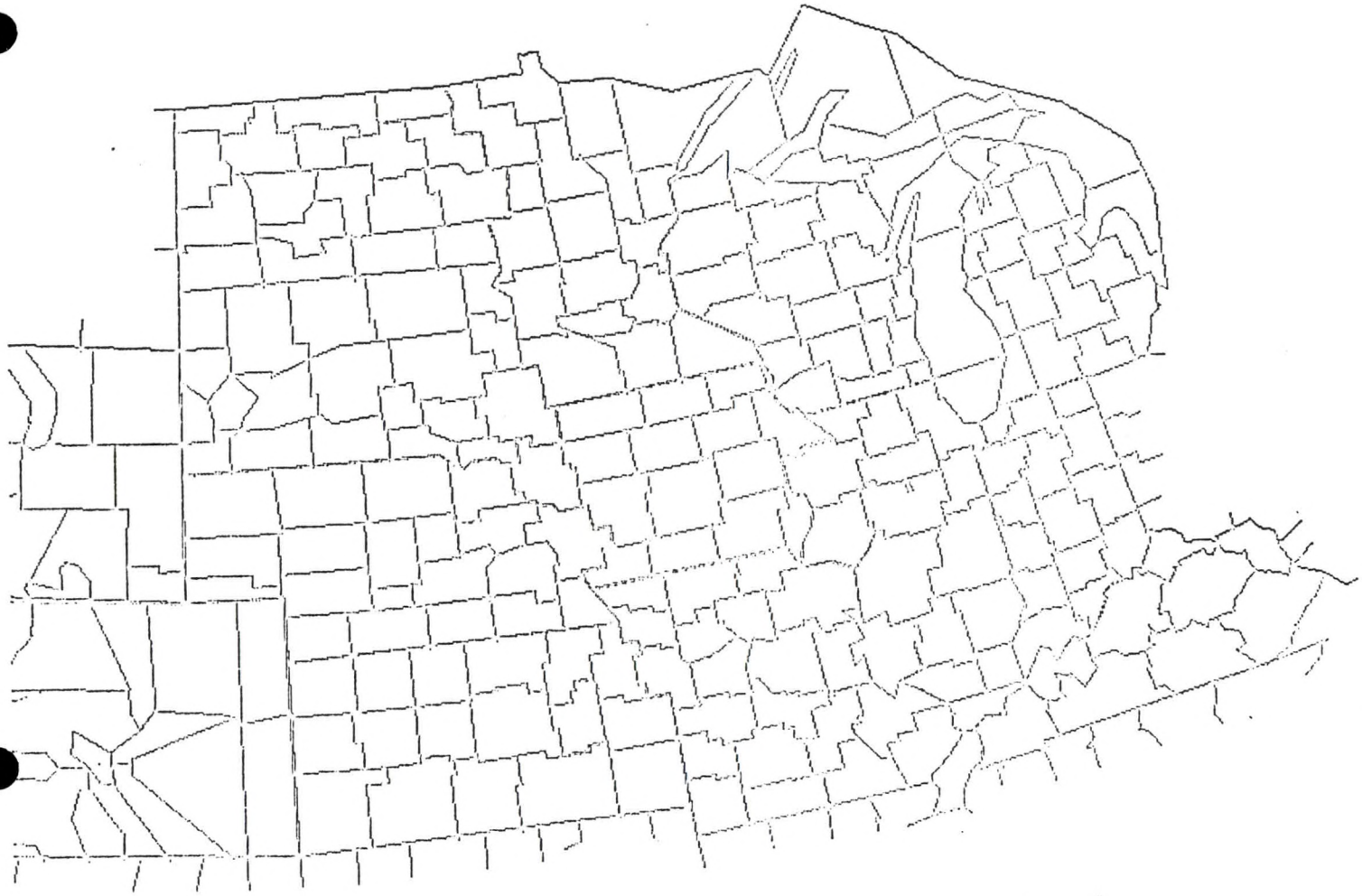

Fig. 1 AFOS graphic B68 of Central Region zones.

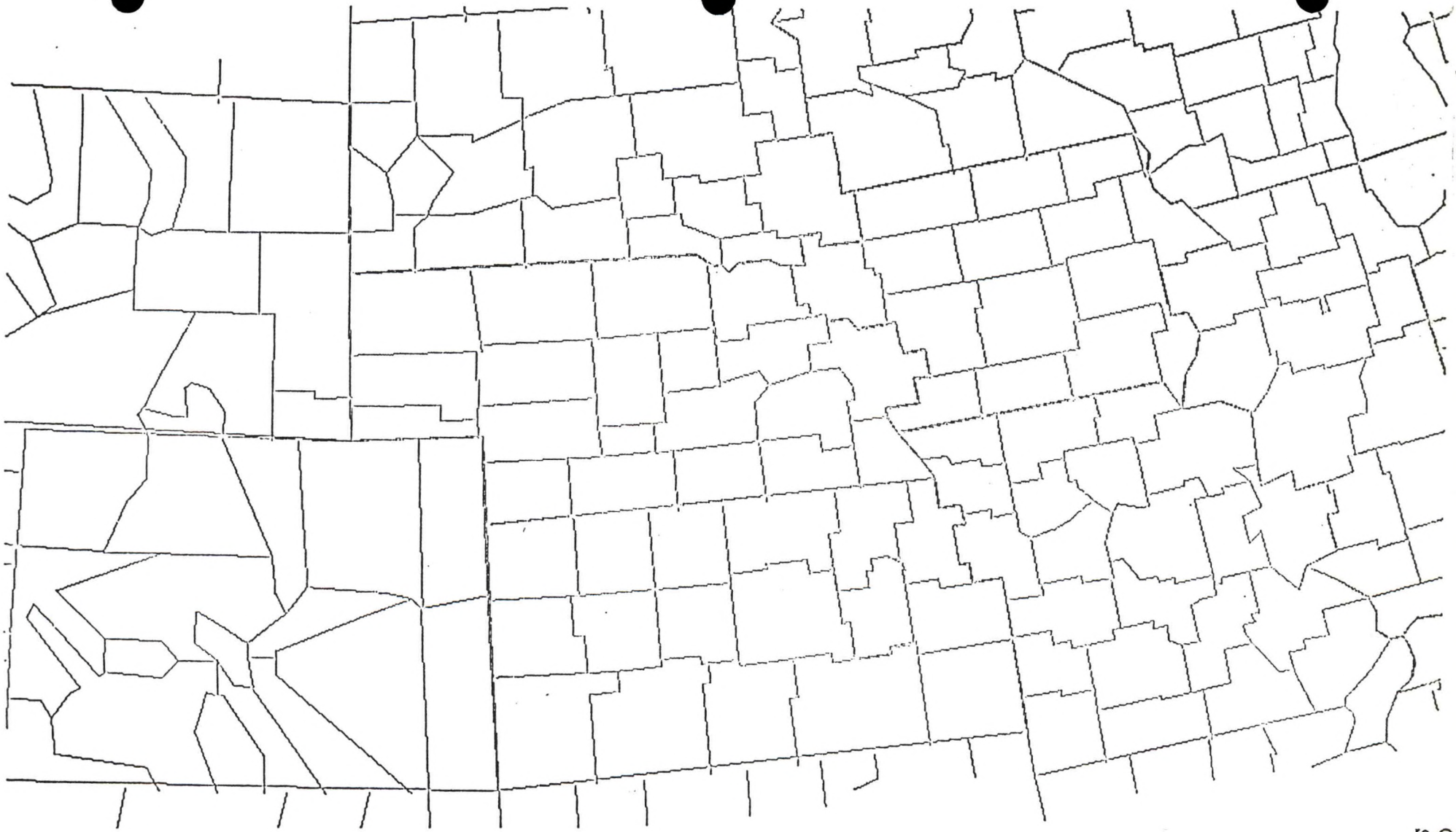

Fig. 2 AFOS graphic B68 of Central Region zones enlarged to 16:1.

Fig. 3. AFOS graphic 90(R,S) overlayed on a detailed zone map.

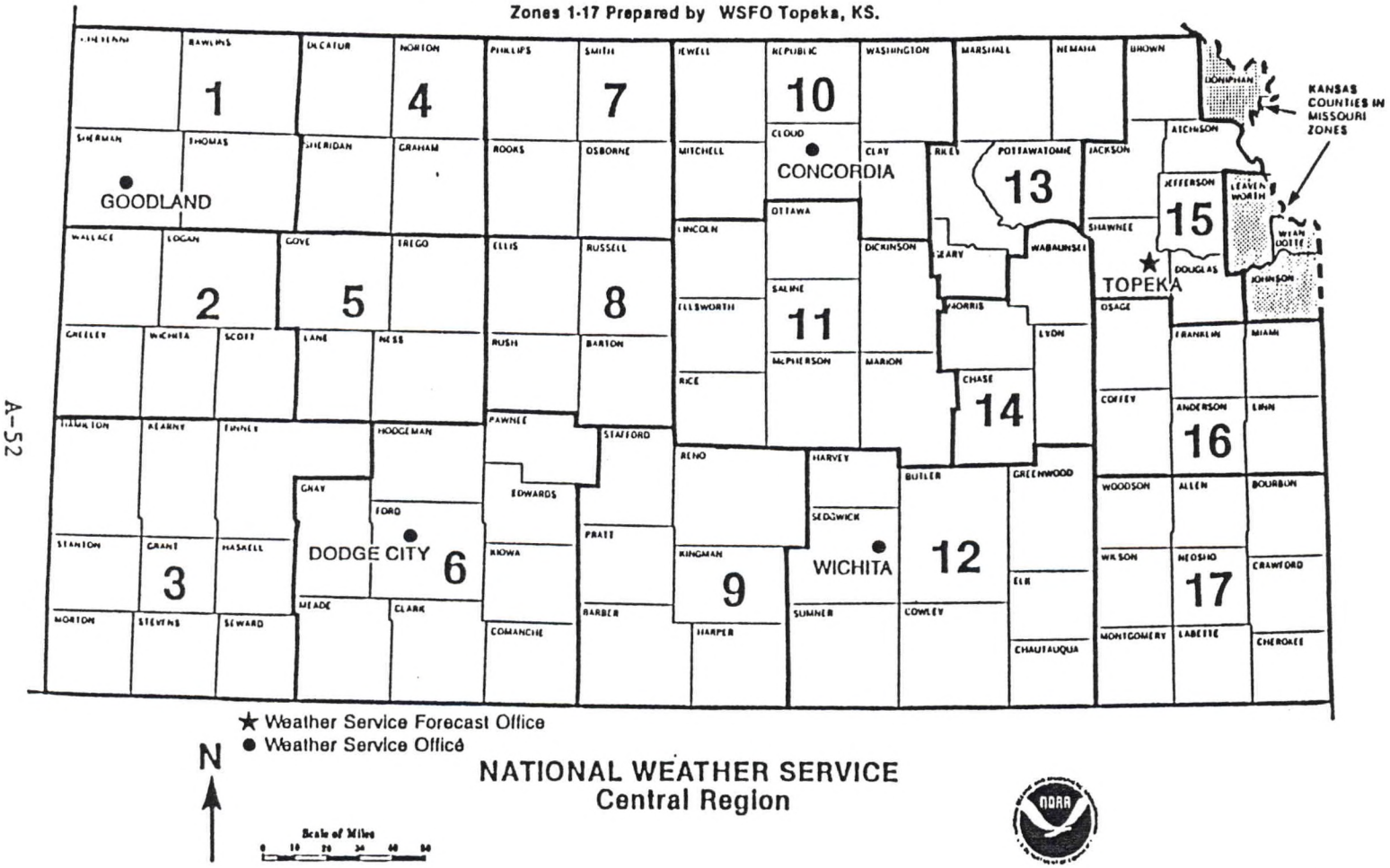

Fig. 4 Kansas zone forecast boundaries.

To show the MOFS concept, we will examine the Kansas zone forecasts issued at 3:39 p.m. (all times hereinafter referred to are in CDT), July 26 (Figure 5). The period of forecast evaluation will be TONIGHT. In general, the forecasts indicated categorical rain events of a scattered nature over south central Kansas (zones 9 and 12) while probabilistic terminology was used over 1, 2, 3, 4, 5, 6, 7, 8, and 17 (i.e., 30 to 60 percent). All other zones had no mention of rain for TONIGHT.

Figures 6a through 6k show the radar echo pattern (AFOS graphic 90(R,S)) over Kansas from 3:35 p.m., July 26, to 1:35 a.m., July 27. The active weather is over the south central part of Kansas and drifts slowly southward throughout this period, moving out of Kansas around midnight. During the period before the TONIGHT portion of the Kansas zone forecast begins (i.e., 5:35 p.m.), the main convective area is concentrated over zone 9 with lesser activity over zones 12 and 17 (Figure 6c). Note the VIP 3 level area in zone 9.

At 6:35 p.m. (Figure 6d) the area still exists but no VIP 3 is shown although some tops around 30,000 feet are indicated within the area immediately after the forecast officially begins (Figure 6e), the VIP 3 again appears with a 40,000 foot top shown in the southeast quarter of zone 9. This probably is located in Kingman or Harper County of zone 9 (see Figure 4).

This strong echo continues to move slowly southward during the next two hours (Figures 6f and 6g) reaching the Oklahoma-Kansas border in southern Harper County around 8:35 p.m. Figure 7 shows a more detailed geography over area of interest. This movement generally put the strong cell over or near the towns of Harper and Anthony in Harper County.

The cell continued southward and by 11:35 p.m. (Figure 6h) it had moved totally into Oklahoma. Most all convective precipitation had ended over south central Kansas around midnight (Figure 6j). Figure 8 shows 24-hour rainfall totals. The amounts are representative of Tuesday late afternoon and night since no precipitation was noted over that area earlier Tuesday.

The reports of .95 inch at Anthony; .75 inch at Runnymede; and .65 inch at Bluff City are of special interest. They all fit nicely with the VIP 3 cell. No doubt, amounts of more than one inch could have occurred in the area south of Harper.

Going back to the 3:39 p.m. zone forecast, the 30 percent probabilities in zones 3 and 8 were indicative of a categorical non-occurrence of rain at any given point, and no mention of showers appeared in zones 10, 11, 13, 14, 15, and 16. If any rain did occur in these zones, it would have been early in the TONIGHT period over the extreme south part of zones 8 and 11. The 60 percent PoP in zone 17 never really materialized substantially although some echo was shown in the western part (Figures 6c through 6f). A 60 percent PoP was a little too strong for the event. Zones 9 and 12 did get scattered rain with heaviest amounts in Kingman and Harper Counties where the VIP 3 echo occurred. Elsewhere, smaller amounts were observed in Pratt and the western portions of Sedgwick and Sumner Counties in zone 12. Wichita, the major city in the area, received 0.01 inch.

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KANSAS ZONE FORECASTS
NATIONAL WEATHER SERVICE TOPEKA KS
339 PM CDT TUE JUL 26 1988

KS01-KS02-
KANSAS ZONES 1 2
339 PM CDT TUE JUL 26 1988

.TONIGHT...PARTLY CLOUDY WITH A 40 PERCENT CHANCE OF THUNDERSTORMS LATE TONIGHT. LOWS 60 TO 65. SOUTHEAST WINDS 10 TO 15 MPH.
.WEDNESDAY...PARTLY SUNNY. A 20 PERCENT CHANCE OF LATE AFTERNOON THUNDERSTORMS. WARMER WITH HIGHS 90 TO 95. SOUTHEAST WINDS 10 TO 20 MPH.
.WEDNESDAY NIGHT...A 30 PERCENT CHANCE OF THUNDERSTORMS. LOWS IN THE MID 60S.
.THURSDAY...PARTLY SUNNY AND VERY WARM. A 30 PERCENT CHANCE OF LATE AFTERNOON THUNDERSTORMS. HIGHS IN THE MID 90S.

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KS03-KS06-
KANSAS ZONES 3 6
339 PM CDT TUE JUL 26 1988

.TONIGHT...PARTLY CLOUDY. A 30 PERCENT CHANCE THUNDERSTORMS LATE. LOWS IN THE MID TO UPPER 60S. WINDS SOUTHEAST 10 TO 15 MPH.
.WEDNESDAY...PARTLY SUNNY. HIGHS IN THE MID 90S. SOUTHERLY WINDS 10 TO 20 MPH.
.WEDNESDAY NIGHT...A 30 PERCENT CHANCE OF THUNDERSTORMS. LOWS 65 TO 70.
.THURSDAY...PARTLY SUNNY AND VERY WARM. A 20 PERCENT CHANCE OF LATE AFTERNOON THUNDERSTORMS. HIGHS 95 TO 100.

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KS04-KS05-KS07-KS08-
KANSAS ZONES 4 5 7 8
339 PM CDT TUE JUL 26 1988

.TONIGHT...PARTLY CLOUDY. A 30 PERCENT CHANCE OF THUNDERSTORMS AFTER MIDNIGHT. LOWS IN THE MID 60S. SOUTHEAST WINDS 5 TO 15 MPH.
.WEDNESDAY...PARTLY SUNNY. HIGHS 90 TO 95. SOUTHERLY WINDS 10 TO 20 MPH.
.WEDNESDAY NIGHT...A 30 PERCENT CHANCE OF THUNDERSTORMS. LOWS 65 TO 70.
.THURSDAY...PARTLY SUNNY AND VERY WARM. A 20 PERCENT CHANCE OF LATE AFTERNOON THUNDERSTORMS. HIGHS 95 TO 100.

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KS09-KS12-
KANSAS ZONES 9 12
339 PM CDT TUE JUL 26 1988

.TONIGHT...MOSTLY CLOUDY WITH SCATTERED SHOWERS AND THUNDERSTORMS. LOWS 65 TO 70. LIGHT AND VARIABLE WINDS...EXCEPT GUSTY NEAR STORMS.
.WEDNESDAY...PARTLY SUNNY...WARM AND HUMID. HIGHS IN THE MID 90S. SOUTHERLY WINDS 10 TO 15 MPH.
.WEDNESDAY NIGHT AND THURSDAY...PARTLY CLOUDY. LOWS WEDNESDAY NIGHT AROUND 70. HIGHS THURSDAY IN THE MID TO UPPER 90S.

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KS10-KS11-
KANSAS ZONES 10 11
339 PM CDT TUE JUL 26 1988

.TONIGHT...PARTLY CLOUDY. LOWS 60 TO 65. LIGHT EASTERLY WINDS.
.WEDNESDAY...PARTLY SUNNY AND WARMER. HIGHS 90 TO 95. SOUTHEAST WINDS 10 TO 15 MPH.
.WEDNESDAY NIGHT AND THURSDAY...PARTLY CLOUDY. LOWS WEDNESDAY NIGHT 65 TO 70. HIGHS THURSDAY IN THE MID 90S.

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KS13-KS14-KS15-KS16-
KANSAS ZONES 13 14 15 16
339 PM CDT TUE JUL 26 1988

.TONIGHT...PARTLY CLOUDY. LOWS IN THE UPPER 50S. LIGHT EAST WINDS.
.WEDNESDAY...MOSTLY SUNNY. HIGHS AROUND 90. SOUTHEAST WINDS 5 TO 10 MPH.
.WEDNESDAY NIGHT AND THURSDAY...PARTLY CLOUDY. LOWS WEDNESDAY NIGHT IN THE LOWER TO MID 60S. HIGHS THURSDAY 90 TO 95.

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KS17-
KANSAS ZONE 17
339 PM CDT TUE JUL 26 1988

.TONIGHT...MOSTLY CLOUDY WITH A 60 PERCENT CHANCE OF THUNDERSTORMS. LOWS AROUND 70. LIGHT AND VARIABLE WINDS...EXCEPT GUSTY NEAR STORMS.
.WEDNESDAY...PARTLY SUNNY...VERY WARM AND HUMID. HIGHS IN THE MID 90S. SOUTHEAST WINDS 5 TO 10 MPH.
.WEDNESDAY NIGHT AND THURSDAY...PARTLY CLOUDY. LOWS WEDNESDAY NIGHT AROUND 70. HIGHS THURSDAY IN THE MID TO UPPER 90S.

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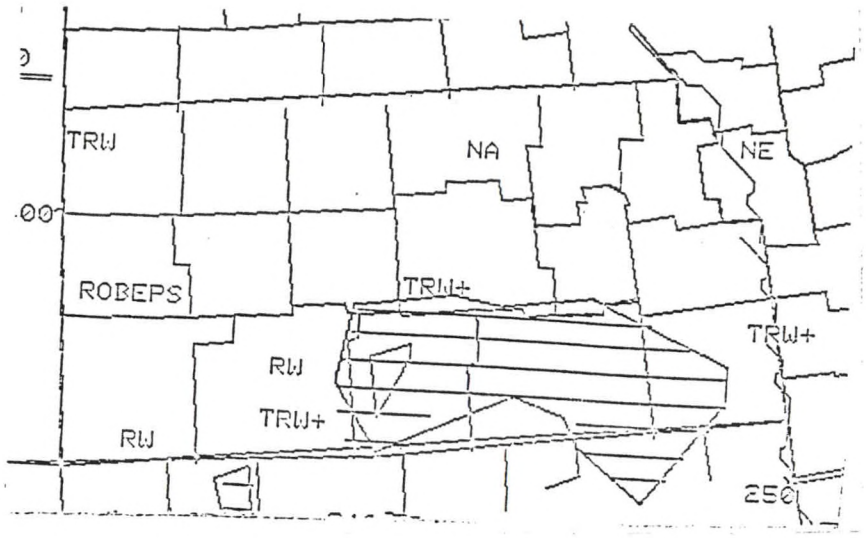
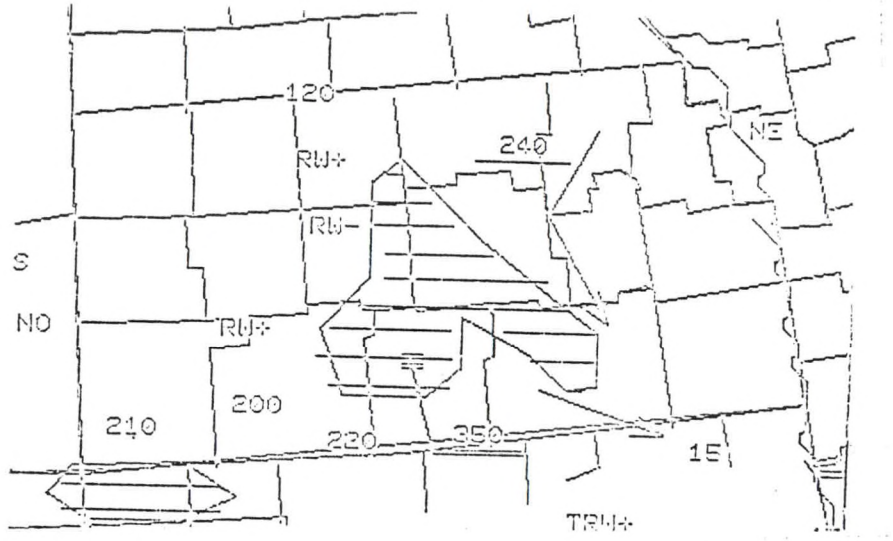
Fig. 5 Kansas zone forecasts issued at 3:39 p.m. CDT, July 26, 1988.



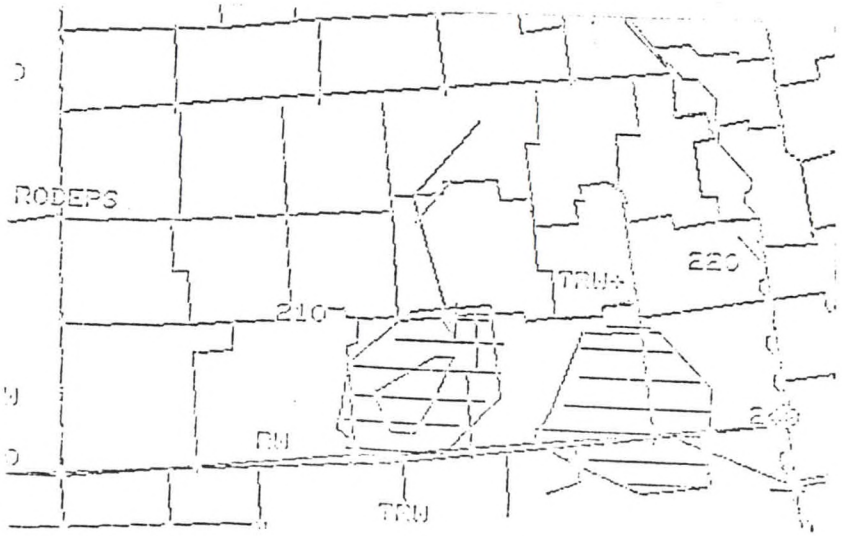
a

Fig. 6a Kansas radar summary, July 26, 1988 at 3:35 p.m. CDT.



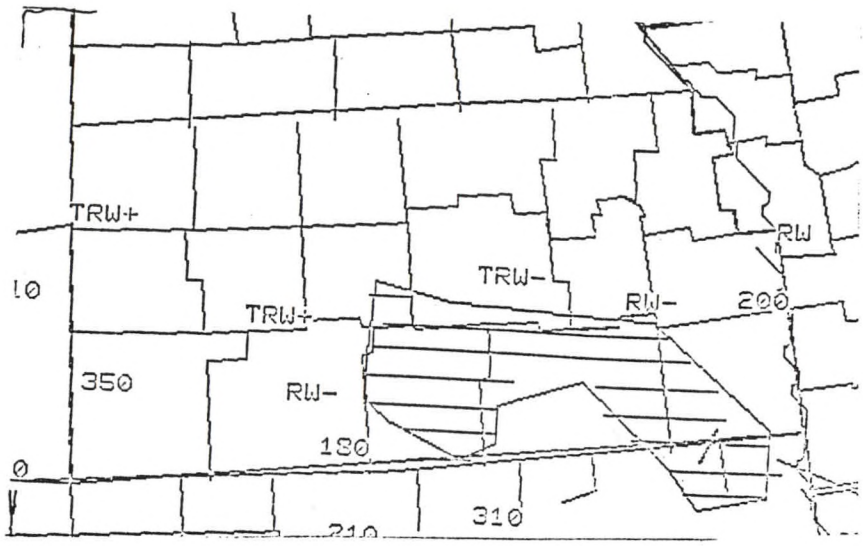
b

Fig. 6b Kansas radar summary, July 26, 1988 at 4:35 p.m. CDT.



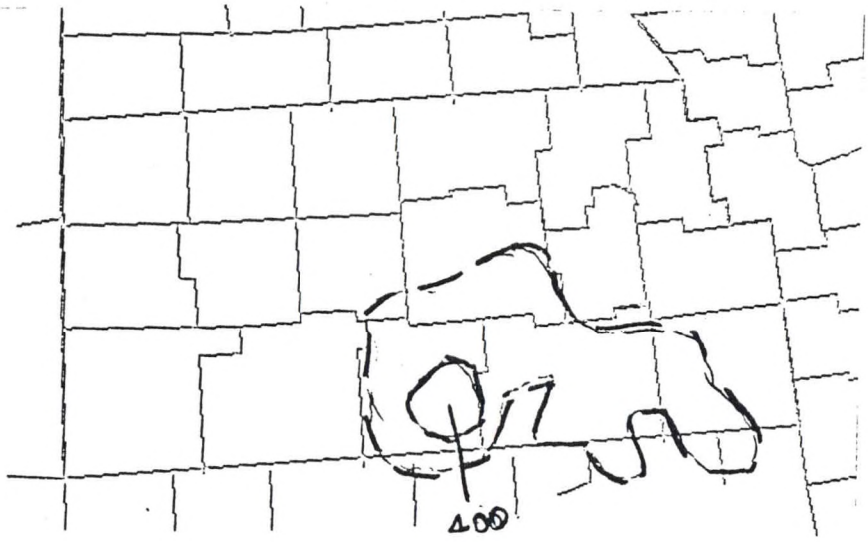
c

Fig. 6c Kansas radar summary, July 26, 1988 at 5:35 p.m. CDT.



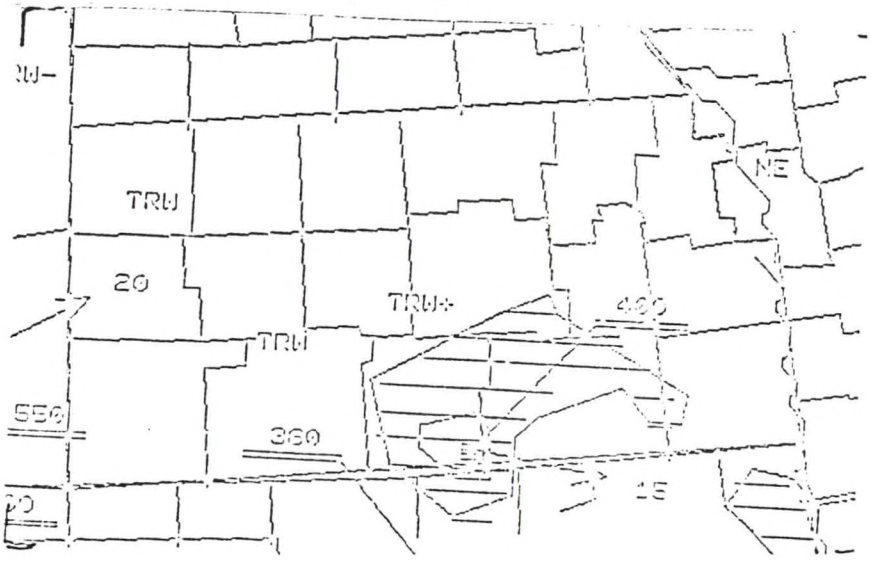
d

Fig. 6d Kansas radar summary, July 26, 1988 at 6:35 p.m. CDT.



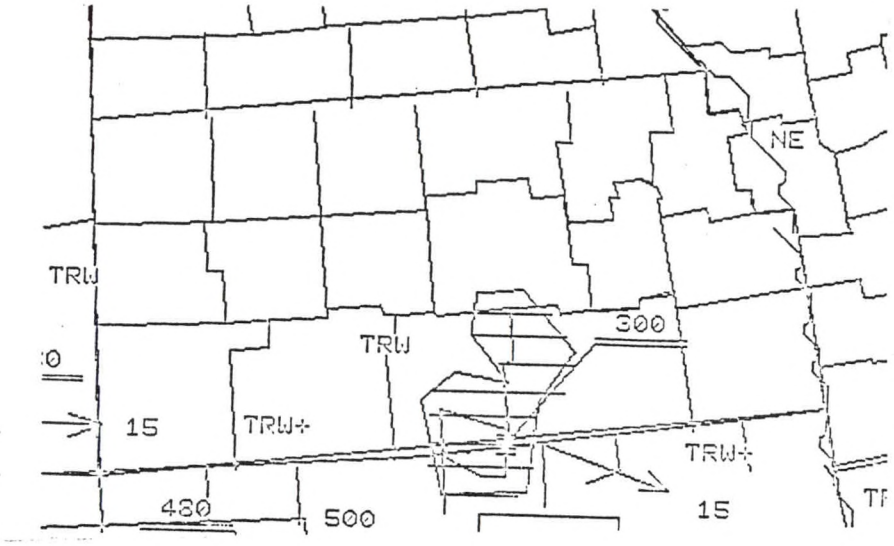
e

Fig. 6e Kansas radar summary, July 26, 1988 at 7:35 p.m. CDT.



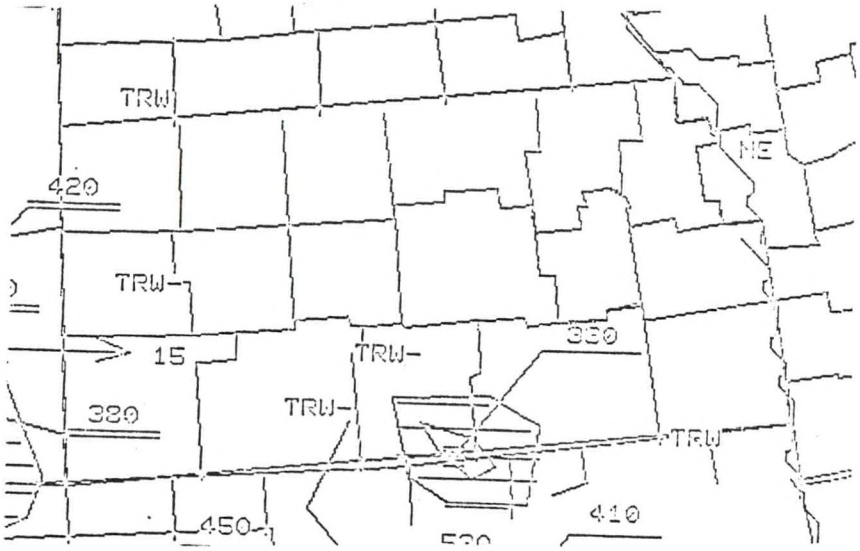
f

Fig. 6f Kansas radar summary, July 26, 1988 at 8:35 p.m. CDT.



g

Fig. 6g Kansas radar summary, July 26, 1988 at 9:35 p.m. CDT.



h

Fig. 6h Kansas radar summary, July 26, 1988 at 10:35 p.m. CDT.

i

Fig. 6i Kansas radar summary, July 26, 1988 at 11:35 p.m. CDT.

j

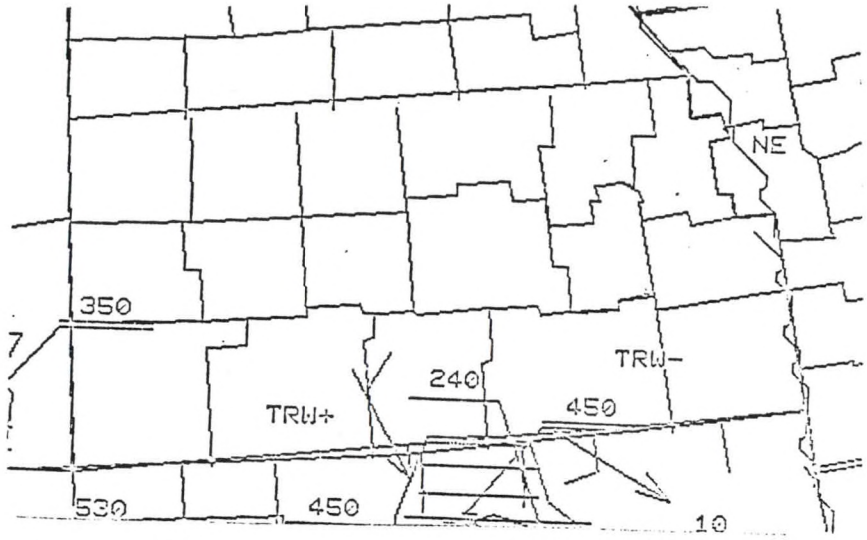


Fig. 6j Kansas radar summary, July 26, 1988 at 12:35 a.m. CDT.

k

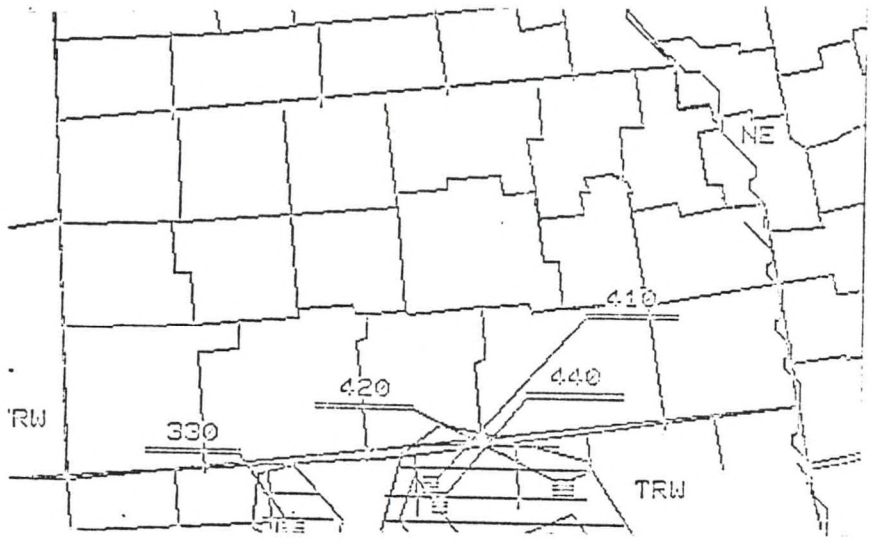


Fig. 6k Kansas radar summary, July 26, 1988 at 1:35 a.m. CDT.

Fig. 7 Detailed geographic map of Wichita, Kansas area.

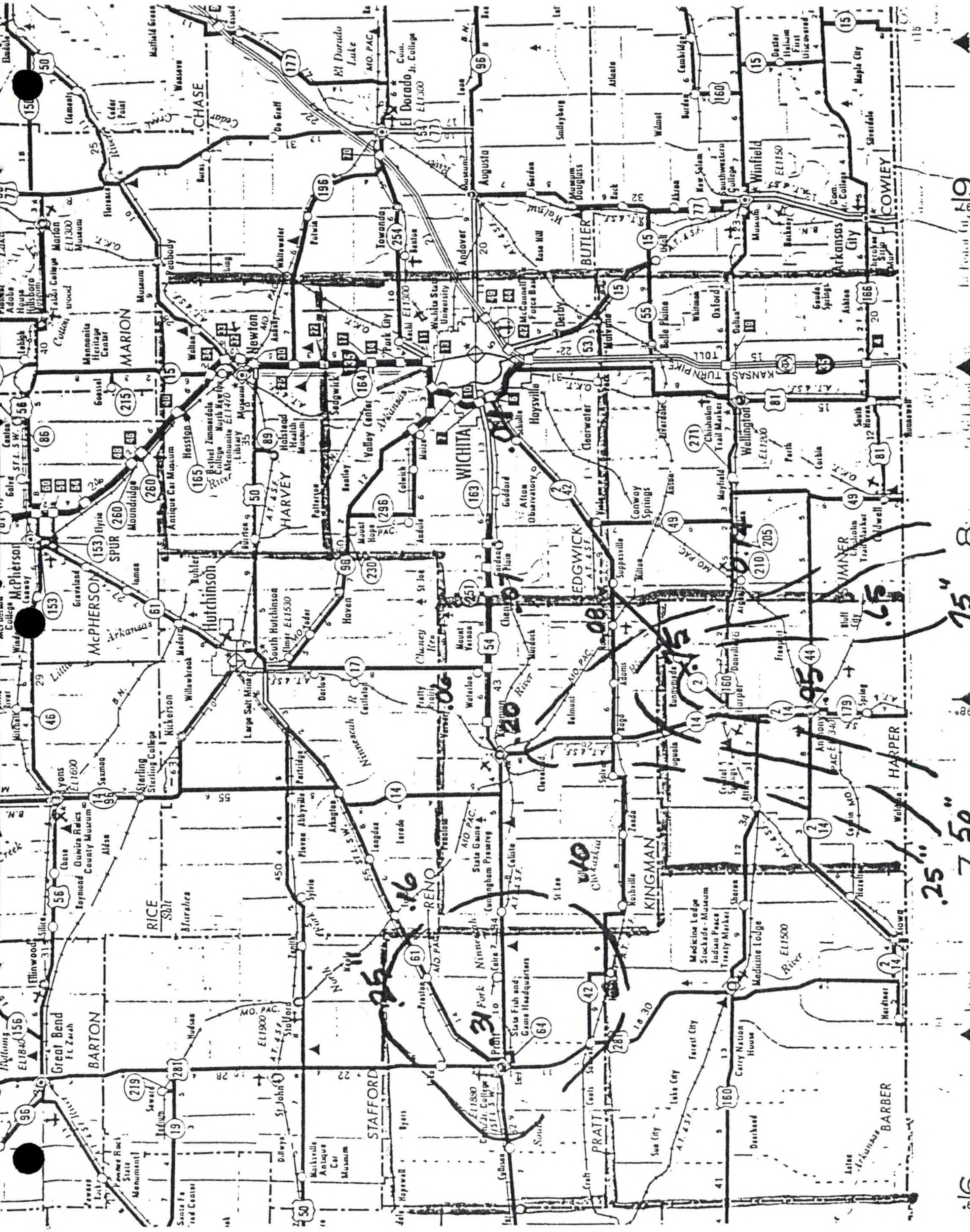


Fig. 8 24 Hour rainfall totals for Wichita, Kansas area.

Overall, when considering the total areas of zones 9 and 12, the forecast of scattered thunderstorms and showers was a good one. Once the event was defined, special statements following the VIP 3 storm would come from WSO Wichita. Utilizing Figure 9 as a MOFS score sheet guideline and considering the total state zone forecast for tonight, a score of 6-7 (i.e., good) would be appropriate.

This specific case, is but one event covering one 12-hour period for one set of zone forecasts. The payoff on an active station program of MOFS comes when skill measurements are kept over a long period of time so trends and strengths or weaknesses can be ascertained. This should be done for many products.

As we move toward the 1990's, it is most important that we start getting down to more detailed diagnosis, prognosis, and MOFS if we are to fully utilize the new technology to prepare warnings and forecasts. There is presently a lot of data in the system to use in MOFS, and AFOS graphics can assist us in this kind of work. Time is a consideration but not a constraint. I believe the payoff for this kind of work is well worth the effort. There's a lot of information available to improve diagnosis, prognosis, and do MOFS. We need to start now.

SCORE		SUBJECTIVE EXPLANATION
8-9	EXCELLENT	All forecasted parameters verified well. Time changes accurate. Forecast information very useful to public for planning purposes, outdoor activities, etc.
6-7	GOOD	Majority of forecast parameters verified well. Time changes verified pretty good although one or two off slightly. Forecast contained useful information to public even though not perfectly accurate.
4-5	FAIR	About half of forecasted parameters verified well. Time changes forecasted correctly about 50 percent. Forecast has some use to the public, but also contains some misinformation about expected weather.
2-3	POOR	Most parameters did not verify well. Time changes mostly in error. Usefulness of forecast to public questionable.
0-1	USELESS	All parameters considerably in error. Forecast did not verify. Time changes in error. Forecasted information of little or no use to public.

PARAMETERS TO BE CONSIDERED IN SCORING FORECAST

1. Precipitation
2. Clouds
3. Temperature
4. Wind

OTHER FACTORS TO BE CONSIDERED

1. Were significant changes well forecasted?
2. Was there major changes across forecast periods?
3. Were word qualifiers appropriate and accurate in the forecast?
4. Did time duration of the forecasted events verify well?

Fig. 9 MOFS score sheet.