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OCTOBER 1988

CENTRAL REGION TECHNICAL ATTACHMENT 88-37

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FLASH FLOOD OF JUNE 30, 1988

14 OCT 1988

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## 1. Introduction

On the night of June 29-30, 1988, very heavy rainfall in southwest Douglas County created flash flood conditions on Washington Creek and extensively damaged the small town of Lone Star. Over 12 inches of rainfall in the Lone Star area contributed to the flash flooding which began around 3:45 a.m. CDT (0845 GMT) on the morning of the 30th.

The purpose of this paper is to compare the measured rainfall with RADAP and satellite rainfall estimates. The 24-hour rainfall ending at 7:00 a.m. CDT on the 30th, as reported to the National Weather Service Forecast Office at Topeka, Kansas, is shown in Figure 1. Rainfall in excess of eight inches was measured in southern Douglas, northeast Osage, and southeast Shawnee Counties. A maximum rainfall of 12.21 inches was reported at Worden in southern Douglas County. An axis of four inches or more of rainfall ran northwest from the eight inch maximum, across western Shawnee County, into south central Pottawatomie County.

## 2. 24-Hour Rainfall

RADAP 24-hour accumulated rainfall for the period 1200 GMT June 29th through 1200 GMT June 30th is shown in Figures 2 and 3. The only difference between these two figures is the contour interval on rainfall accumulation. Figure 2 depicts rainfall to the nearest one-half inch, while Figure 3 uses a one-inch interval.

The axis of heaviest rainfall in both figures as defined by the four inch contour extends from central Pottawatomie County to southwest Douglas County. A large area of eight inches or more is seen in northeast Osage County and southwest Douglas County. The maximum rainfall in Figure 2 is 11.50 inches (N) in northeast Osage County, and 12 inches (C) in the same location on Figure 3. These values imply a maximum RADAP rainfall between 11.50 and 11.75 inches. Several local maximums in the 7.50 to 7.75 inch range are shown from near Wamego in south central Pottawatomie County along a line to southwest Shawnee County.

Comparison with the measured rainfall (Figure 1) shows quite a variation. Along the northwest half of the rainfall pattern, measured rainfall maximums



10T AVERAGE ACCUMULATED RAINFALL MAP  
1200Z, JUN 29, 1988 TO 1200Z, JUN 30, 1988

CODE VALUE	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
RAIN(100TH IN)	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750

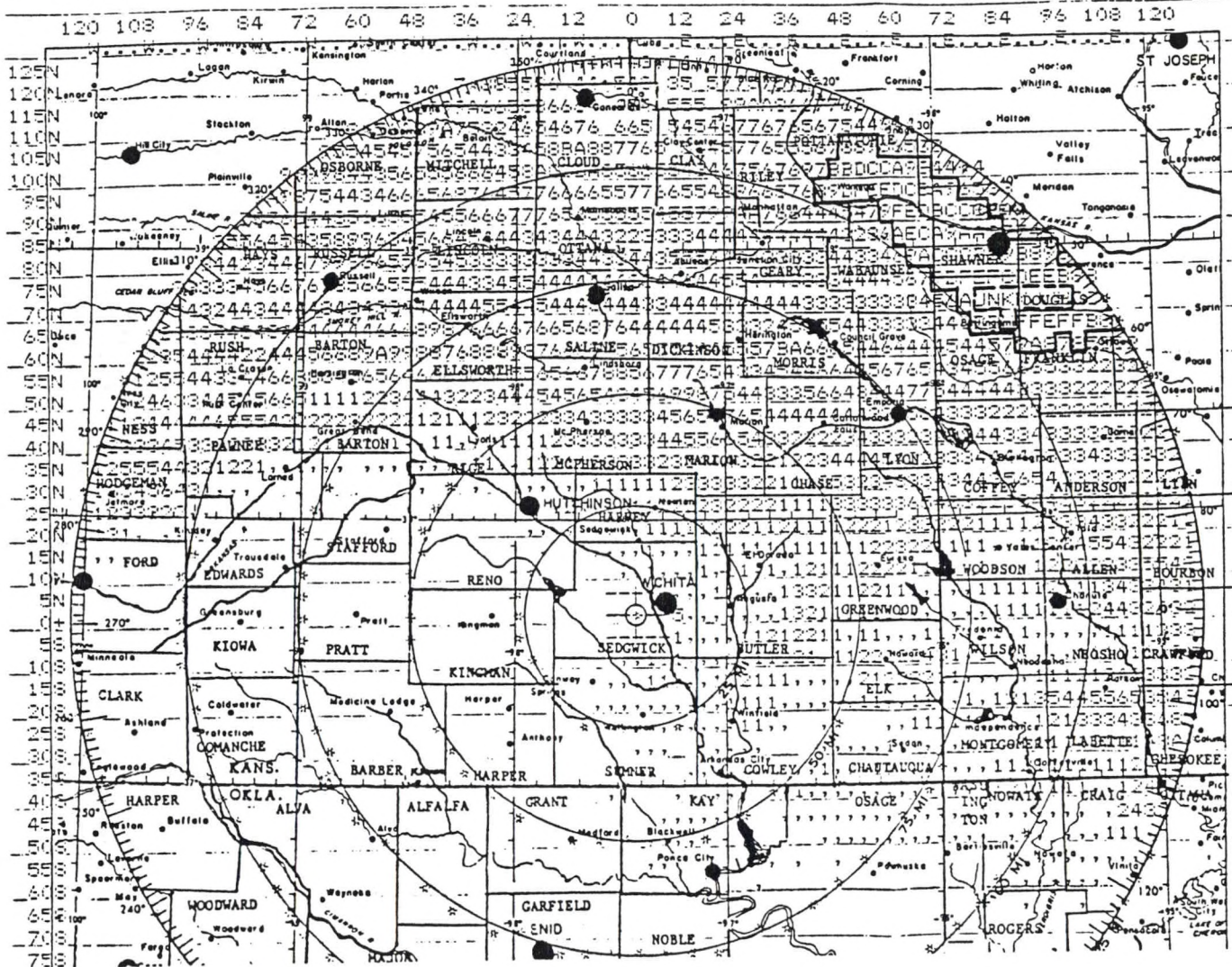


Figure 2 RADAP 24 hour accumulated rainfall. Contour interval is .5 inches. Bold solid line encompasses four inches or greater. Bold dashed line encompasses eight inches or greater. Maximum 24 hour amount 11.5 inches (contour label N).

CODE VALUE 1 2 3 4 5 6 7 8 9 A B C D E F  
RAIN(100TH IN) 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500

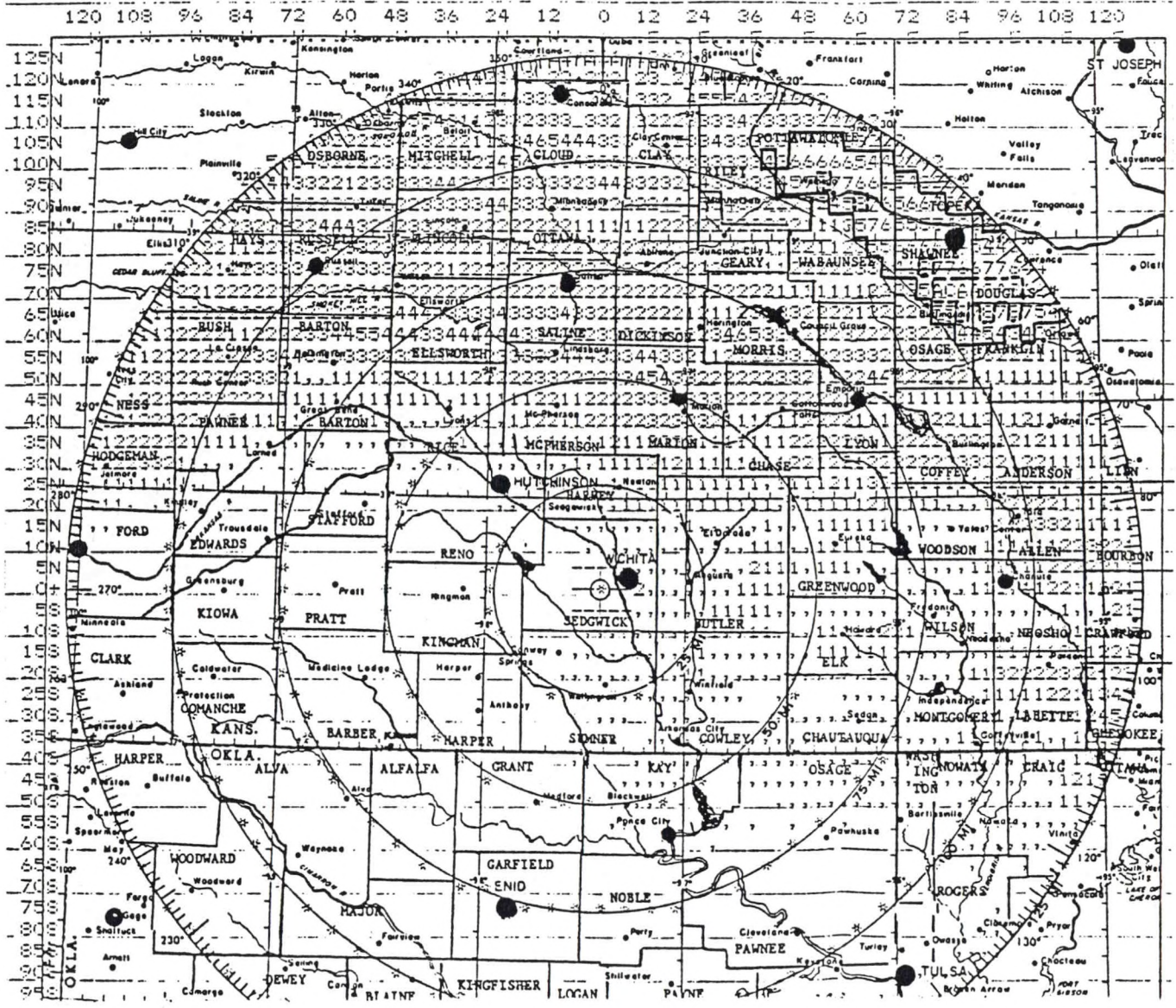


Figure 3 Same as Figure 2 except contour interval is one inch and maximum amount is 12 inches (contour label C).

ranged from 4 1/2 inches to 5 1/3 inches. This is two to three inches less than indicated by RADAP. On the other hand, the 12.21 inches at Worden in southern Douglas County was underestimated. The RADAP maximum of 11.50 to 11.75 inches was fairly close to the Overbrook observation of 8.72 inches.

The overall conclusion based on the above comparison is:

1. The pattern of heavy rainfall was well located and focused attention on the northeast Osage and southwest Douglas County areas.
2. RADAP generally overestimated rainfall amount and the area covered by the four inch contour.
3. The peak measured rainfall was underestimated.

Although not highlighted in Figures 2 and 3, four inch or heavier rainfall totals were scattered across the entire northern portion of the chart. Except for a small area just west of Concordia in Cloud County, the four inch RADAP values were all overestimated.

### 3. Three-Hourly Rainfall

The three-hourly RADAP accumulated rainfall amounts for 03 GMT to 06 GMT, 06 GMT to 09 GMT, and 09 GMT to 12 GMT are shown in Figures 4, 5, and 6, respectively. Rainfall totals in excess of 1.50 inch and three inch are highlighted.

Two features should be noted. First, three-hourly rainfall in excess of three inches are common. A few locations, particularly on the 03-06 GMT chart showed question marks (?), implying three-hourly rainfall in excess of 3.75 inches. Second, the rainfall maximum over north central Kansas moves from the 03-06 GMT chart to the 06-09 GMT chart. However, the maximum over northeast Kansas remains stationary. The rainfall on the 09-12 GMT chart was light compared to the two earlier charts.

### 4. Satellite Estimates

Estimates of rainfall based on satellite imagery interpretation techniques were received from the Synoptic Analysis Branch/NESDIS from 0435 GMT to 0840 GMT on the 30th. The 0635 GMT and 0840 GMT messages are shown in Figure 7.

The estimates for the 02-08 GMT period (0840 GMT message) show four to 4.7 inches in Pottawatomie and Shawnee Counties. These estimates are fairly good. Measured rainfall ranged from 4.10 inches in southwest Shawnee County to 5.30 inches in south central Pottawatomie County.

A glaring omission is the absence of estimates over Osage or Douglas Counties!

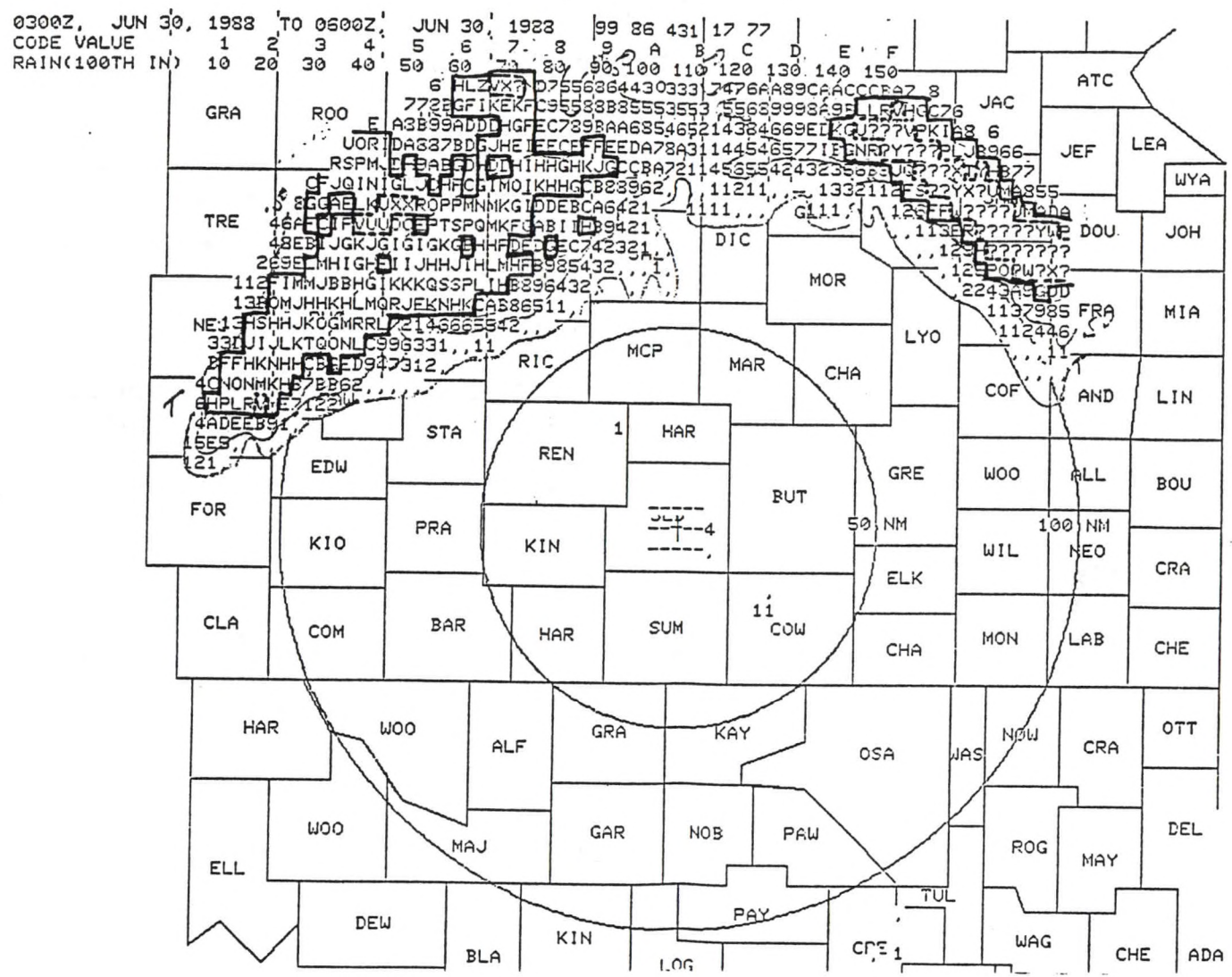


Figure 4 RADAP three hour accumulated rainfall for 03 to 06 GMT. Bold solid line encompasses 1.5 inches or greater and bold dashed line encompasses three inches or greater. (?) Indicates greater than 3.75 inches.

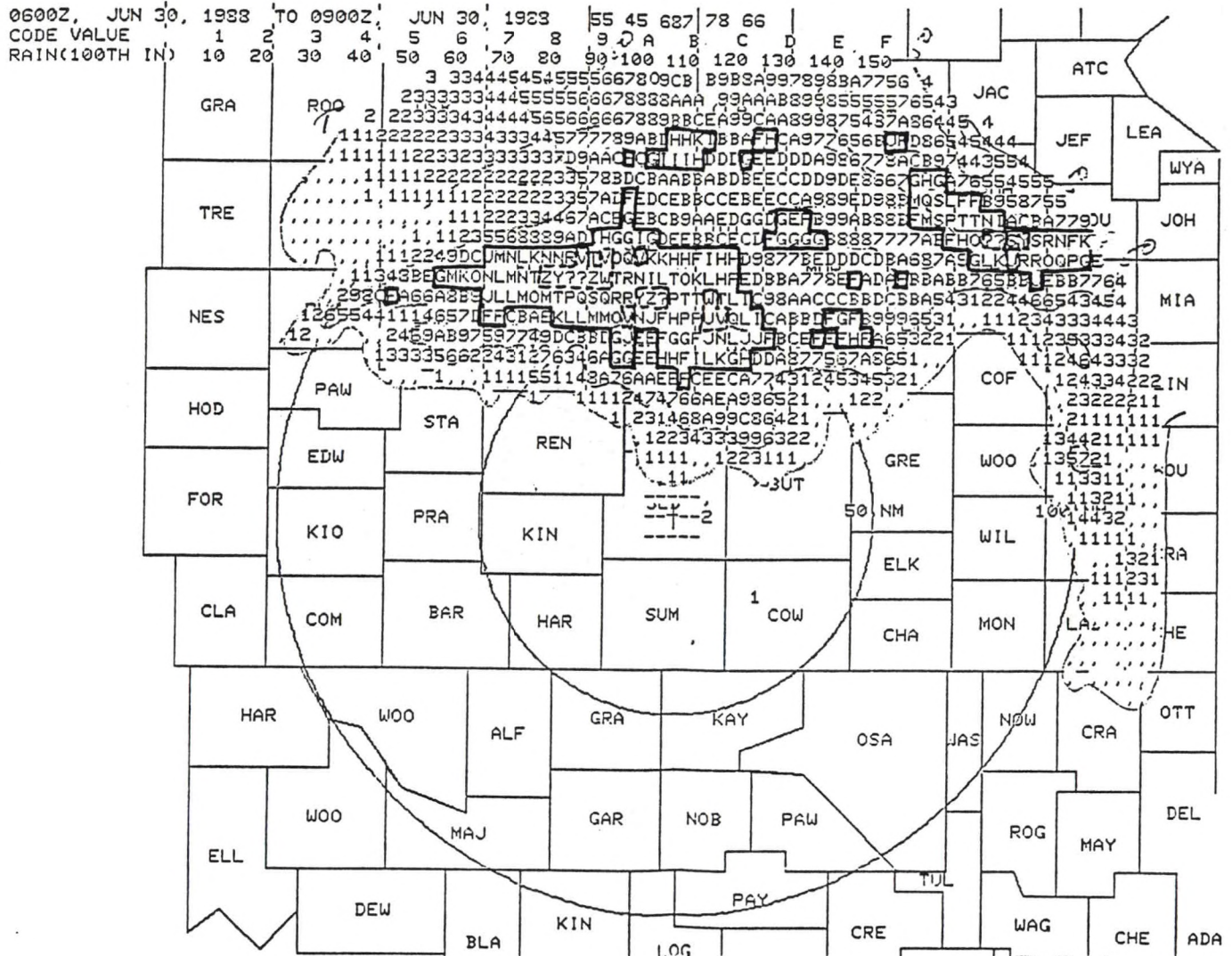
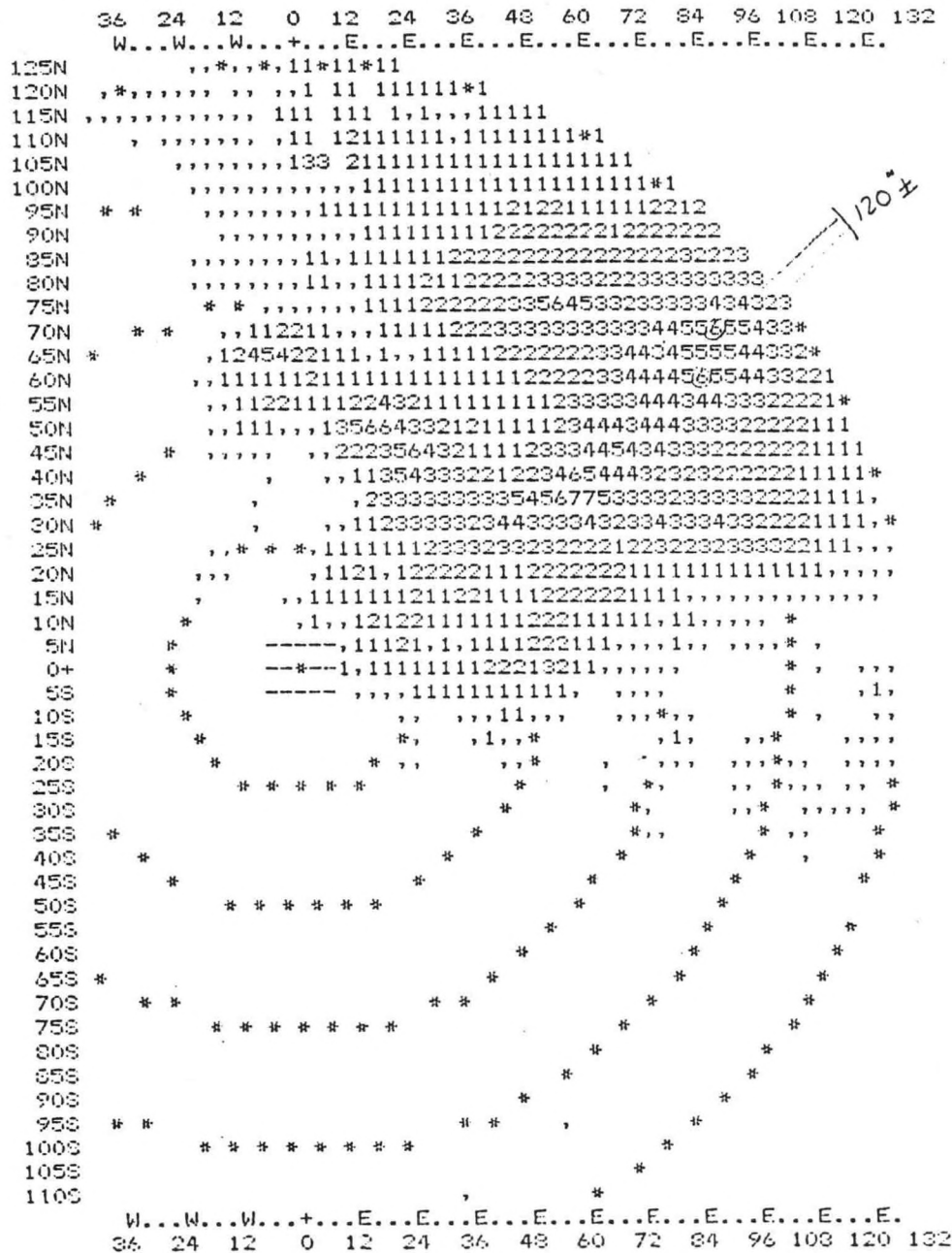


Figure 5 Same as Figure 4 except for time period 06 to 09 GMT.

ICT AVERAGE ACCUMULATED RAINFALL MAP  
0900Z, JUN 30, 1988 TO 1200Z, JUN 30, 1988

CODE VALUE 1 2 3 4 5 6 7 8 9 A B C D E F  
RAIN(100TH IN) 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300



MISSING PERIODS: 0930-1020

Figure 6 Same as Figure 4 except for time period 09 to 12 GMT. Maximum amount is 1.20 inches.



NFDSPENES  
 SATELL KNFD 300645

410,0990;410,0965;390,0965;390,0990

SATELLITE PRECIP ESTIMATES... DATE/TIME 6/30/88 0635Z  
 PREPARED BY THE SYNOPTIC ANALYSIS BRANCH/NESDIS TEL. 763-8444  
 VALUES REFLECT MAX OR SGFNT ESTS. OROGRAPHIC EFFECTS NOT ACCTD FOR.  
 REFER TO TPB#375 FOR DTLs. LATEST DATA USED: 0600Z TWF

LOCATION	2 HR TOTALS	4 HR TOTALS	REMARKS
N/NE KS CNTIES...	04-06Z	02-06Z	CMLX OVR NE KS IS
NW SHAWNEE	1.8"	3.9" (SHAWNEE)	SLOLY WRMG BUT AS
SE POTTAWATOMIE	1.9"	4.1"	CELLS APPROACH FM
WASHINGTON	2.1"	3.1" (S WASH.)	NW, THIS CUD BRING
JEWELL	2.9"	3.4"	MORE CNVCTN INTO
MITCHELL	2.7"	3.3"	NE KS IN A CPLE HRS.
E OSBORNE	2.5"	3.7" (NE OSB.)	
S SMITH		3.5"	VRY INTNS LINE
S NE CNTIES...			(XTRMLY CD TPS OF
THAYER	2.2"		-78 TO -79 C) MVG
HUCKOLLS		3.6"	E/SE THRU N/CNTRL
			KS WL CAUSE XTRMLY
			HVY RAFL IN ITS PATH.

PAGE 01

:410,0990;410,0965;390,0965;390,0990:SATELL KNFD 300853

SATELLITE PRECIP ESTIMATES... DATE/TIME 6/30/88 0840Z  
 PREPARED BY THE SYNOPTIC ANALYSIS BRANCH/NESDIS TEL. 763-8444  
 VALUES REFLECT MAX OR SGFNT ESTS. OROGRAPHIC EFFECTS NOT ACCTD FOR.  
 REFER TO TPB#375 FOR DTLs. LATEST DATA USED: 0830Z TWF

LOCATION	2 HR TOTALS	6 HR TOTALS	REMARKS
KS CNTIES...	06-08Z	02-08Z	
CLAY	3.2"	3.7" (S CLAY)	MRGR RESULTED IN A
WASHINGTON	2.7"	4.5-5.4"	RARE -80 C TP OVR
S REPUBLIC/CLOUD	2.1-2.6"	3.9" (REPUB.)	CLAY CNTY AT 0730Z.
LINCOLN	2.5-2.9"	3.8-4.4"	VRY INTNS LINE MVG
ELLSWORTH/N DICKERSON	2.4"		E/SE...HWEVR...
SALINE	2.5"	2.9"	0830Z IMAGE SHWD
N POTTAWATOMIE	1.1"	4.7" (E POTT.)	THAT CDST TPS IN
SHAWNEE		4.0-4.7"	THIS LINE WRMD
S NE CNTIES...			SLIGHTLY FM 08Z
W JEFFERSON/E THAYER	3.0-3.5"	5.5"	INDICATING THAT IT
			MAY BE BGNG TO WKN.
			ANTHR CELL BHND LINE
			MVG E THRU LINCOLN &
			SALINE AT 08 & 0830Z.

Figure 7 Estimates of rainfall based on satellite imager interpretation.

5. Conclusion

Based on this one case, it can be concluded that:

1. In areas where echoes persist, RADAP gives a fairly good indication of relative rainfall amount. That is, the orientation of the rainfall axis and location of the maximum rainfall will be very close to the corresponding measured rainfall pattern.
2. RADAP accumulated rainfall amounts and areal coverage of the heavier values will, in general, be overestimated.

An attempt to correlate the RADAP rainfall values to one or two surface rainfall measurements may distort operational usefulness of the product. For example, Figure 2 implies approximately seven inches of rainfall at WSFO Topeka. The actual measurement was 2.93 inches. If the 2.93 inches is used to proportionally reduce the remainder of the pattern, the maximum rainfall estimated by RADAP would come out less than five inches. Obviously, this would be an over-correction in the vicinity of the maximum on the Osage-Douglas County line.

The general conclusion on RADAP rainfall estimates as shown by this one case is that they should be used qualitatively, not quantitatively.