CENTRAL REGION TECHNICAL ATTACHMENT 95-19

RESULTS FROM THE GOODLAND WSR-88D PRECIPITATION ESTIMATES IN DETERMINING THE FLOOD POTENTIAL ACROSS PARTS OF NORTHWEST KANSAS DURING MAY OF 1995.

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1. Introduction

May of 1995 was the third wettest May on record at the National Weather Service Office (NWSO) Goodland (GLD), Kansas. Total precipitation collected at the Weather Service Office was 4.87 inches, and this was 1.38 inches above average for May. The entire County Warning Area of the NWSO experienced above normal precipitation during this month with some totals exceeding 12 inches over the far eastern parts of the area. Many areas received as much as 75 percent of their annual precipitation from late April through May.

Hydrologic conditions across northwest Kansas, during May 1995, responded to the excessive rainfall. Subsoils were saturated and runoff into local rivers and creeks occurred almost immediately with any rainfall event. The highest water levels indicated by river gages and reported by river observers was noted east of Goodland and Colby, although standing water was common in nearly every farm field and low-lying area during the month. The River Forecast Center (RFC) river models also showed wet soil conditions by producing low flash flood guidance values across the area.

This study examined the accuracy of the WSR-88D (KGLD) rainfall estimates in hydrologically active areas during the middle to late May using the Storm Total Precipitation Product (STP) data and reports from local cooperative observers across northwest Kansas. The data collected contains both the cooperative (COOP) rainfall totals and STP estimates for up to 24 hours with each case ending around 1200 UTC (the time that most of the GLD observers transmit their accumulative rainfall reports).

With the limited gage data support (non-cooperative observations) that will be utilized in the Precipitation Processing Subsystem (PPS) of the radar, it is important that the WSR-88D serves as a reliable diagnostic tool for precipita-

tion detection and accumulation, especially during possible flood situations. Shown below, the KGLD radar has proven to be dependable during most instances for diagnosing precipitation amounts.

2. Cases and Results

As with many other NWSO's with the WSR-88D, the STP is a commonly viewed Principal User Processor (PUP) product at NWSO GLD. The Storm Total accumulation is updated every volume scan when precipitation is detected within radar range. The 88D samples a volume of the atmosphere and provides areal estimates of precipitation. On the other hand, rain gage data taken from the field provides point source measurements of precipitation. For the purposes of this project, rain gages distributed over northwest Kansas combined to compute Mean Areal Precipitation (MAP). This was done by using the simple Arithmetic Method of computing MAP (Linsley et al. 1975). It was common to see that results from these two sources were not the same for every given case.

Many rainfall events from late April into early May led to saturation of the soils across the Goodland Hydrological Services Area (HSA). Additional rain through late May would cause concerns for flooding in some river basins.

A. Case 1

From May 16 to the morning of May 17 the KGLD STP product indicated generally 1.5 to 2.5 inches of rain over sections of Logan, Gove, and southern Thomas Counties of northwest Kansas (Figure 1). Rain gages in this area computed a MAP of .80 inches in 24 hours. Only one COOP station exceeded a total of 1 inch. The difference was approximately 250 percent, or about 1.2 inches if the radar estimates were averaged. Based on this difference and from other reports received during the event, no advisories or warnings were issued. Regardless, the KGLD STP estimates alerted the radar operator to the situation that led some rivers to rise to levels that had not been reached for sometime.

B. Case 2

The second case, ending the morning of May 22, the STP estimated .5 to 1.0 inches of rain over Thomas and Sheridan Counties (not shown). MAP amounts produced by 5 COOP gage stations in the area were .75 inches, and very small differences resulted from the radar/gage computations.

Rainfall amounts on the morning of May 22 were not very large, yet they were enough to create additional runoff into the local rivers and creeks that were previously affected by sudden rises and high flows. As it turned out, flood advisories were issued for five northwest Kansas counties including Thomas, Sheridan, and Graham from late on the 22 to the following morning due to more

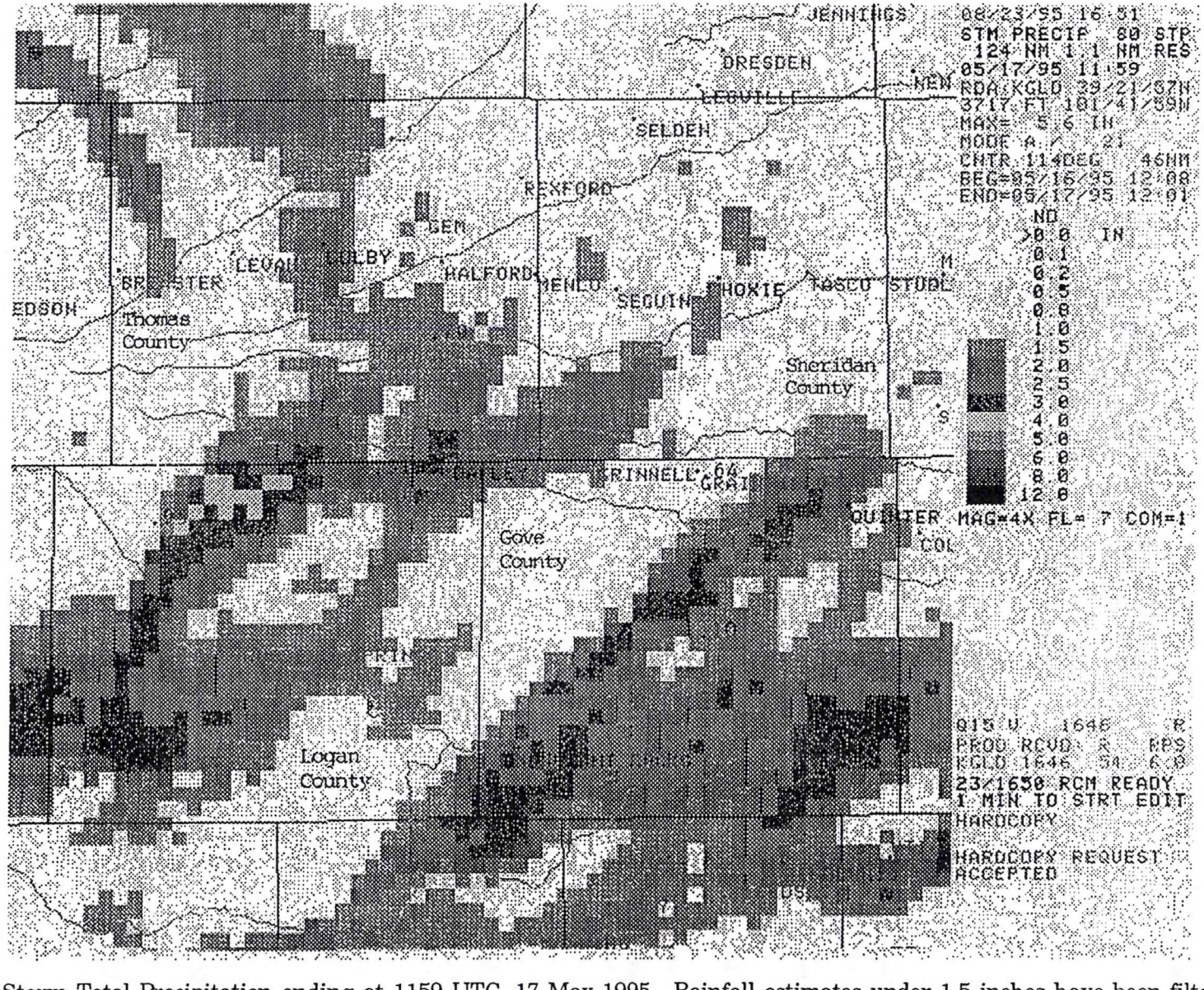

Figure 1. Storm Total Precipitation ending at 1159 UTC, 17 May 1995. Rainfall estimates under 1.5 inches have been filtered out for clarity of the product. Actual COOP rainfall reports have also been added to this product.

showers and thunderstorms. This activity, combined with the earlier rains detected by radar, enhanced the threat of flooding.

C. Case 3

The final case was a rainfall event that occurred over the far eastern counties of the Goodland HSA. Rain gage stations in Norton and Graham Counties on the morning of May 27 indicated average rainfall of 2.7 inches. In fact, all gages collected more than 2 inches. The STP ranged between 1.5 and 2.5 inches as shown in Figure 2. This time the difference was about .7 inches if the radar estimates were averaged and compared to the MAP.

Based on the KGLD precipitation estimates early May 27, NWSO GLD issued flood warnings for parts of Norton and Graham Counties where numerous creeks and rivers were flooding. Water levels remained at or above bankfull along sections of the South Fork Solomon River in Graham County through the day. Two small bridges were washed out in southeast Norton County with estimated damage costs of 7,000 dollars.

3. Conclusion

Although the KGLD STP product did not match the gage amounts each time, it did give a good areal representation of precipitation for the flood prone river basins of northwest Kansas. Considering the hydrologic conditions at the time, the radar detected rainfall data necessary for forecasting several river stages and the more significant flooding toward the end of May. In situations where flooding was a threat, the KGLD radar provided valuable precipitation amount information that was utilized for flood advisory and warning situations at NWSO GLD.

Currently, the WSR-88D PPS generates a 2x2 km grid for display with 16 data levels. Precipitation product thresholds can be adjusted to improve the utility of the data levels. Future software build changes, including higher resolution products, should more accurately pinpoint rainfall amounts with fewer adjustments. This will further increase the effectiveness of the Goodland HSA flood/flash flood warning program.

4. Acknowledgments

Special thanks goes to John Kwiatkowski, SOO at NWSO GLD, for his review and suggestions regarding this paper.

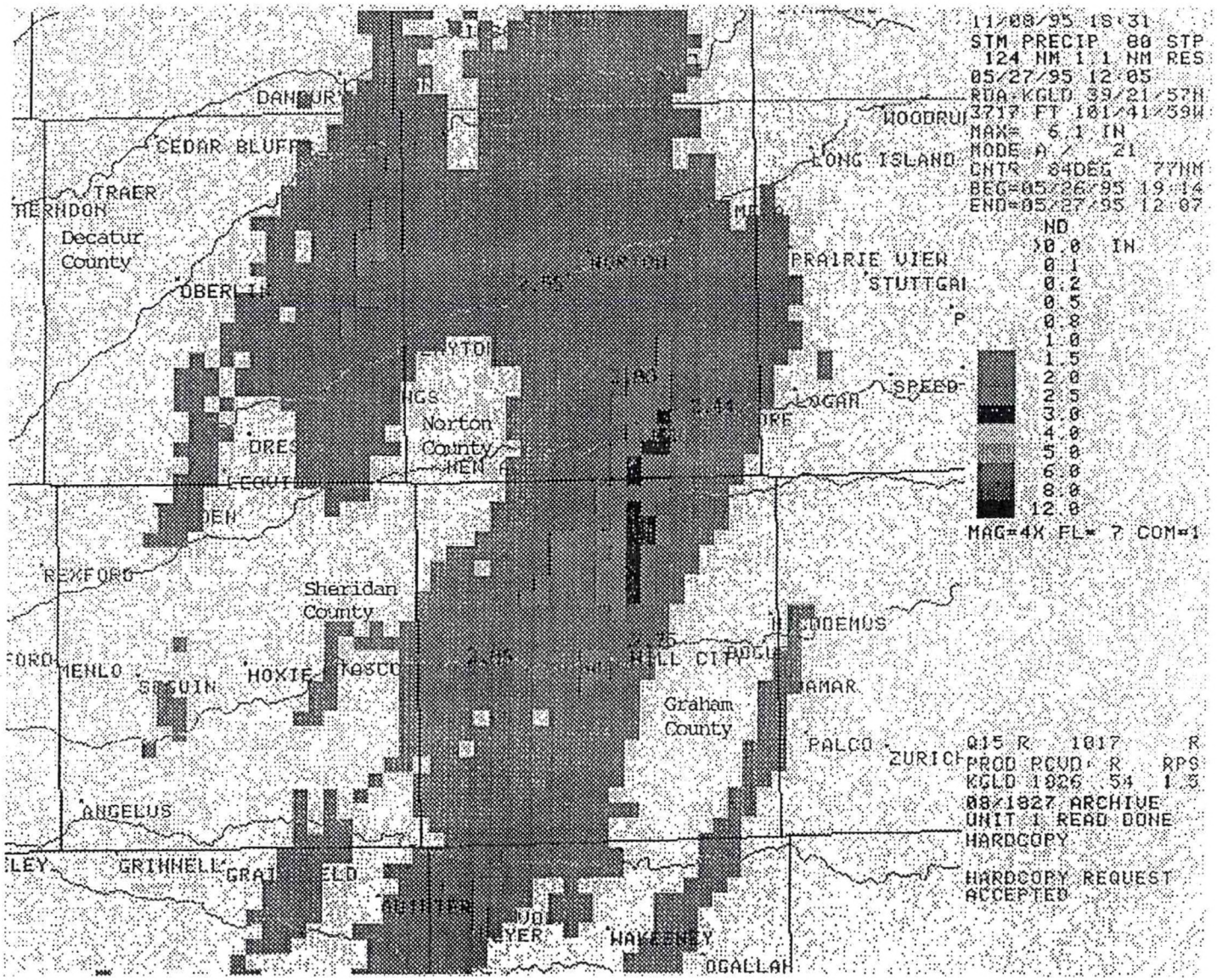

Figure 2. Same as Figure 1, but ending at 1205 UTC, 27 May 1995. The event caused flooding over parts of Norton and Graham Counties through May 27. Again, COOP rainfall reports are shown on this product.

5. References

Linsley, R. K., M. A. Kohler, and J. L. H. Paulhus, 1975: *Hydrology for Engineers*, McGraw/Hill, Inc., Second Edition, 482pp.