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A FIELD EVALUATION OF THE AFOS PLOTTING PROGRAM FOR MANUALLY DIGITIZED RADAR DATA

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1. INTRODUCTION

An operational field test of the plotting program for Manually Digitized Radar (MDR) data using the Automation of Field Operations and Services (AFOS) system was conducted for approximately 6 weeks at four sites in the Southern Region. The stations that participated consisted of two Weather Service Forecast Offices (WSFO's) and two Weather Service Office's (WSO's). The two WSFO's were Atlanta (ATL) and Jackson (JAN); the two WSO's were Athens (AHN) and Meridian (MEI).

The purpose of the field test was to determine if the AFOS plotting program for MDR data would perform as designed and to assess the impact of the software on station operations. Two additional objectives of the test were:

(1) to determine if the program is convenient to the user and does not make the task more time-consuming than before, and

(2) to determine if there are additional requirements that may be incorporated in an enhanced version.

For specific details of the field test plan and procedures, see National Weather Service (1984).

2. PROGRAM SOFTWARE DESCRIPTION

The MDR plot program will create two graphics each time it is run. One of the graphics consists of an array of MDR digits with each digit representing a single hour's MDR value for the grid square where it appears. The number of hours that will be plotted is determined by the user when the program is initiated. A maximum of 6 hours is allowed. A second graphic will depict the summed MDR values for each grid square for the selected number of hours. A 1-h selection will only produce one graphic.

Either of the two graphics may then be overlayed on a local map background. Local map backgrounds are state maps that give such features as county boundaries, rivers and lakes, watershed boundaries, and major highways and roadways. Fig. 1 depicts a local area map background with counties for the Atlanta forecast area.

The software that produces the two graphics is composed of two FORTRAN applications programs designed to run in the background partition of the AFOS Data General Eclipse S230 minicomputer. MDRCREAT and MDRPLT, both described in Newton (1984) are the installation and main program, respectively, that produce the graphical overlays. The first program, MDRCREAT, is an interactive program that is run only once, at program installation time. It defines for the main program, MDRPLT, which radar stations are to be plotted and their coordinates, the size of the rectangular area on which data are to be plotted, and the coordinates of the map background.

The program, MDRPLT, is the primary program for plotting MDR data on local map backgrounds. It is initiated each time a plot of MDR totals or array of MDR values is desired. When the program is initiated, the user may specify a month, day, ending time (hour), and the number of hours that should be plotted and summed. If any of the input parameters are omitted, the program defaults to the following:

Date:	Month	- Current
	Day	- Current
Time:	Hour	- Current if minute is after 35; otherwise, previous hour is used
Totals:	Total	- 1 hour

MDRPLT decodes the MDR section of the radar observations (ROB's) and transfers the data into the appropriate location of the MDR grid. The observation is searched through for any contractions that qualify the radar's operational performance. When contractions are found, they will be displayed in abbreviated form along with the corresponding radar station's call letters in the upper right hand corner on the MDR maps. They will appear only at zoom levels of 4:1 and above.

Graphical routines are called in to convert the coordinates of the MDR data from the MDR grid to the AFOS GDM. A single collective message containing all errors encountered decoding ROB's is generated after both graphical overlays have been stored in the AFOS database.

3. TEST DESCRIPTION

The field test was conducted officially at WSFO's ATL and JAN and WSO's AHN and MEI for the 6 week period between March 12 and April 21, 1984. Two other WSFO's participated in the test on an unofficial basis. They were WSFO Ft. Worth (FTW) and WSFO San Antonio (SAT). A field test plan (National Weather Service, 1984) was used at each of the official test sites.

For the duration of the test, the MDR plotting program was run on the public weather shift on an ad hoc basis as determined by weather conditions. All weather personnel who ran the MDR plot program were asked to fill out an evaluation form after the completion of the test. There were no restrictions placed on how the plotting program should be run during the test. The user had the option of executing the program within a procedure or initiating it manually.

TDL participated in the field test in the following manner. Station information files needed to run the MDR plot program were built for the ATL and JAN forecast areas. The weather situations for both offices were carefully monitored during the test period. Whenever a significant rain event affected any participating test site's area of responsibility, maps of MDR data were generated and checked with actual observations. This was done to allow rapid response to field questions if any problems occurred with the MDRPLT program.

4. SUMMARY OF RESULTS

Responses received from the field indicate that the MDR plot program is a useful tool in assessing heavy rainfall potential. The following comments, extracted from the responses, support this conclusion.

From WSFO Jackson:

"Even though we have not had as many flood/flash flood situations this spring as we have become accustomed to, we were able to test the MDRPLT program sufficiently to say that it is a good one and will be a big help in the future."

From WSO Meridian:

"We did not have any critical flooding situations during the test period, but it (MDRPLT) is a real time saver for a WSO with limited staff."

From WSFO Atlanta"

"This routine has been one of the few that really aid the operational person when help is actually needed. I've never seen so many forecasters agree on the utility of a program as I have seen in this case."

From WSO Athens:

"It is apparent that the MDR AFOS Program developed by Mary C. Newton has a wide range of users.... Most personnel were impressed with the graphics from the start.... The program is a good alerting system to potential flash flooding/flooding as is ...."

A summary of all responses to questions contained in the evaluation form is provided below. The questionnaire was designed to allow users of the MDR plot program an opportunity to comment not only on the program's utililty, but also on specific aspects of the program.

The numbers shown below correspond to the actual number of responses received except for WSFO ATL which submitted one summary questionnaire for all users. The call letters of the WSO or WSFO to which the responses apply are included as appropriate.

Question: Do you feel the MDR plotting program is a useful tool?

Response:

	MEI	JAN	AHN	ATL
Yes	5	7	9	√
No	0	0	0	

Question: Do you feel that the graphics are of an acceptable quality?

Response:

	MEI	JAN	AHN	ATL
Yes	5	7	9	✓
No	0	0	0	
Partially	0	0	0	

Question: If you routinely plot MDR data, did MDRPLT save you any time?

Response:

	MEI	JAN	AHN	ATL
Yes	5	7	9	
No	0	0	0	
Partially	0	0	0	
Do not routinely plot MDR data	5	3	6	✓

Question: Are there any changes you would like to see made in the program (e.g., method of running the program, station plotting model, information displayed, etc.)?

Response: Most users felt the present format was good. They recommended no change be made at this time.

Question: Are the two graphical displays (array and sum) necessary?

Response:

	MEI	JAN	AHN	ATL
Yes	6	5	8	✓
No	0	1	1	

There were two respondents who felt that the two graphs were not necessary. One felt that the array map was sufficient; the other felt the sum map was sufficient.

Question: Is a 6-h display of MDR values (i.e., six MDR digits plotted per grid square), the maximum allowed by the program, sufficient?

Response:

	MEI	JAN	AHN	ATL
Yes	4	7	6	✓
No	0	0	2	
Not sure	1			

Three respondents felt that a 6-h display of MDR digits was not sufficient. Two of them felt that a 12-h display would be useful; the other respondent was uncertain in his choice.

Question: Are MDR values being plotted in the correct geographical location?

Response: Most respondents felt that MDR values were being plotted in correct geographical locations.

Question: Is the legend displayed on the maps visible and does it accurately express what is needed?

Response:

	MEI	JAN	AHN	ATL
Yes	3	4	9	√
No	2	2	0	

Four respondents felt that the legend should be displayed at all zoom levels and should be enlarged.

Question: Do you feel the local map backgrounds are suitable for displaying MDR data?

Response: All stations felt that local map backgrounds were suitable for displaying MDR data. They felt the county map was the most useful.

Question: What is your overall impression of the local map background?

Response: All respondents felt the local map backgrounds were in the "good" category. One user commented that he would like to see additional terrain features such an mountains/hills/valleys.

5. CONCLUSIONS

The MDR plot program, MDRPLT, was used quite heavily during the 6-week test period. A series of slow-moving flood potential rainstorms occurred in the Southern Region during the period and provided a valuable source of data with which to test MDRPLT.

The program performed under operational conditions as designed and had minimal impact on WSFO/WSO operations. The program was not reported to have crashed AFOS during real-time use. However, this program, along with other applications programs, may have collectively contributed to system instability and overloads on AFOS during periods of heavy use.

The program was found to be convenient to the user and saved the operational forecaster/observer a great deal of time that he or she used in analyzing the current weather situation. One forecaster noted that MDRPLT alerted him to an area of rainfall in the state that he had otherwise overlooked.

Two program "bugs" were discovered during the tests. One problem dealt with the proper handling of radar specials; the other was the transition between

23Z and 00Z radar observations. These problems were identified and corrected very early during the test period.

The radar observation is composed of two major sections--the storm detection (SD) or first section and the digital section. The radar observation decoder, ROBDEC (Peroutka, 1983), does not decode the SD section. Instead it searches through it for two operational status contractions--PPINE (no echoes) or PPIOM (radar out for maintenance). If it does not find either of the two, it assumes that a digital radar section exists and proceeds to search for the "↑" which designates the start of MDR data. If the "↑" is missing, or hence no digital section exists, ROBDEC flags this observation as an error and moves on to the next radar report.

There are, however, a few radar reports that are not PPIOM or PPINE, and that legally don't carry a digital radar section. These are reports of echoes of weak intensity which cover less than 20 percent of each grid box. In this case, the digital part of the radar observation is properly omitted.

ROBDEC may eventually be modified by the programmer to correct the problem mentioned above. In the interim, however, MDRPLT was modified to display all error messages collectively at the completion of a run of MDRPLT. This not only reduces the number of AFOS alerts considered annoying by most operational personnel but also groups observational errors so they can be dealt with on a one-time basis. Handling the error messages in this manner also eliminates the harsh alert message "JOB ROBDEC ABORTED: ERROR CONDITION," previously used.

The overall consensus of the users (forecasters and observers) of MDRPLT was that it is a useful tool. However, an enhanced version of the program will become more useful. We received several recommendations for enhancements to the program. One recommendation was to link MDR plots to River Forecast Center flash flood guidance (FFG) in mapped form. The user would have the option of adjusting the FFG if necessary and selecting the action thresholds. The computer can then determine the critical MDR totals and continuously monitor the data during a forecast shift.

6. ACKNOWLEDGMENTS

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7. REFERENCES

National Weather Service, 1984: AFOS display of MDR data on local map backgrounds field test plan--March 1984. National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 5 pp. [Available from Techniques Development Laboratory, National Weather Service, Silver Spring, Md.]

Newton, M. C., 1984: AFOS display of MDR data on local map backgrounds NOAA Techniques Development Laboratory Computer Programs NWS TDL CP 84-1, National Weather Service, NOAA, U.S. Department of Commerce, 22 pp.

Peroutka, M. R., 1983: A decoder for manually digitized radar observations. NOAA Eastern Region Computer Programs and Problems NWS ERCP No. 13, National Weather Service, NOAA, U.S. Department of Commerce, 8 pp.

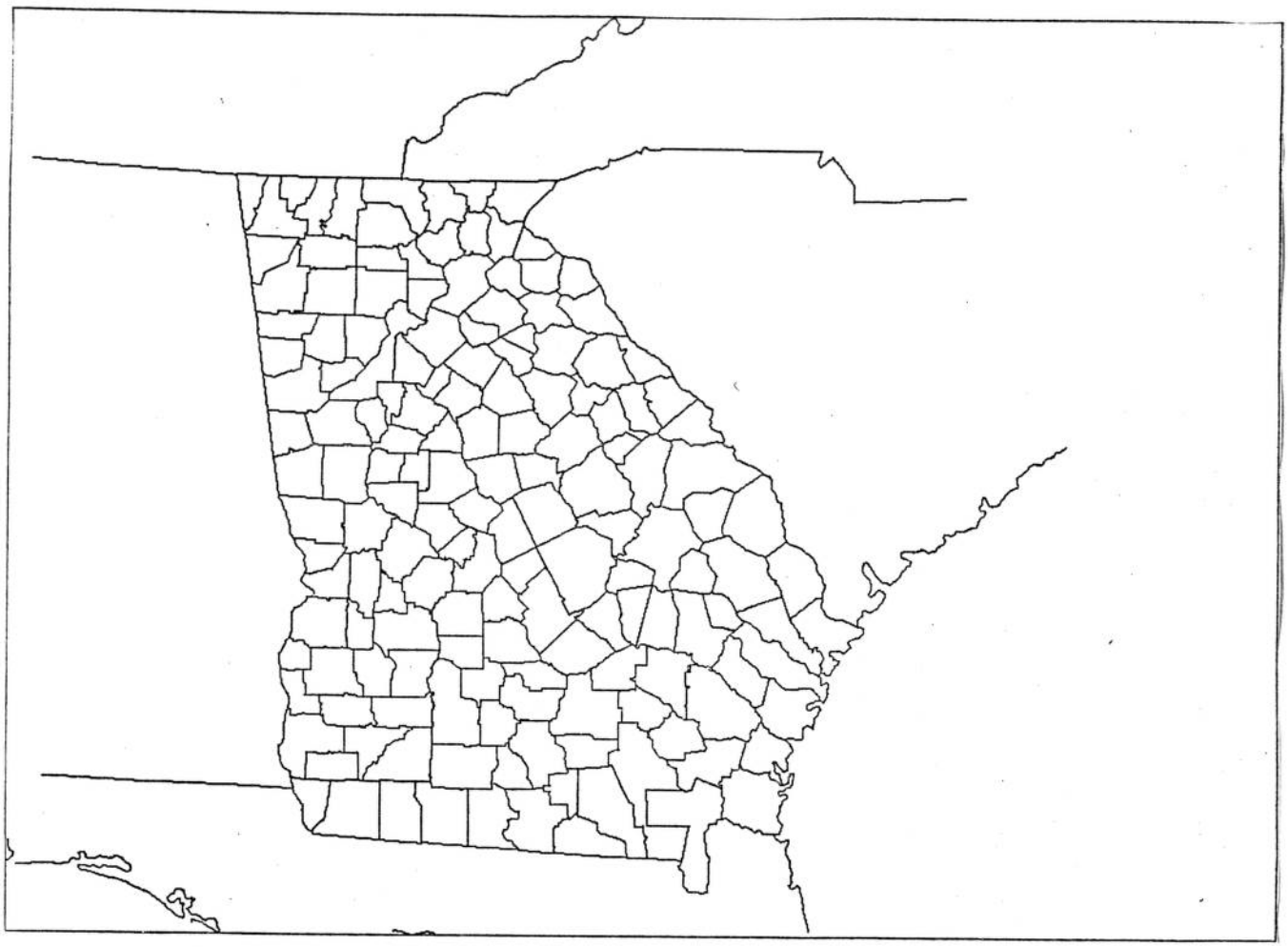

Figure 1. An example of a local map background depicting counties for the state of Georgia.