NOAA Techniques Development Laboratory
Computer Program NWS TDL CP 87-4

AFOS MONITORING OF MDR DATA USING FLASH FLOOD GUIDANCE

Silver Spring, Md.
October 1987

U.S. DEPARTMENT OF COMMERCE / National Oceanic and Atmospheric Administration / National Weather Service

PREFACE

The Techniques Development Laboratory's (TDL's) computer program (CP) series is a subset of TDL's technical memorandum series. The CP series documents computer programs written at TDL primarily for the Automation of Field Operations and Services (AFOS) computers.

The format for the series follows that given in the AFOS Handbook 5, Reference Handbook, Volume 6: Applications Programs, Part 1: Policy and Procedures, published by the Office of Technical Services/AFOS Operations Division.

NOAA Techniques Development Laboratory
Computer Program NWS TDL

CP 83-1 Cross Sectional Analysis of Wind Speed and Richardson Number. Gilhousen, Kemper, and Vercelli, May 1983. (PB83 205062)
CP 83-2 Simulation of Spilled Oil Behavior in Bays and Coastal Waters. Hess, October 1983. (PB84 122597)
CP 83-3 AFOS-Era Forecast Verification. Heffernan, Newton, and Miller, October 1983. (PB84 129303)
CP 83-4 AFOS Monitoring of Terminal Forecasts. Vercelli, December 1983.
CP 83-5 Generalized Exponential Markov (GEM) Updating Procedure for AFOS. Herrmann, December 1983.
CP 84-1 AFOS Display of MDR Data on Local Map Background. Newton, July 1984.
CP 84-2 AFOS Surface Observation Decoding. Perrotti, September 1984.
CP 84-3 AFOS-Era Forecast Verification. Miller, Heffernan, and Ruth, September 1984.
CP 85-1 AFOS Monitoring of Terminal Forecasts. Vercelli and Norman, May 1985.
CP 85-2 AFOS Terminal Forecast Decoding. Vercelli, Norman, and Heffernan, October 1985.
CP 85-3 AFOS-Era Forecast Verification. Ruth, Miller, and Heffernan, October 1985.
CP 87-1 AFOS Terminal Aerodrome Forecast Formatting. Wantz and Eggers, July 1987.
CP 87-2 AFOS-Era Forecast Verification. Ruth and Alex, July 1987.
CP 87-3 Forecast Review. Wolf, July 1987.

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UNITED STATES
DEPARTMENT OF COMMERCE
Secretary of Commerce

National Oceanic and
Atmospheric Administration
Anthony J. Calio, Under Secretary

National Weather Service
Richard E. Hallgren
Assistant Administrator

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1. INTRODUCTION

The Automation of Field Operations and Services (AFOS) applications program MDRPLT, distributed to the field by the Techniques Development Laboratory (TDL), plots Manually Digitized Radar (MDR) data on local map backgrounds (Newton, 1984). These plots can be displayed on AFOS Graphic Display Modules (GDM's) and can assist the forecaster in identifying significant rain areas. In an effort to provide additional information to the forecaster in flash flood situations, we have enhanced this system so that it will also automatically monitor 3-h MDR totals and alert the forecaster if these values meet or exceed forecaster-assigned thresholds.

This enhanced procedure, called AFOS Flash Flood Monitoring and Alerting (AFFMA), consists of two additional main applications programs, RDFFG and MDRWATCH. The first program, RDFFG, decodes the current 3-h flash flood guidance (FFG) bulletins produced by the River Forecast Center (RFC) and creates an alphanumeric guidance product which is then stored in the AFOS database. This preformatted product gives 3-h MDR values corresponding to probabilities of occurrence (30%, 50%, 70%, and 90%) of 3-h flash flood rainfall amounts. Also in the product are 3-h MDR action values (thresholds) for each zone within the forecaster's area of responsibility. The forecaster has the option to manually change these MDR threshold values. The second program, MDRWATCH, then compares the latest 3-h MDR totals to the corresponding action value for each zone. If one or more action values are met or exceeded, an AFOS product is created which contains the zone identifications. The forecaster is alerted by a console alarm when this product has been stored in the database.

In addition, MDRWATCH creates two graphic products each time it is run. The first consists of an array of MDR values where each value represents a single hour's MDR value for the grid square in which it appears. The second graphic is a 3-h MDR summation map. Both products can be displayed on the GDM and can be overlaid on the local map backgrounds developed by the Office of Hydrology.

2. METHODOLOGY OF SOFTWARE STRUCTURE

Both the FFG decoding program, RDFFG, and the MDR data monitoring program, MDRWATCH, read an RDOS data file which contains information about the area of responsibility for the WSFO or WSO running the AFFMA procedure. This file, FFG.D1, is created by RDFFG and is subsequently read by programs RDFFG, MDRWATCH, and the set-up program MDRCREAT. Both RDFFG and MDRCREAT must be run prior to the first run of MDRWATCH. If your zone configuration changes, program MDRZONES must be run once before MDRCREAT to set up the state data file (xx.D1, where xx is the state ID from Table 1) of MDR grid-to-zone values. It should be noted that MDRPLT may still be run under the new format of MDRFIL, the RDOS file created by MDRCREAT, since the changes do not affect the successful execution of MDRPLT (Newton, 1984). (The reader may want to review CP 84-1 for additional background information on the MDRPLT program.) Fig. 1 gives an overview of the data flow and program relationships for the AFFMA system.

A. Program RDFFG

RDFFG (Fig. 2) is the program which decodes the FFG (Fig. 3) and creates a forecaster guidance product. When RDFFG is run for the very first time, the user is asked to enter information concerning the zones in the states he/she wishes to monitor. The entered data are recorded in file FFG.D1. This is accomplished through a brief interactive session in the subroutine CHOICE.

The user may specify up to 2 RFC's and a total of 4 states. Each entry is error-checked to avoid having to restart the program in case of input error. A sample session is shown in Fig. 4. The forecaster must enter the number of RFC's to be used and the call letters (the ccc and xxx of cccFFGxxx) of each RFC whose flash flood guidance will be used. Then, the forecaster must enter the number of states to be monitored and a two-letter state ID for each state. A table of valid two-letter state ID's is given in Table 1. Finally, the zones to be monitored in each state are entered.

The flexibility of RDFFG program allows either a WSFO or a WSO to monitor any area by simply entering the appropriate information into file FFG.D1. The file may be changed by running the program with a local switch /N, signifying that a new FFG.D1 file is to be created. Otherwise, once stored, this file does not change unless it is inadvertently deleted. Subsequent runs of RDFFG read the required data from this file, so it is not necessary to enter in this set-up information more than once. Table 2 gives the structure of FFG.D1.

After the file FFG.D1 has been created, RDFFG then finds the appropriate FFG's and decodes them using subroutine DFFG. The product created by RDFFG in subroutine WGUID will have the name cccGUIDAN where ccc is the local node identifier. The product, shown in Fig. 5, tells the user when the product was created and from what RFC guidance. Column 1 contains the forecast zone number decoded from the FFG, and the corresponding flash flood rainfall amount is shown in column 2. Only the zones in the states specified in FFG.D1 will be decoded from the FFG. Columns 3-6 contain guidance information. The 3-h MDR totals are listed under four probability of occurrence columns. For example, in zone 7 there is a 30% chance that a 3-h MDR total of 10 will produce 4.3 inches of rain, and so on for the remaining probability values (Moore and Smith, 1979).

Column 7 contains forecaster-set MDR action values within brackets. MDRWATCH will compare these values with the actual 3-h MDR totals, and generate an AFOS product if the 3-h total has reached or exceeds the bracketed action values for a given zone. If the forecaster does not edit the product and manually change these threshold values, the program will retain the defaulted values obtained from the 50% probability column. Once these values have been stored in the database, they remain until changed by the forecaster, or until RDFFG is rerun, upon receipt of a new or updated FFG. This feature allows the forecaster to adjust the suggested threshold values as conditions warrant.

If the FFG for any of the RFC's cannot be decoded or is older than 21 hours, an error message will appear in cccGUIDAN instead of the guidance information. The forecaster may therefore elect to key the alarm/alert on this

product upon program completion. If the FFG has been altered in some way, whether by manual editing or some other means, RDFFG may have problems decoding the information correctly. An error message will appear in cccGUIDAN even though the product may look correct on the screen. In this case, the forecaster should re-store the product and then rerun RDFFG.

The software structure and load line for RDFFG are shown in Fig. 6.

B. Program MDRWATCH

MDRWATCH (Fig. 7) is the program which compares the 3-h MDR totals with threshold values obtained from the guidance product cccGUIDAN and alerts the forecasters when the thresholds have been met or exceeded in a zone, and which produces 3-h individual and summed MDR plots. The program reads the command line to determine the date (month and day) and ending time for which a 3-h plot will be created. This information is entered by user-specified local switches. If no switches are used, the program defaults to using the current month and day and the last three consecutive hour's radar observations stored in the local database. The format of the command line is the same as in MDRPLT (Newton, 1984) with the exception that the totals switch has now been voided.

After reading the command line, MDRWATCH reads the information in MDRFIL and begins to decode the appropriate radar observations in the same manner as MDRPLT. The MDR values are stored in a temporary array which is later summed and then used to compare against threshold values. The product cccMSGMDR is created to store the times and locations of radar observations which cannot be decoded due to error, or are not found in the specified time sequence. If there are no decoding errors and all of the radar observations requested are found and used, cccMSGMDR will display the message "NO DECODING ERRORS."

Next, the subroutine GETHRS reads the most recent zone threshold values for each state stored in cccGUIDAN. These threshold values are compared with the 3-h MDR totals for each of the zones specified to be monitored from cccGUIDAN in the subroutine THRESH. Zones which exceed or meet the threshold are written to the AFOS product cccFFAZON through the subroutine ALERT. Only the highest total is actually written out, even though several totals within a zone may have met the criteria. Fig. 8 gives an example of the program output when an MDR total exceeds the threshold. In addition, notations are made in the output if a zone location has at least one hour's data missing and still meets the threshold criteria. If none of the monitored zones meets or exceeds threshold values, a default message appears in the product indicating this condition.

Finally, the 3-h individual and summed MDR plots are generated and stored as in MDRPLT (Newton, 1984). The software structure and load line for MDRWATCH are shown in Fig. 9.

C. Program MDRCREAT

As stated earlier, MDRCREAT has been modified to insert additional information into the RDOS file MDRFIL. This alteration is necessary because the AFFMA procedure is designed to alert forecasters based on zone areas. Therefore, the program must know where an MDR grid location is relative to a zone boundary.

This is accomplished through the subroutine FILMDR, added to MDRCREAT, to read in this grid-zone information from state files.

State zone files are created from MDRZONES (see section D, below) by taking the MDR grid of each state and drawing in the zones. (See Fig. 10 for sample MDR grid superimposed on the state, county, and zone map.) The locations of the grid points are then entered into the database along with the corresponding zone they are in. MDRZONES need only run if your zone configuration changes. FILMDR then writes to MDRFIL only those grid locations which fit the window given by the user in MDRG3 (Newton, 1984).

If MDRCREAT cannot find state files for the appropriate states as given in FFG.D1, or if FFG.D1 is missing, no values will be written out to MDRFIL. In this case, MDRFIL cannot be used with MDRWATCH, but it still may be used with MDRPLT. Therefore, it is important that the originating site secure copies of the necessary state files for MDRCREAT to read from. Also, recall that MDRCREAT must read information from FFG.D1, so it is important that RDFFG be run first to create FFG.D1 prior to running MDRCREAT.

Fig. 11 contains the software structures for MDRCREAT. Table 3 contains the new file format of MDRFIL.

D. Program MDRZONES

MDRZONES will be used ONLY if your zones change. Once the zone configuration changes, the MDR grid-zone data in the state data file must change. It is an interactive program initiated from the Dasher. See Fig. 10 for an illustration of how the points were determined for Tennessee.

3. AFOS DATABASE REQUIREMENTS

At least three hours' worth of radar observations for the desired stations should be stored in the local database. The two output graphic products are NMCGPHSR3 and NMCGPHDR3. The former consists of an array of the accumulated sums of MDR digits for 3 hours. The latter contains the array of MDR digits for 3 hours. The products cccGUIDAN, cccMSGMDR, and cccFFAZON containing the flash flood probability guidance, radar decoding error messages, and threshold alert messages, respectively, must also be stored in the database. The "ccc" refers to the local node identifier of the station running the program. Finally, the appropriate local map background should be stored in the database and the two graphics products keyed to this background.

4. PROCEDURES

A. RDFFG

The first step prior to running RDFFG, the pivotal piece of software in AFFMA, is deciding what area is to be monitored. This requires knowledge of the necessary RFC's to use as well as which states from each RFC are to have FFG's decoded, and finally, which zones from each state chosen will have FFG's decoded. Then, after RDFFG has successfully run and produced cccGUIDAN, the forecaster should examine the product and see if the thresholds need to be adjusted. If so, this product may be manually edited and the values within

the brackets modified as the forecaster sees fit. This should be done with some care, owing to the sometimes fickle behavior of the E: command at an Alphanumeric Display Module (ADM). If the forecaster feels that the 50% values shown in the product are reasonable, then no further action is required. In the event that a new FFG is issued after this product has been created, this program should be rerun to reflect the updated guidance.

B. MDRCREAT

As when using MDRPLT, the user should decide on the appropriate radar sites to use and the proper MDR window to have monitored. Naturally, the information entered here should reflect the choices made when running RDFFG in regard to states chosen, etc. Once again, the user should note that the state files needed should be in the database so that a correct MDRFIL may be created for use with the rest of the AFFMA system. If the zone configuration changes for any reason, an interactive session of program MDRZONES must be run from the dasher.

C. MDRZONES

If your zones have changed, the state file xx.D1 (where xx is your state ID from Table 1) MUST be updated by MDRZONES. To illustrate how the MDR grid points and zones are determined, refer to Fig. 10.

D. MDRWATCH

The user will probably wish to set the alarm/alert conditions for cccFFAZON and cccMSGMDR to indicate their creation and storage in the database. In addition, the program will automatically alert the forecaster that the graphic products have been created and stored. The program should be set to run once an hour after the most recent radar observations have been stored. This program will most likely benefit a forecaster during heavy rainfall situations because that is when the 3-h MDR totals will most likely reach or meet the probabilistically determined thresholds. Also, since the majority of the map backgrounds are for counties and the cccGUIDAN and cccFFAZON products present information relative to zones, the forecaster might wish to make a transparency of the map background to overlay onto the SR3 graphic for easier zone identification.

5. REFERENCES

Moore, C. L., and D. L. Smith, 1979: Manually digitized radar data--interpretations and applications. NOAA Technical Memorandum NWS SR-99, National Oceanic and Atmospheric Administration, 24 pp.

National Weather Service, 1980: Radar code user's guide. National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 21 pp.

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.

6. PROGRAM INFORMATION and PROCEDURES for INSTALLATION and EXECUTION

AFOS MDR Automated Flash Flood Monitoring and Alert System

PART A: PROGRAM INFORMATION and INSTALLATION PROCEDURES

PROGRAM NAME: RDFFG

AAL ID: DBC064
Revision No.: 02.00

FUNCTION: Reads and decodes Flash Flood Guidance (FFG) AFOS database products from up to two River Forecast Centers (RFC's). The FFG products can apply to up to a maximum of four states for all RFC's combined. Prepares a guidance product (cccGUIDAN) based on a nomogram method which assigns a probability of rainfall amount to a 3-h Manually Digitized Radar (MDR) total. The guidance product is input to the MDRWATCH (DBC065) program which monitors current MDR reports, comparing them to threshold MDR amounts for the potential occurrence of flash floods.

PROGRAM INFORMATION:

Development Programmer:		Maintenance Programmer:	
Gene A. Norman, Jr.		Phillip Bothwell	
Location:	Techniques Development Laboratory	Location:	Scientific Services Division, Southern Region Headquarters
Phone:	FTS 427-7772	Phone:	FTS 334-2671
Language:	FORTRAN IV/ Rev 5.20	Type:	Standard program

Save file creation dates: RDFFG.SV
Original release/Rev 01.00 - August 8, 1985
First revision/Rev 02.00 - March 4, 1987

Running time: Regular operations - 30 sec
Interactive operations - N/A

Disk space: Program files - 69 RDOS blocks
Data files - 2 RDOS blocks

PROGRAM REQUIREMENTS

Program Files:

NAME	COMMENTS
RDFFG.SV	

Data Files:

NAME	Disk location	READ/WRITE	COMMENTS
FFG.D1	Master Directory	R/W	Interactively created by user before regular operations (using Global switch /N).

AFOS Products:

ID	ACTION	COMMENTS
cccGUIDAN	Stored	Contains MDR guidance probabilities.

LOAD LINE

RLDR RDFFG DFFG CKEY MASK PROB WGUID NLINE FLLSFC CONVERT OPNOUT HEADE BANNER IZOUT WRITIT CHOICE GETZON PUTZON SORT AFDTIM DCMPR COMTIM ELAPS FFGERR MADM <ATOP UTIL BG FORT>.LB

PROGRAM INSTALLATION

1. RDFFG.SV must be on or linked to the master directory.

2. Determine the RFC's for which FFG guidance is to be monitored by MDRWATCH. These RFC's produce flash flood guidance for specific zones in specific states. Display cccFFGxxx from your database to determine states and zones of interest.

3. PIL edit cccGUIDAN into the AFOS database. Two versions should be sufficient for normal operations.

4. Run the RDFFG program in an interactive mode to generate the FFG.D1 file. At the Dasher, type:

   RDFFG

   and supply the requested information:

   Total RFC's required (2 or less)
   Your ccc
   ccc of cccFFGxxx from RFC #1
   xxx of the cccFFGxxx for RFC #1
   Number of states covered by this FFG
   State #1
   Zones covered in State #1
   State #2
   Zones covered in State #2
   ccc of cccFFGxxx from RFC #2
   xxx of the cccFFGxxx for RFC #2
   Number of states covered by this FFG
   State #1
   Zones covered in State #1
   State #2
   Zones covered in State #2

5. To update the information in the FFG.D1 file, type:

   RDFFG/N

   where the global /N switch reactivates the interactive mode for creating a new FFG.D1 file.

AFOS MDR Automated Flash Flood Monitoring and Alert System

PART B: PROGRAM EXECUTION and ERROR CONDITIONS

PROGRAM NAME: RDFFG

AAL ID: DBC064
Revision No.: 02.00

PROGRAM EXECUTION

1. Once a day, after the current FFG products are received into the AFOS database (usually after 1600 GMT), run the RDFFG program. Enter at an ADM:

   RUN:RDFFG

2. Check the FFG product receipt times to insure they are for the current day. If the product header time in the TTAA line (WOUS line) is more than 21 hours old, this is noted in the AFOS product cccGUIDAN. The MDRWATCH program will abort with a RUNTIME 25 error when this happens.

3. Examine the 3-h MDR action values in the cccGUIDAN product. These can be modified via message composition. Be careful to maintain the exact same product format.

ERROR CONDITIONS

	ADM MESSAGE	MEANING
1.	"NO SUCH FFG KEY"	Could not locate one of the FFG's in the AFOS database. Check your PIL to insure all the required FFG's are in it.
2.	"CAN'T FIND KCCC"	Trouble decoding the WOUS header of one of the FFG's. Correct WOUS header and rerun.
3.	"CAN'T FIND ".." PRECEDING STATE ID"	Couldn't locate expected information in the FFG product--periods in front of the state ID. Try to edit the offending FFG and rerun.
4.	"CAN'T FIND STATE"	Can't locate the state ID listed in the FFG. Try editing the offending FFG and rerun.
5.	"CAN'T FIND ZONE NUMBER"	Can't locate the zone number in the FFG product. Try to edit the offending FFG and rerun.
6.	"CAN'T FIND FIRST DIGIT OF RAIN AMT"	Can't locate rain amount in the FFG product. Try to edit the offending FFG and rerun.

7. "PRODUCT IS 22 HOURS OLD"	An FFG is more than 21 hours old. Wait for the new FFG's before rerunning and don't bother running MDRWATCH until they come in. MDRWATCH will abort with a RUNTIME 25 error if it is run in this situation.

AFOS MDR Automated Flash Flood Monitoring and Alert System

PART A: PROGRAM INFORMATION and INSTALLATION PROCEDURES

PROGRAM NAME: MDRCREAT

AAL ID: DBC065
Revision No.: 02.00

FUNCTION: Creates an MDR information file (MDRFIL) that contains the local station's ccc identifier, the ccc identifiers for the radar observations that must be decoded, the coordinates of the relevant radar sites, the coordinates and size of the region to be monitored, and the "window" coordinates of the local map background. Revision 2.00 is designed for use with MDRWATCH (AAL ID:DBC065), the MDR monitoring and alert system. For that system, states and River Forecast Center's are selected interactively by the user to define which Flash Flood Guidance products are to be monitored.

PROGRAM INFORMATION:

Development Programmer:

Gene A. Norman, Jr.

Location: Techniques Development Laboratory
Phone: FTS 427-7772

Maintenance Programmer:

Phillip Bothwell

Location: Scientific Services Division
Phone: FTS 334-2671

Language: FORTRAN IV/ Rev 5.20

Type: Standard program

Save file creation dates: MDRCREAT.SV
Original release/Rev 01.00 - April 18, 1984
First revision/Rev 02.00 - June 28, 1985

Running time: user interactive program

Disk space: Program - 32 RDOS blocks
Data files - 3 RDOS block

PROGRAM REQUIREMENTS

Program Files:

NAME	COMMENTS
MDRCREAT.SV	

Data Files:

NAME	DISL LOCATION	READ/WRITE	COMMENTS
MDRFIL	Master Directory	W	Created by MDRCREAT

FFG.Dl	Master Directory	R	Created by RDFFG (AAL ID: DBC064). Lists states and zones to be monitored.
xx.Dl	Master Directory	R	State MDR grid/zone files, xx= two letter state ID. (Created by MDRZONES)

LOAD LINE

RLDR MDRCREAT MDRG<1 2 3 4> SETUP PUTZON FILMDR STFIL IZOUT <BG UTIL FORT>.LB

PROGRAM INSTALLATION

1. Move MDRCREAT.SV to an available directory.

2. Select the state data files to be installed in the same directory as MDRCREAT.SV. The available state files are:

AL.Dl	-	Alabama
AR.Dl	-	Arkansas
FL.Dl	-	Florida
FW.Dl	-	Fort Worth, Texas area
GA.Dl	-	Georgia
LA.Dl	-	Louisiana
LB.Dl	-	Lubbock, Texas area
MS.Dl	-	Mississippi
OK.Dl	-	Oklahoma
SA.Dl	-	San Antonio, Texas area
TN.Dl	-	Tennessee

These are the states which are to be monitored. These should be consistent with the states entered interactively with RDFFG. For Texas, all three Texas area files (FW.Dl, LB.Dl, and SA.Dl) are required. RDFFG expects the state designator TX for this case.

The state data files can be removed from the directory after successful completion of MDRCREAT.

3. Be prepared to give the following information: (Figures and Tables are referenced from TDL CP 84-1, AFOS Display of MDR Data on Local Map Backgrounds)

   (1) Upper left and lower right coordinates of desired rectangular regional area selected from Fig. 2,
   (2) Call letters (cccnnnxxx) of all radar stations that are within the desired regional area,
   (3) Radar station's coordinates, (I,J), and whether it is a network or local warning radar found in Tables 2 and 3, and
   (4) Top and bottom latitudes and left and right longitudes of the local map background that will be used.

AFOS MDR Automated Flash Flood Monitoring and Alert System

PART B: PROGRAM EXECUTION and ERROR CONDITIONS

PROGRAM NAME: MDRCREAT

AAL ID: DBC065
Revision No.: 02.00

PROGRAM EXECUTION

1. Make sure the current directory contains MDRCREAT.SV and the state data files.

2. Run RDFFG (AAL ID: DBC064) before initiating MDRCREAT. This produces the required FFG.D1 data file required for MDRCREAT.

3. Enter at the Dasher: MDRCREAT

4. Enter answers to questions asked.

   A message signifying that the MDRFIL has been built denotes successful execution of the program.

ERROR CONDITIONS

	MESSAGE	MEANING
1.	"CAN'T DELETE MDRFIL"	This message will be displayed when a previously created MDRFIL can't be deleted. Probable cause is that MDRFIL has been made permanent on disk. CHATR the file to remove the permanency attribute and rerun MDRCREAT.
2.	"REGION IS TOO LARGE-- 30x30 IS MAXIMUM"	Error occurred because the size of the desired rectangular region to be monitored is larger than the program allows (30x30 grid size). Decrease the size of the desired area and re-enter the upper left and lower right coordinates.

Error conditions other than those listed above occur during file manipulation. This includes creating, opening a channel to, writing, and closing the MDRFIL. These errors occur most likely because of system/disk problems rather than program failure. Check the RDOS error code and rerun MDRCREAT, if necessary.

AFOS MDR Automated Flash Flood Monitoring and Alert System

PART A: PROGRAM INFORMATION and INSTALLATION PROCEDURES

PROGRAM NAME: MDRZONES

AAL ID: DBC078
Revision No.: 1.00

FUNCTION: Creates a state data file of MDR-zones grid values. The grid locations are relative to the overall national MDR grid. The RDOS file created is xx.D1, where xx is the two letter state abbreviation supplied by the user. Interactively, the user enters I & J coordinates and corresponding zone location, which are then written to xx.D1. Some error checking is done as the data are entered. The structure of the RDOS file is J*100+I followed by the zone for every entry made. These xx.D1 files are intended for use with MDRCREAT.

PROGRAM INFORMATION:

Development Programmer(s):		Maintenance Programmer(s):	
Gene A. Norman, Jr.		Phillip Bothwell	
Location:	Techniques Development Laboratory	Location:	Scientific Services Division
Phone:	FTS 427-7772	Phone:	FTS 334-2671
Language:	FORTRAN IV/ Rev 5.20	Type:	Standard program

Save file creation dates:
Original release/Rev 01.00 - May 1985

Running time: about 5 seconds - user interactive

Disk space: Program - 19 RDOS blocks
Data files - 2 RDOS block

PROGRAM REQUIREMENTS

Program Files:

NAME
MDRZONES.SV

Data Files:

NAME	Disk location	READ/WRITE	COMMENTS
xx.D1	Master Directory	W	Created by program. xx is two letter state identifier.

LOAD LINE

RLDR/P MDRZONES ZONES.LM/L IZOUT <UTIL BG FORT>.LB

PROGRAM INSTALLATION

1. MDRZONES.SV must be on or linked to the master directory.

AFOS MDR Automated Flash Flood Monitoring and Alert System

PART B: PROGRAM EXECUTION and ERROR CONDITIONS

PROGRAM NAME: MDRZONES

AAL ID: DBC078
Revision No.: 1.00

PROGRAM EXECUTION

1. Make sure the current directory contains MDRZONES.SV
   At the dasher enter: MDRZONES

2. Enter answers to questions asked.

3. Enter 9999 for I grid coordinate to stop execution. A message stating the number of grid points entered denotes end of the program.

ERROR CONDITIONS

	MESSAGE	MEANING
1.	"Are I and J correct?" "Is ZONE correct?"	These messages are displayed after each grid point and zone are entered to allow for input mistakes. If the incorrect grid point or zone is entered, the program must be rerun.

Error conditions other than these occur during file manipulation. These errors occur most likely because of system/disk problems rather than program failure. Check the RDOS error code and rerun MDRZONES, if necessary.

AFOS MDR Automated Flash Flood Monitoring and Alert System

PART A: PROGRAM INFORMATION and INSTALLATION PROCEDURES

PROGRAM NAME: MDRWATCH

AAL ID: DBC065
Revision No.: 02.00

FUNCTION: Reads and decodes the MDR section of radar observations (ROB's) from the AFOS database. Generates two graphical displays of MDR VIP level codes on local area map backgrounds. One graphic contains an hourly array of MDR digits over a 3-h period; the other graphic contains the sum of the MDR digits per grid square over the 3 hours. The 3-h values are compared to the "ACTION" thresholds stored in the cccGUIDAN product (see RDFFG). If the MDR values meet or exceed the threshold, an AFOS database message is created indicating which zones are affected.

PROGRAM INFORMATION:

Development Programmer:

Gene A. Norman, Jr.

Location: Techniques Development Laboratory

Phone: FTS 427-7772

Language: FORTRAN IV/ Rev 5.20

Maintenance Programmer:

Phillip Bothwell

Location: Scientific Services Division, Southern Region Headquarters

Phone: FTS 334-2671

Type: Overlay program

Save file creation dates: MDRWATCH.SV
Original release/Rev 01.00 - August 14, 1985
First revision/Rev 02.00 - March 4, 1987

Running time: 2 minutes

Disk space: Program files - 109 RDOS blocks
Data files - 6 RDOS blocks

PROGRAM REQUIREMENTS

Program Files:

NAME	COMMENTS
MDRWATCH.<OL SV>	

Data Files:

NAME	DP	READ/WRITE	COMMENTS
MDRFIL	Master Directory	R	Created by MDRCREAT.

DR3	Master Directory	W	Created by MDRWATCH and deleted after being stored in the AFOS database.
SR3	Master Directory	W	Created by MDRWATCH and deleted after being stored in the AFOS database.
FFG.Dl	Master Directory	R	Created by RDFFG.

AFOS Products:

ID	ACTION	COMMENTS
NMCGPHDR3	Stored	3 hours of data are displayed at each grid square.
NMCGPHSR3	Stored	3 hours of data are in the sum plotted in the graphic.
cccGUIDAN	Retrieved	Updated and stored by RDFFG each day.
cccMSGMDR	Stored	MDR decoding performance messages, an alerted product.
cccFFAZON	Stored	Zone alerting messages, an alerted product.

LOAD LINE

RLDR MDRWATCH MDR<CMD SU> CKEY MADM ROBDEC GROB ROBOP MASK IASC<R L> MDRGRID ADDMDR FILL THRESH LARGE ALERT MDRSTAT JDATE J2MA IZOUT EOMSG [GETHRS NAFREAD SSEARCH COUNT AFDTIM DCMPR WRZON ONEZON SORT1, MDRGP1 POLAR MDRCOORD ASIN PIXEL LIMITS MDRLB SUMGP1 SUMLB] <AG ATOP BG UTIL FORT>.LB

PROGRAM INSTALLATION

1. MDRWATCH.<OL SV> must be on or linked to the default directory.

2. Run RDFFG and MDRCREAT (and, if necessary, MDRZONES) to prepare the data files required by MDRWATCH.

3. PIL edit into the AFOS database the 2 products accessed by MDRWATCH:

cccMSGMDR	1 version recommended
cccFFAZON	6 versions recommended

Insure cccGUIDAN has been PIL edited into the database.

3. Verify that the required radar observations are stored in the database and that they are version rather than time purged.

4. Verify that the appropriate local map backgrounds are stored in the database. Use the KEY: command to set the output graphics with the appropriate map background.

AFOS MDR Automated Flash Flood Monitoring and Alert System

PART B: PROGRAM EXECUTION and ERROR CONDITIONS

PROGRAM NAME: MDRWATCH

AAL ID: DBC065
Revision No.: 02.00

PROGRAM EXECUTION

1. From an ADM console, enter:

   RUN:MDRWATCH MM/M DD/D HH/E (optional switches same as MDRPLT except totals switch has been omitted).

2. The ADM alarm light will be activated once for each graphic and alphnumeric product stored, a total of 4, when the program has completed.

ERROR CONDITIONS

	ADM MESSAGE	MEANING
1.	!!ROB DECODER ERROR MESSAGES "CCC MODA HHMM"	Problem occurred because an observation was not found or could not be decoded properly. Station name, month, day, hour, and minute of the observation is printed at console. Error message is displayed by depressing blinking light at program completion.

	DASHER MESSAGES	COMMENTS
1.	"CAN'T READ MDRFIL"	Probable cause is that the MDRFIL has been deleted or its contents have been destroyed. Restore from backup or rerun MDRCREAT.
2.	"CAN'T DELETE 'FILENAME'"	Error occurred because the specified RDOS file could not be deleted. A manual deletion should be applied.
3.	RUNTIME 25	A RUNTIME 25 error will result when cccGUIDAN is formatted incorrectly or if error conditions are written into cccGUIDAN by RDFFG.

Table 1. Valid two-letter state ID's.

ID		State
AL.Dl	-	Alabama
AR.Dl	-	Arkansas
FL.Dl	-	Florida
FW.Dl	-	Fort Worth, Texas area
GA.Dl	-	Georgia
LA.Dl	-	Louisiana
LB.Dl	-	Lubbock, Texas area
MS.Dl	-	Mississippi
OK.Dl	-	Oklahoma
SA.Dl	-	San Antonio, Texas area
TN.Dl	-	Tennessee

Table 2. Structure of the FFG.Dl data. Data type "A" indicates packed ASCII data; data type "B" indicates binary data.

Word	Definition	Data Type
1	Total RFCS needed	B
2-3	Originating Station ccc	A
4-5	ccc of cccFFGxxx for RFC #1	A
6-7	xxx of cccFFGxxx	A
8	Number of States	B
9	State #1	A
10-31	Zones from State #1	B
32	State #2	A
33-54	Zones from State #2	B
55-56	ccc of cccFFGxxx for RFC #2	A
57-58	xxx of cccFFGxxx	A
59	Number of States	B
60	State #1	A
61-82	Zones from State #1	B
83	State #2	A
84-105	Zones from State #2	B

Table 3. Format of the MDRFIL file. Data type "A" indicates packed ASCII data; data type "B" indicates binary data.

Word	Description	Data Type
0-4	cccnnnxxx for station 1	A
5	Network radar	A
6	Offset to convert station I-coordinate to regional I-coordinate	B
7	Offset to convert station J-coordinate to regional J-coordinate	B
8-15	Same as 0-7 for station 2	
16-23	Same as 0-7 for station 3	
.		
.		
.		
152-159	Same as 0-7 for station 20	
160	I-coordinate of upper left corner of regional grid	B
161	J-coordinate of upper left corner of regional grid	B
162	Height of regional area in grid squares	B
163	Width of regional area in grid squares	B
164	Top latitude of area map	B
165	Bottom latitude of area map	B
166	Left longitude of area map	B
167	Right longitude of area map	B
168	Local station's call letters	A
169	Number of zone/grid data points	B
170	State	A
171	Grid location (I,J) I*100+J	B
172	Zone	B
173,174	pairs are like 171, 172	B
.		
.	Repeat if necessary for each state	
.		
509		

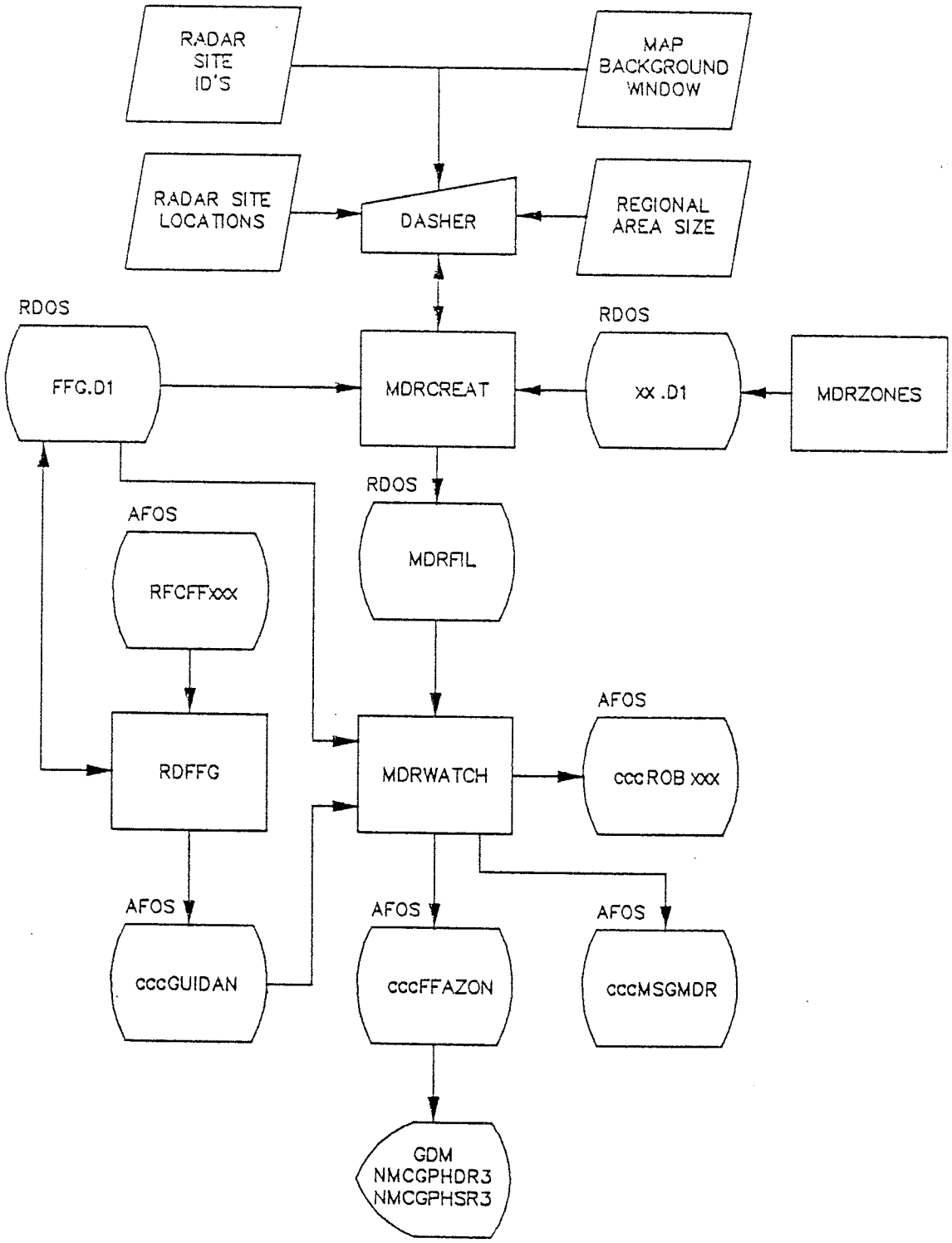


Figure 1. AFOS Flash Flood Monitoring and Alerting System.

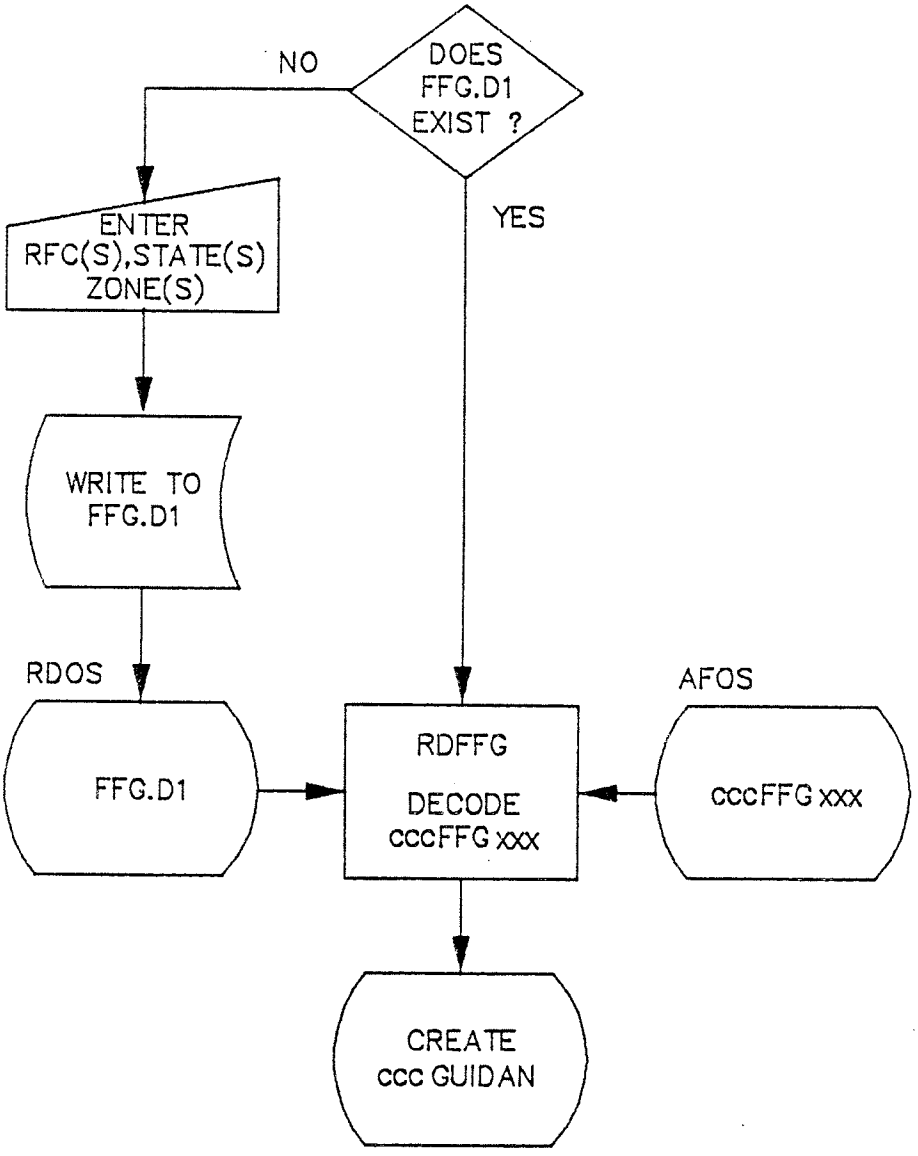


Figure 2. Flash Flood Guidance Program (RDFFG).

```
NEWFFGSIL
RGUS KSIL 251545??CES
FLASH FLOOD GUIDANCE FROM LMRFC
MON FEB 25 1985

INCHES OF RAINFALL FOR 3 HOUR DURATION REQUIRED TO PRODUCE
FLASH FLOODING IN STATE FORECAST ZONES.
RAINFALL AMOUNTS LESS THAN THOSE INDICATED MAY CAUSE
FLASH FLOODING IN URBAN AND MOUNTAIN AREAS.

STATE
ZONE/RAIN
..MS - MISSISSIPPI
 1/2.0  2/2.1  3/1.7  4/1.9  5/2.5  6/1.6  7/1.5  8/1.2
 9/1.8 10/1.2 11/1.3 12/2.2 13/2.3 14/1.8 $
..LA - LOUISIANA
 1/1.8  2/1.8  3/1.8  4/1.7  5/1.4  6/1.4  7/1.6  8/1.3
 9/1.5 10/1.6 11/1.9 12/2.1 13/2.6 $
..AR - ARKANSAS
 2/1.9  3/1.7  6/1.8  8/1.4 10/1.8 11/2.1 12/2.0 13/2.0
14/2.1 15/1.9 16/2.2 $
..TN - TENNESSEE
 1/1.8  2/2.3  3/1.9  5/2.0  6/2.1  7/2.3 11/2.1 12/2.3
13/2.4 14/2.0 15/2.1 $
..MO - MISSOURI
18/1.8 20/1.4 21/1.5 22/1.8 23/1.7 $
..TX - TEXAS
22/1.6 23/1.5 28/1.9 $
NORTH CAROLINA
ZONE  3HR   12HR   24HR
 9    2.2   2.7    3.4
10    2.5   3.0    3.7
11    2.3   2.8    3.5
12    3.1   3.6    4.3

DUTY FORECASTERS
BOB STUCKY
GEORGE CRY
END SIL-
```

Figure 3. Flash Flood Guidance message.

```
R
RDFFG
NUMBER OF RFC INPUTS TO USE 1
PLEASE ENTER THE CCC OF YOUR STATION
NEW

IS NEW OK ? (Y/N)
Y

PLEASE ENTER CCC OF RFC NUMBER  1
NEW

IS NEW OK ? (Y/N)
Y
ENTER NNN FOR NEWFFG  (NOTE:  NNN should be XXX)
SIL

IS SIL OK ? (Y/N)
Y

NUMBER OF STATES TO BE DECODED FROM NEWFFGSIL
1
ENTER 2-LETTER STATE ID FOR STATE NUMBER  1
LA

IS LA OK ? (Y/N)
Y
ENTER S IF ZONE NUMBER ARE ALL IN SEQUENCE FOR LA
OTHERWISE, HIT A RETURN
S
STARTING AND ENDING ZONE NUMBERS (EG 1,13)1,13
R
```

Figure 4. Sample session from subroutine CHOICE.

CREATED 041704 FROM FFG OF 4/ 4 1539
FL ZONES

FCST ZONE	3-HR FLASH FLOOD RAIN GUIDANCE	MDR SUM THAT GIVES GUIDANCE RAINFALL IN 3HRS WITH PROB OF: 30%	50%	70%	90%	ENTER 3-HR MDR ACTION VALUE*
5	4.9	10	14	19	—	[14]
6	3.3	9	12	16	22	[12]
7	4.3	10	13	17	—	[13]
8	5.0	11	15	20	—	[15]
9	5.0	11	15	20	—	[15]
10	4.5	10	14	19	—	[14]
11	4.6	10	14	19	—	[14]
12	5.0	11	15	20	—	[15]
13	5.0	11	15	20	—	[15]
14	4.4	10	13	17	—	[13]
15	5.0	11	15	20	—	[15]
16	5.0	11	15	20	—	[15]

*FORECASTER NOTE: ACTION VALUE DEFAULTS TO 50% IF NOT CHANGED.
MORE GUIDNACE ON NEXT PAGE
FL ZONES

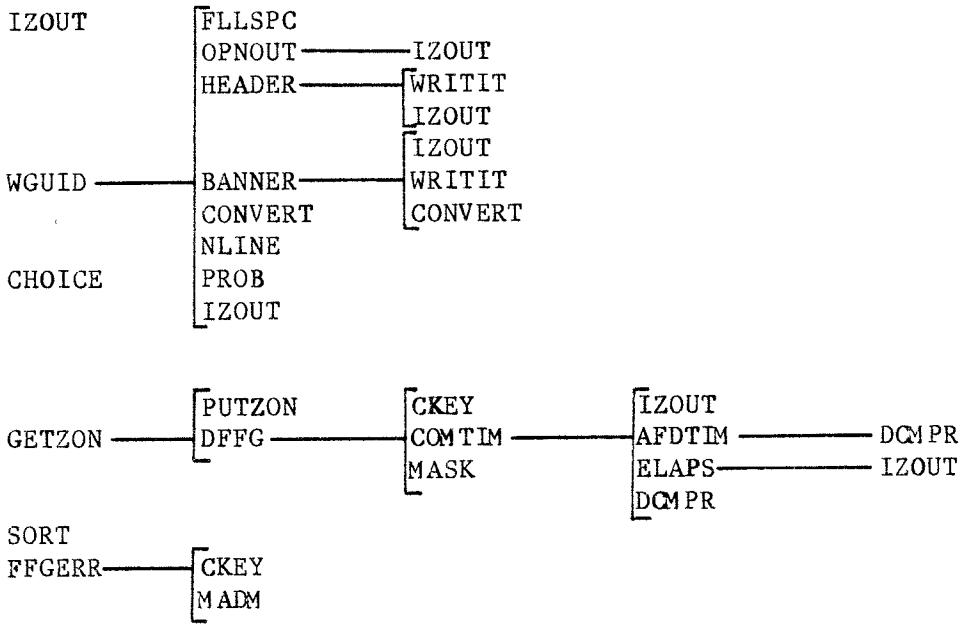
FCST ZONE	3-HR FLASH FLOOD RAIN GUIDANCE	MDR SUM THAT FICES GUIDANCE RAINFALL IN 3HRS WITH PROB OF: 30%	50%	70%	90%	ENTER 3-HR MDR ACTION VALUE*
17	5.0	11	15	20	—	[15]
18	5.0	11	15	20	—	[15]
19	5.0	11	15	20	—	[15]
20	5.0	11	15	20	—	[15]
21	5.0	11	15	20	—	[15]
22	5.0	11	15	20	—	[15]
23	5.0	11	15	20	—	[15]

*FORECASTER NOTE: ACTION VALUE DEFAULTS TO 50% IF NOT CHANGED.

Figure 5. The product cccGUIDAN.

MAIN PROGRAM
RDFFG

SUBROUTINES



LOAD LINE

```
RLDR/P RDFFG RDFFG.LM/L DFFG CKEY MASK PROB WGUID NLINE  FLLSPC CONVERT
   OPNOUT HEADER BANNER IZOUT WRITIT CHOICE  GETZON PUTZON SORT AFDTIM DCMPR
   COMTIM ELAPS FFGERR MADM  <ATOP UTIL BG FDRT>.LB
```

Figure 6. Software structure and load line for RDFFG.

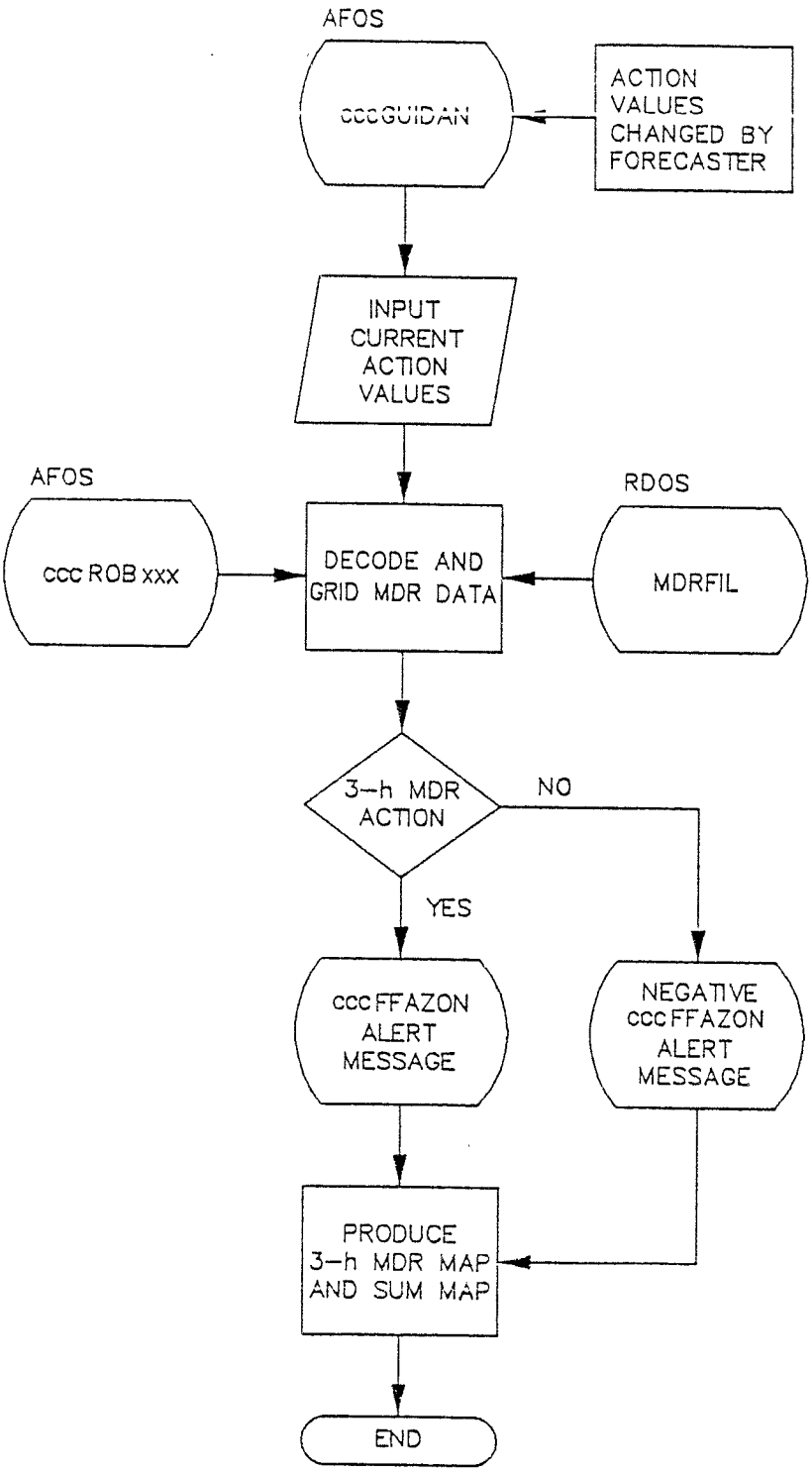


Figure 7. Flash flood monitoring and alerting program (MDRWATCH).

CREATED 841704 FROM FFG OF 4/ 4 1539
TX ZONES

FCST ZONE	3-HR FLASH FLOOD RAIN GUIDANCE	MDR SUM THAT GIVES GUIDANCE RAINFALL IN 3HRS WITH PROB OF: 30%	50%	70%	90%	ENTER 3-HR MDR ACTION VALUE*
19	2.9	8	11	15	20	[11]
20	2.8	8	11	15	20	[11]
21	2.8	8	11	14	19	[11]
22	2.7	8	11	15	20	[11]
23	3.1	9	12	16	22	[12]
24	3.1	9	12	16	22	[12]
25	3.3	9	12	16	22	[12]
26	2.9	8	11	15	20	[11]
27	2.7	8	11	15	20	[11]
28	4.6	10	14	19	--	[14]
29	3.1	9	12	16	22	[12]
30	3.2	9	12	16	22	[12]

*FORECASTER NOTE: ACTION VALUE DEFAULTS TO 50% IF NOT CHANGED.
MORE GUIDANCE ON NEXT PAGE
TX ZONES

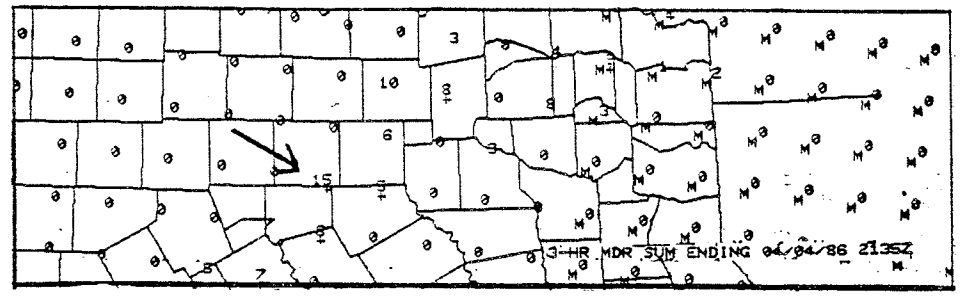
FCST ZONE	3-HR FLASH FLOOD RAIN GUIDANCE	MDR SUM THAT GIVES GUIDANCE RAINFALL IN 3HRS WITH PROB OF: 30%	50%	70%	90%	ENTER 3-HR MDR ACTION VALUE*
31	2.9	8	11	15	20	[11]
32	3.0	9	12	16	22	[12]
33	3.3	9	12	16	22	[12]

*FORECASTER NOTE: ACTION VALUE DEFAULTS TO 50% IF NOT CHANGED.

SRHGUIDAN

SRHFFAZON
MDR THRESHOLD EXCEEDED IN TX ZONE 26....THRESHOLD IS 11....MAX VALUE IS 15

xxxxxxx END OF MESSAGE xxxxxxxxx



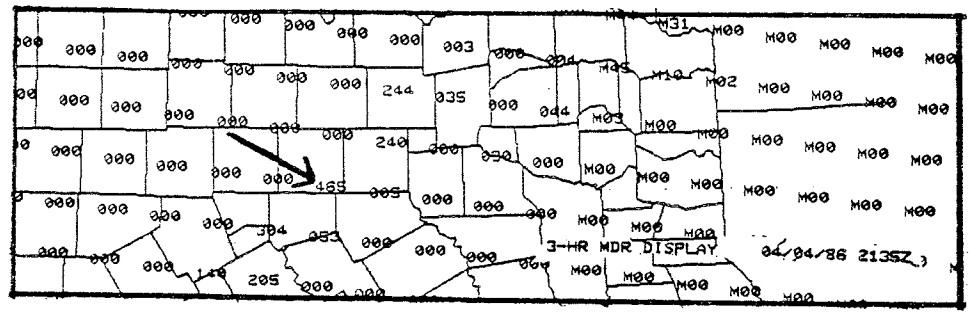
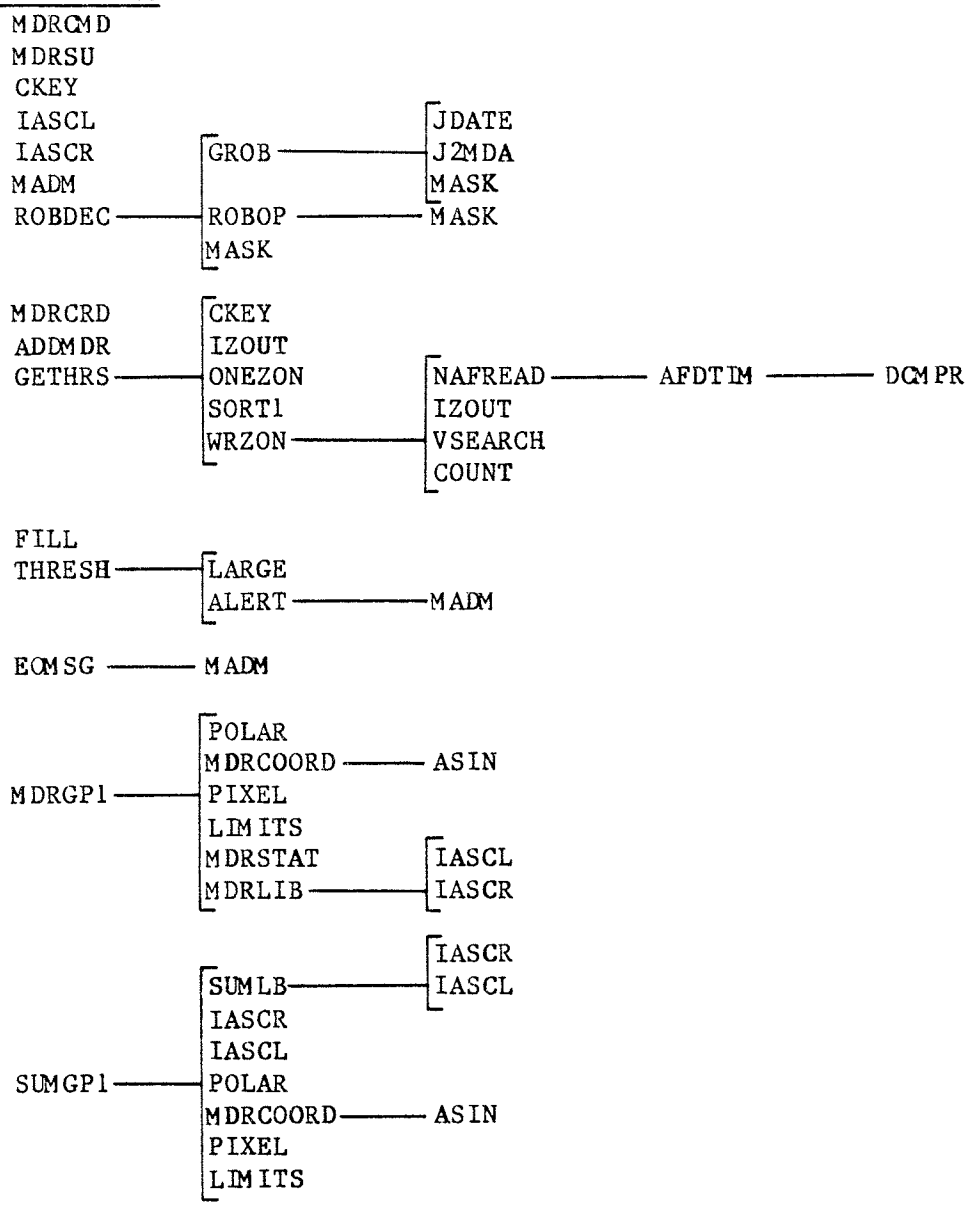


Figure 8. Example of output (cccGUIDAN, cccFFAZON, NMCGPHSR3, and NMCGPHDR3) when the MDR's value exceeds the threshold.

MAIN PROGRAM
MDRWATCH

SUBROUTINES



LOAD LINE

```
RLDR/P MDRWATCH MDRWATCH.LM/L MDR<SU CMD> CKEY MADM ROBPEC GROB ROBOP  MASK
   IASC <R L> MDRGRID ADDMDR FILL THRESH LARGE ALERT  MDRSTAT JDATE J2MDA
   IZOUT EDMSG  [GETHRS NAFREAD VSEARCH COUNT AFDTIM DCMPR WRZON ONEZON
   SORT1,  MDRGP1 POLAR MDRCOORD ASIN PIXEL LIMITS MDRLB  SUMGP1 SUMLB]
   <AG ATOP BG UTIL FORT>.LB
```

Figure 9. Software structure and load line for MDRWATCH.

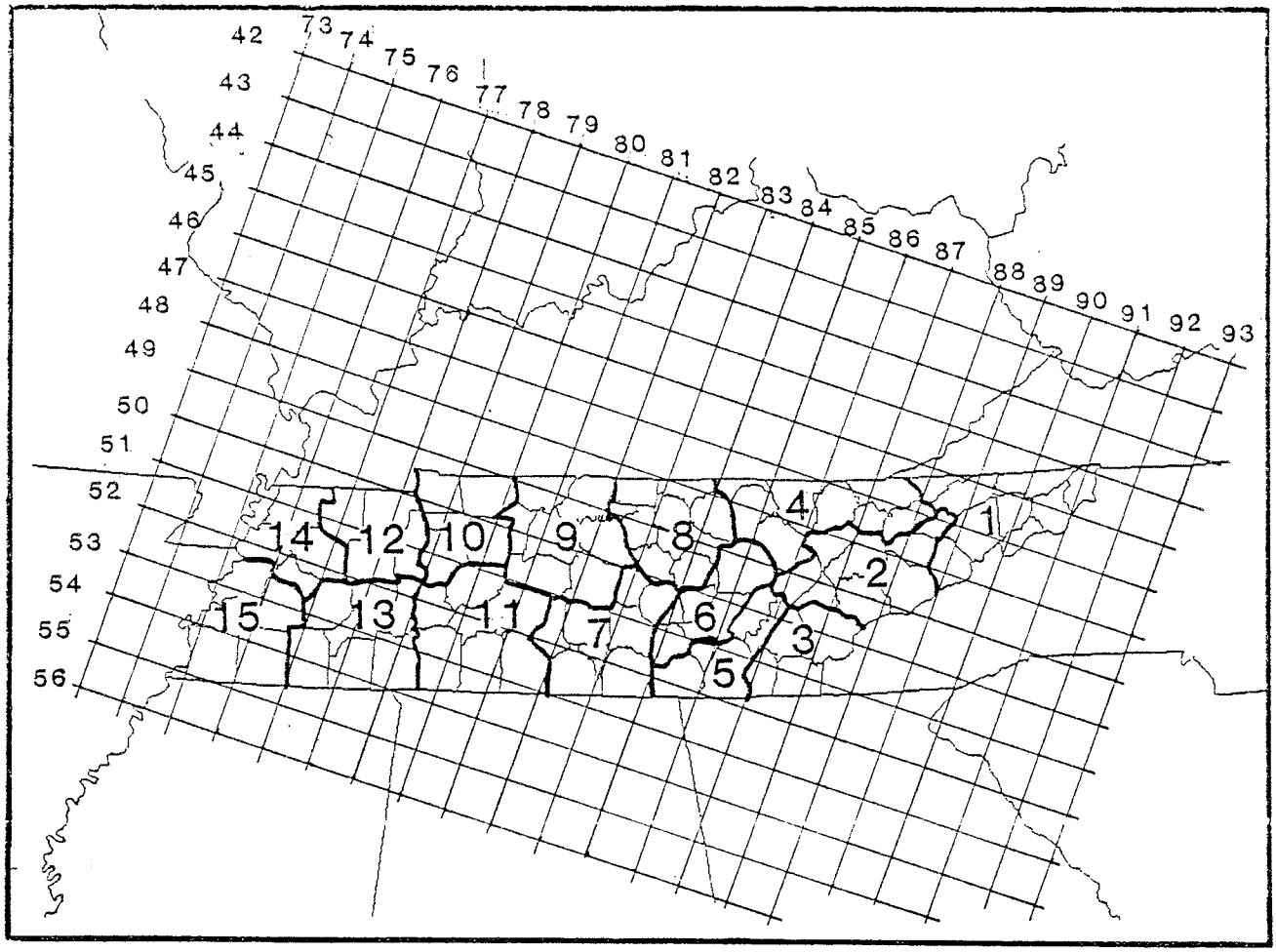
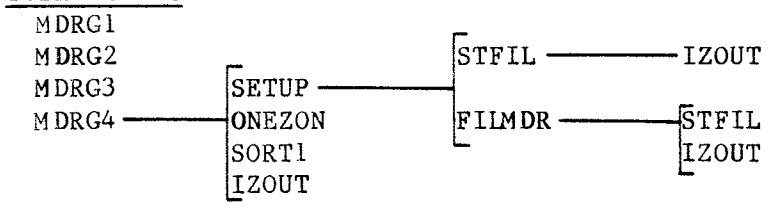


Figure 10. The MDR grid superimposed on the state, county, and zone map background.

MAIN PROGRAM
MDRCREAT

SUBROUTINES



LOAD LINE

```
RLDR/P MDRCREAT MDRCREAT.LM/L MDRG1 MDRG2 MDRG2 MDRG4 SETUP ONEXON  SORT1
   FILMDR IZOUT STFIL
   <BG UTIL FORT>.LB
```

Figure 11. Software structure and load line for MDRCREAT.