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RADAP II ARCHIVE DATA
USER'S GUIDE

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1. INTRODUCTION

In 1971, the National Weather Service (NWS) began the Digitized RADar EXperiment (D/RADEX) to improve the operational use of radar data through computer processing (McGrew, 1972). The early stages of D/RADEX involved four sites: Kansas City, Mo. (August 1971); Oklahoma City, Okla. (October 1971); Fort Worth, Tex. (December 1971); and Monett, Mo. (February 1972), as shown in Fig. 1. Many useful meteorological and hydrological products were developed under D/RADEX including echo tops, vertically integrated liquid water content (Green, 1971), severe weather probability (Saffle, 1976), storm structure, and rainfall accumulation. In 1983, positive evaluation of the results of D/RADEX resulted in transfering the system to quasi-operational status and renaming it RAdar DAta Processor, version II (RADAP II). Currently, the RADAP II network consists of the twelve sites shown in Fig. 2. The sites are Amarillo, Tex. (AMA); Binghamton, N.Y. (BGM); Nashville, Tenn. (BNA); Charleston, W. Va. (CRW); Garden City, Kans. (GCK); Wichita, Kans. (ICT); Jackson, Ky. (JKL); Limon, Colo. (LIC); Oklahoma City, Okla. (OKC); Pittsburgh, Pa. (PIT); Tampa Bay, Fla. (TBW); and Monett, Mo. (UMN).

2. DATA QUALITY CONTROL

Based on the strength of the signal returned from a target, the current NWS weather radar receivers estimate the equivalent reflectivity factor (in $mm^6 m^{-3}$) that would be representative of such a signal. This reflectivity factor quantity is called "Z" and can range from about 50 to about $5x10^5$ $mm^6 m^{-3}$. The receiver then calculates the logarithm of each estimated value of Z; the dynamic range of Log Z is about 1.7 to 5.7. To simplify further processing of the data, the Log Z values are scaled upwards by a factor of 10 (10 Log Z); these values are commonly referred to as dBZ values. The RADAP II system utilizes dBZ values for calculations and archiving.

The RADAP II system performs several quality control procedures on each scan of radar reflectivity data before that scan is passed to any other task, including archiving. The first of these procedures corrects the data for attenuation due to absorption by atmospheric gases. This correction is a linear function that increases with distance and reaches a maximum corrective value of +3 dBZ for data at a range of 126 n mi.

Next, in order to mitigate the effects of normal ground clutter, a hybrid base-level scan is generated by merging higher elevation angle scan data out to a given range with 0.5 degree elevation angle scan data from that range out to 126 n mi. Both the higher elevation angle and the range of its use are site-adaptable and vary from site to site. These values are included in the header data for each scan, as shown in Section 4.

Finally, each scan is processed to remove isolated point targets by requiring a given nonzero data value to be adjacent to at least two other nonzero data values. During this filtering procedure, a check is also made on whether a given data value exceeds the maximum of its adjacent neighbors by more than about 16 dBZ. If so, the data value is changed to that of the neighborhood maximum.

3. DATA COLLECTION

Although two types of radars (WSR-57 or WSR-74S) are used in the RADAP II network, they share the common characteristics of a 2.2 deg beam width and a 10 cm wavelength. The RADAP II sites schedule base-level and tilt-sequence (volumetric) observations of reflectivity every 10 or 12 min. These observations are built from input scans of data consisting of 180 radials covering 360 deg of azimuth under the radar umbrella. The radials are centered on even azimuths, cover a range from 10 to 126 n mi, and contain a data value for each nautical mile of range (Fig. 3). The data values range from 0 to 15 with each nonzero value representing a RADAP II category of radar reflectivity. The nominal reflectivity thresholds for the categories are given in Table 1. As previously noted in Section 2, a base-level observation is a hybrid of a scan taken at an elevation angle of 0.5 deg for data at farther ranges and one taken at a site-adaptable higher elevation angle for data near the radar site. In contrast, a volumetric observation consists of a series of single elevation angle scans starting at 0.5 deg elevation and extending, in vertical steps of two degrees, to the top of the existing echoes or to 22.0 deg, whichever comes first.

In 1984, the NWS began archiving RADAP II data to support the development of reflectivity-based operational algorithms that could be tested at RADAP II sites and later implemented on future NWS radar systems. The data are first written to floppy diskettes at each RADAP II site and later transferred to a central location for final archiving to IBM compatible 9-track magnetic tapes. RADAP II data for the period April 1985 through March 1987 were archived to tape under contract. Since April 1987, the diskettes have been transferred to NWS Headquarters for final archiving to tape.

In order to increase the utility of the RADAP II archive for snowfall research, the cool season base-level data have been coded since 1986 according to category thresholds that cover, in 2-dBZ steps, the reflectivity range 18-46 dBZ (Table 1). Nominally, the cool season is November 1 through March 1, but individual sites will vary somewhat. Volumetric observations taken during the cool season are coded according to the warm season category thresholds in Table 1. Thus, the cool season archive will enable research both on frozen precipitation and on severe convective events that might occur during that season.

4. ARCHIVE DATA TAPES

The data tapes are 9-track, nonlabeled (NL), high density (6250 bpi) magnetic tapes. They are written in binary coded decimal (BCD) with an unformatted FORTRAN write statement using a variable spanned (VS) record format and a maximum record length of 32,756 bytes. Each tape contains one file of data for one RADAP II site. Each record has two logical parts representing one scan of data. Part 1 contains thirty-four 16-bit words of header parameters which describe the station and data characteristics for the scan (Table 2). Part 2 has a variable number of 16-bit words and contains the radial reflectivity category data for each scan in the form shown in Table 3.

The RADAP II archive tapes can be read with a FAST FORTRAN I/O (FFIO) package subroutine called FFGET(BUF,N,L,&END,&ERR), where FFGET reads a record from FORTRAN unit "N" into contiguous locations starting at "BUF." The length of the record in bytes is returned in "L." At end-of-file (EOF), transfer will be made to statement number "END" and errors to statement number "ERR." The FFIO package is available at the NOAA Computer Center to 360/195, 360/65, and NAS 9000 users and will automatically be included in programs executed under the NFOR, NPL1F, and XFORX procedures. For non-FFIO users, the data tapes can be read with basic FORTRAN unformatted read statements or with any other compatible utility.

5. DECODING ARCHIVED DATA

Table 4 represents a sample formatted display of the alphanumeric value of each byte of one record. Note that each record corresponds to one 360° observational scan of data. A graphical display of all of the scan data in this record is presented in Fig. 4. Table 2 contains the information that allows line 1 of this record to be decoded to reveal the following information:

ISTAT	= OKC
IYR	= 87
IJUL	= 123
IMMDD	= May 3
ITIME	= 1000 GMT
IELEV	= 0.5 deg
IRINT	= 1.00 n mi
IMERGR	= 60 km
IMERGA	= 2.9 deg
IALT	= 1300 ft above msl
IOBFLG	= 0 (base elevation observation)
IDRFLG	= 0 (clockwise rotation)
IAPFLG	= 0 (no AP present)
ISNFLG	= 0 (no snow)
NVAL	= 5248
NONZIP	= 3222
IMEAN	= 5
ISTDEV	= 99 (standard deviation not calculated)
ITRESH(15)	= 18,25,30,36,39,41,43,44,46,48,49,51,53,55 & 57 (warm season threshold values)

Lines 2 through the end-of-record (EOR) are coded reflectivity category values listed by azimuth. The coding method records (1) the azimuth of the radial with nonzero values, (2) the number of runs at that azimuth, and, for each run at the azimuth, (3) the number of range bins in the run and (4) the reflectivity category value of the run. Azimuths that contain only zeros as reflectivity category values are not coded in an observational record. The user should assume zeros for any noncoded azimuths. A run is defined as a group of range bins with identical reflectivity category values along an azimuth, i.e., a new run starts when the reflectivity category value changes. The total sum of all range bins per radial (10-126 n mi) will always be equal to 116. For example, if a series of 8 range bins along a radial contained the reflectivity values 22221144, there would be 3 runs detected with reflectivity category values of 2, 1, and 4, respectively. This series of 3 runs would then be coded as 42, 21, and 24; where the first number indicates the number of range bins in the run (the run length) and the second the reflectivity category value of the run. As a further example, a portion of Table 4 has been decoded according to the format shown in Table 3 to reveal the following information:

Azimuth	Number of runs	Run	Range Bins	Reflectivity Category value
0	53	1	32	0
		2	1	1
		3	1	0
		4	2	1
		5	1	0
		6	1	1
		7	1	2
		8	1	4
		9	1	2
		10	1	4
		11	1	13
		12	4	15
		13	1	13
		.	.	.
		.	.	.
		.	.	.
		48	2	9
		49	1	3
		50	1	4
		51	2	6
		52	3	1
		53	1	0

6. DATA AVAILABILITY

The National Climatic Data Center (NCDC) will maintain a RADAP II data archive. The initial shipment of data to NCDC was in January 1989 and covered the period 1985 through 1987, as shown in Table 5. Future updates to this archive will be shipped to NCDC twice a year. Each shipment will be timed to cover the preceding 6 month season (warm or cool). An inventory of the days available for each RADAP II site will be included with each data shipment. Interested parties should query NCDC about the availability of data for specific times and RADAP II sites. When requesting copies of archive RADAP II data tapes, address all correspondence to:

National Climatic Data Center (NCDC)
Attn: User Services Branch
Federal Building
Asheville, NC 28801-2696

or call the Customer Service Section on (704) 259-0682 (commercial) or 672-0682 (FTS).

7. ACKNOWLEDGEMENTS

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8. REFERENCES

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McGrew, R. G., 1972: Project D/RADEX (Digitized Radar Experiments). Preprints Fifteenth Radar Meteorology Conference, Champaign-Urbana, Amer. Meteor. Soc., 101-106.

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Table 1. Nominal values of reflectivity thresholds for archived RADAP II data for base-level scans for warm and cool seasons. The actual values used for a given archive scan are included in the header data for that scan. All tilt-sequence scans are archived with warm season category thresholds regardless of the season.

RADAP II category	Warm Season threshold (dBZ)	Cool Season threshold (dBZ)
1	18.5	18
2	24.5	20
3	30.0	22
4	35.5	24
5	38.5	26
6	41.0	28
7	43.0	30
8	44.0	32
9	46.0	34
10	47.5	36
11	49.0	38
12	51.0	40
13	53.0	42
14	55.0	44
15	57.0	46

Table 2. Header information (Part 1) of a RADAP II archive data record.

Bytes	Parameter	Description
1-4	ISTAT	Station identifier. 3 characters + a blank. two 16-bit words (ISTAT(2)) (left-justified)
5-6	IYR	Last two digits of the year.
7-8	IJUL	Julian date.
9-10	IMMDD	Calendar date (MM=month & DD=day).
11-12	ITIME	Hour and minute (HHMM). GMT
13-14	IELEV	Elevation angle (scaled by 10). Deg
15-16	IRINT	Range interval (scaled by 100). n mi
17-18	IMERGR	Ending range for merging higher elevation data with base elevation data. Km
19-20	IMERGA	Elevation angle of the higher elevation data used for merging with base elevation data. (scaled by 10). Deg
21-22	IALT	Station elevation above msl. Ft
23-24	IOBFLG	Type of observation scan. 0=base Level 1=volumetric
25-26	IDRFLG	Rotational direction of antenna during data collection. 0=clockwise 1=counter clockwise
27-28	IAPFLG	Operator indication of Anomalous Propagation (AP). 0=None 1=Some
29-30	ISNFLG	Operator indication of snow. 0=none 1=some
31-32	NVAL	Number of 16-bit words in the input record. Contains the header information (1-34) + coded reflectivity values (35-NVAL).
33-34	NONZIP	Number of nonzero reflectivity values.
35-36	IMEAN	Mean of the nonzero reflectivity values.
37-38		Reserved for future use.
39-68	ITRESH	Threshold reflectivity values. dBZ Fifteen 16-bit words (ITRESH(15)).

Table 3. Specification of coded reflectivity data (Part 2) of a RADAP II archive data record.

Element	Parameter	Description
1	IRADAZ(1)	Azimuth of first radial with nonzero data
2	NGROUP(1)	Number of groups (runs) at this azimuth
3	NBIN(1,1)	Number of bins (run length) in the first run
4	IDVIP(1,1)	RADAP II category value of the first run
5	NBIN(2,1)	Number of bins in the second run
6	IDVIP(2,1)	RADAP II category value of the second run
.	.	.
.	.	.
.	.	.
1+(NGROUP(1)*2)	NBIN(NGROUP(1),1)	Number of bins in the last run
2+(NGROUP(1)*2)	IDVIP(NGROUP(1),1)	RADAP II category value of the last run
3+(NGROUP(1)*2)	IRADAZ(2)	Azimuth of the second nonzero azimuth
4+(NGROUP(1)*2	NGROUP(2)	Number of runs at this azimuth
5+(NGROUP(1)*2)	NBIN(1,2)	Number of bins in the first run
6+(NGROUP(1)*2)	IDVIP(1,2)	RADAP II category value of the first run
.	.	.
.	.	.
.	.	.
NVAL-1	NBIN(NGROUP(n),n)	Run length of last run of last radial
NVAL	IDVIP(NGROUP(n),n)	Run value of the last run of last radial

Table 4. A portion of a sample scan of coded reflectivity data for Oklahoma City, Okla.

OKC 87123 5031000 5X00 60 29 13000000 5248 3222 599 18 25 30 36 39 41 43 44 46 48 49 51 53 55 57

053	32 0	1 1	1 0	2 1	1 0	1 1	1 2	1 4	1 2	1 4	113	415	113	111	515
1 6	1 5	1 8	515	111	1 5	1 6	1 5	111	114	815	113	114	115	111	113
214	1 6	1 5	2 3	1 4	1 9	1 6	110	1 6	1 3	1 7	4 9	311	113	111	3 6
2 9	1 3	1 4	2 6	3 1	1 0	243	41 0	1 1	1 2	1 6	3 9	2 3	1 9	1 6	215
1 8	2 3	1 5	214	515	113	114	715	112	115	213	114	113	111	113	112
1 9	2 1	1 3	1 1	5 3	1 2	1 4	2 6	2 5	3 6	1 4	1 3	3 2	2 3	2 2	2 4
1 1	3 0	447	40 0	2 1	2 0	3 1	2 0	1 1	1 0	1 3	1 4	2 0	2 1	1 4	1 9
315	1 8	815	110	112	1 9	115	112	115	110	1 8	1 6	1 5	1 4	1 3	2 1
1 5	1 3	1 5	1 2	1 3	2 1	1 2	2 3	2 9	1 3	1 2	3 1	1 4	1 3	1 4	1 2
3 1	7 0	633	40 0	2 3	1 1	8 0	2 1	4 0	2 2	2 3	2 2	111	115	114	1015
113	110	1 8	1 7	3 6	1 5	210	2 6	1 4	1 5	3 4	2 6	210	1 2	1 1	3 0
1 7	3 3	2 1	8 0	828	40 0	2 1	9 0	2 1	10 0	1 2	1 4	1 3	1 7	111	915
214	211	214	1 9	211	1 9	1 6	2 5	1 3	1 6	1 4	2 5	2 3	6 0	1 1	1 3
11 0	1031	44 0	3 1	4 0	1 1	1 3	15 0	1 2	1 4	1 6	2 8	1 6	1 8	112	110
1 5	111	1 5	210	1 9	1 6	3 3	1 2	1 3	1 2	1 3	1 4	1 5	2 1	9 0	1 1
11 0	1223	44 0	3 1	4 0	1 2	1 4	22 0	3 1	2 3	2 7	2 5	2 4	1 1	1 3	1 3
1 4	1 3	1 2	1 3	2 1	9 0	1 2	1 1	10 0	14 3	105 0	1 2	10 0	26 3	0 0	2 1
114 0	28 5	0 0	2 3	69 0	3 1	42 0	30 5	0 0	2 2	69 0	3 1	42 0	44 3	29 0	3 3
84 0	46 5	29 0	3 1	76 0	2 1	6 0	48 3	108 0	215	6 0	52 3	106 0	2 1	8 0	54 3
106 0	2 1	8 0	76 3	0	1 1	115 0	146 3	3 0	2 2	111 0	148 3	3 0	2 1	111 0	150 5
89 0	3 1	1 2	1 1	22 0	16216	35 0	2 1	1 3	1 4	1 6	1 7	111	110	1 9	1 5
1 4	1 2	2 1	6 0	1 1	10 0	16421	4 0	1 1	1 2	78 0	1 1	1 3	1 2	1 6	110
113	114	115	314	113	1 6	1 4	1 3	4 4	3 3	3 2	7 0	16629	4 0	2 1	73 0
1 1	1 2	1 1	1 3	1 4	1 6	1 9	1 7	1 8	1 9	1 8	2 6	1 5	110	113	112
114	115	110	2 9	1 5	2 3	1 1	2 0	3 1	1 0	16831	2 0	2 1	41 0	1 4	1 3
1 4	1 3	1 5	37 0	1 1	2 2	4 1	1 2	2 3	1 4	1 7	111	1 9	112	110	1 8
1 7	1 8	112	213	1 9	1 3	2 2	1 1	1 2	1 0	17020	2 0	2 1	41 0	1 2	1 1
1 2	1 1	1 2	42 0	5 1	4 3	2 4	2 6	110	314	312	110	1 9	1 7	1 0	17223
45 0	1 3	1 1	1 3	1 2	1 1	3 0	3 1	7 0	1 2	33 0	4 1	1 2	1 3	1 5	1 6
1 9	113	214	313	212	1 9	1 0	17428	1 0	2 2	41 0	1 1	3 2	1 4	1 1	2 0
1 1	2 4	1 3	1 1	4 0	1 2	1 1	1 3	2 1	35 0	1 1	1 2	2 3	1 4	1 5	1 7
2 9	210	3 8	1 0	17641	1 0	2 2	36 0	2 2	1 1	2 3	1 4	1 5	1 3	1 5	1 6
1 5	1 2	1 3	1 4	1 9	3 4	1 0	4 1	2 0	1 1	12 0	3 1	7 0	3 1	1 2	4 1
2 0	1 1	3 2	1 1	2 2	1 3	2 2	1 3	1 4	2 5	1 6	2 8	1 6	1 0	17838	0 0
3 2	35 0	1 2	1 1	2 3	1 9	212	1 6	1 2	113	215	112	113	2 5	2 4	1 1
1 0	3 3	2 0	1 2	1 1	12 0	2 1	1 2	7 0	1 1	1 2	4 3	1 2	1 1	2 0	7 1
1 2	2 3	5 1	3 2	1 0	18028	0 0	1 1	2 2	32 0	3 1	1 3	1 2	2 3	1 5	2 8
1 7	1 1	315	213	1 2	3 3	7 0	2 1	6 0	2 2	1 1	10 0	2 1	26 0	1 1	1 0
1 1	1 0	18232	0 0	2 1	32 0	1 3	2 1	1 2	1 5	3 8	1 6	2 8	112	1 2	215
113	1 9	1 2	1 0	2 2	14 0	5 1	5 0	2 2	2 1	3 3	1 2	2 3	2 1	1 0	6 1
1 0	2 1	15 0	18447	0 0	1 1	31 0	1 6	1 3	112	1 8	1 5	113	415	113	1 5
1 6	115	110	215	110	1 2	1 1	12 0	1 2	1 1	2 0	1 2	3 4	1 2	1 5	1 5
1 3	1 5	2 1	2 3	2 6	1 8	1 6	1 8	1 4	1 5	1 2	1 1	1 7	212	2 8	1 5
1 3	2 4	15 0	18653	31 0	1 2	114	1 8	114	1 9	114	115	114	415	1 9	1 6
311	115	1 5	1 3	2 1	1 0	5 1	1 3	1 1	1 3	1 1	1 4	1 7	1 2	2 3	1 4
1 6	1 3	212	111	1 5	1 9	1 6	1 8	110	3 3	1 4	3 7	1 5	1 6	2 5	1 6
1 2	1 3	211	110	1 9	1 5	3 4	1 2	14 0	19850	30 0	1 1	1 3	115	1 7	415
1 8	212	1 9	1 8	211	110	1 8	1 7	111	1 6	1 4	1 2	1 0	2 4	1 3	2 5
1 2	8 3	2 6	2 7	1 8	210	1 7	1 6	1 8	1 7	1 6	111	110	2 3	1 5	4 3
1 7	1 1	2 2	1 1	1 4	2 5	1 3	2 4	1 3	1 2	1 3	14 0	19054	28 0	1 3	2 4
114	515	110	1 3	2 6	1 4	4 6	1 5	1 1	1 8	1 6	1 5	1 3	1 2	2 5	2 4
2 5	1 6	1 5	1 6	1 5	1 3	1 2	1 5	1 6	1 5	2 6	210	2 6	1 4	1 3	2 5
1 7	113	111	110	211	110	211	1 8	112	1 6	2 1	1 0	1 1	3 5	2 6	1 2
1 1	1 2	14 0	19255	28 0	2 6	1 7	113	115	114	115	1 6	1 4	3 3	1 2	1 3
4 4	1 1	1 0	1 4	1 9	112	111	1 4	2 9	214	2 8	2 6	1 3	1 3	1 5	1 3
2 6	1 4	1 2	1 3	3 4	1 2	1 7	3 1	1 3	1 5	1 4	1 3	2 6	2 4	1 2	1 3
1 4	1 8	1 1	1 2	1 0	1 1	2 4	1 1	2 2	1 1	15 0	19439	28 0	3 3	5 4	2 3
1 5	2 4	1 5	2 7	212	1 9	1 1	1 8	115	113	110	1 5	2 8	2 7	3 4	4 3
1 1	1 2	1 4	1 3	1 1	3 3	2 1	4 0	1 3	6 0	4 1	1 2	2 1	1 0	1 2	1 1
1 0	2 1	18 0	19625	31 0	1 1	1 4	1 3	2 4	1 2	4 3	1 2	2 3	2 5	1 4	2 3
1 5	1 3	1 8	1 1	1 2	2 4	2 3	1 1	30 0	1 1	3 0	2 1	21 0	19811	31 0	1 3
1 6	1 4	2 7	3 1	1 3	2 5	6 3	4 2	64 0	20020	27 0	1 2	2 3	1 1	1 3	1 7
1 6	110	1 5	1 3	1 2	1 3	2 4	1 3	1 2	2 3	1 2	1 1	2 2	67 0	20218	26 0
1 1	1 3	2 5	1 0	1 1	1 2	1 1	1 2	1 1	1 0	1 1	1 2	1 1	3 3	3 2	3 1
67 0	20415	27 0	3 3	1 0	3 1	4 0	1 3	1 2	2 5	2 3	4 4	1 5	1 4	1 3	1 1
64 0	20618	26 0	1 1	2 3	3 2	1 1	7 0	3 3	1 0	1 1	3 3	1 4	1 3	1 2	1 1
2 0	3 3	1 2	58 0	20818	27 0	3 3	4 2	2 1	1 3	3 0	2 1	2 0	1 1	1 3	1 2
1 3	2 5	2 4	2 2	2 4	2 3	58 0	21022	29 0	2 2	1 3	1 2	1 3	1 9	1 6	1 3
1 1	5 0	1 1	1 3	112	1 3	113	114	1 7	2 5	3 3	1 2	2 1	58 0	21223	29 0
2 1	1 8	111	1 8	211	1 0	3 1	1 2	2 1	1 4	110	114	1 9	114	112	113
1 4	1 5	1 2	2 4	1 3	60 0	21424	26 0	2 2	3 0	1 3	111	1 9	211	2 0	1 1
1 0	3 1	1 3	1 7	1 8	1 7	1 8	1 6	1 4	1 1	1 2	4 1	4 2	1 1	55 0	21631
26 0	2 3	2 2	1 0	1 1	1 5	1 3	1 5	1 6	7 0	1 3	1 5	112	1 9	112	1 5
1 3	1 1	1 4	2 0	1 2	3 5	3 7	1 3	1 4	1 2	1 3	1 1	2 3	1 1	47 0	21321
26 0	1 2	4 3	3 0	1 2	1 3	9 0	1 2	1 1	1 2	2 1	5 0	2 2	2 6	3 3	110
2 1	1 2	2 5	3 1	45 0	22015	26 0	1 1	2 5	2 2	3 0	1 1	1 2	1 3	25 0	1 1
3 0	3 1	1 0	2 1	44 0	22212	26 0	1 2	2 7	1 1	5 0	1 1	1 4	29 0	3 1	2 0

Table 4. Continued.

1 1
1 4
1 4
23023
1 2
1 1
2 3
1 9
1 4
2 2
1 1
1 2
1 0
1 2
248 7
2 1
2 4
1 2
2 2
276 9
1 2
1 2
1 4
28434
1 1
4 3
2 8
2 2
1 2
1 1
1 4
1 0
1 4
1 9
210
1 2
211
1 5
1 1
3 2
1 2
2 2
1 4
2 3
1 3
65 0
1 6
2 1
210
32224
1 1
1 3
1 1
214
1 8
1 3
3 2
1 2
33422
1 4
110
33829
1 7
1 3
1 5
1 4
1 4
113
2 3
1 4
1 2
2 3
4 1
2 5
5 2
515
1 4
1 0
1 5
25 0
1 7
1 5
2 0
111
314
1 8

44 0
212
1 9
22 0
1 4
1 0
1 1
1 1
1 7
2 3
2 3
1 5
2 1
1 0
27 0
70 0
1 1
10 0
69 0
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Table 5. Number of months of data available in the RADAP II seasonal archives as of October 25, 1988. The warm season is defined as March through August and the cool season as September through February.

RADAP II sites	Start date Mo/Yr	1985		1986		1987		1988	
		Warm	Cool	Warm	Cool	Warm	Cool	Warm	Cool
AMA	4/85	4	4	3	0	6	6	6	
BGM	6/88							3	
BNA	4/86			5	5	6	6	6	
CRW	3/85	6	5	6	6	6	6	6	
GCK	4/85	4	0	4	5	6	6	6	
ICT	4/85	5	3	0	2	5	6	6	
JKL	5/86			4	6	5	6	6	
LIC	4/85	5	6	6	1	2	4	6	
OKC	4/85	5	4	5	5	6	6	6	
PIT	6/85	3	3	6	5	6	6	6	
TBW	4/85	3	5	4	2	5	6	6	
UMN	4/85	3	4	5	2	2	6	6	

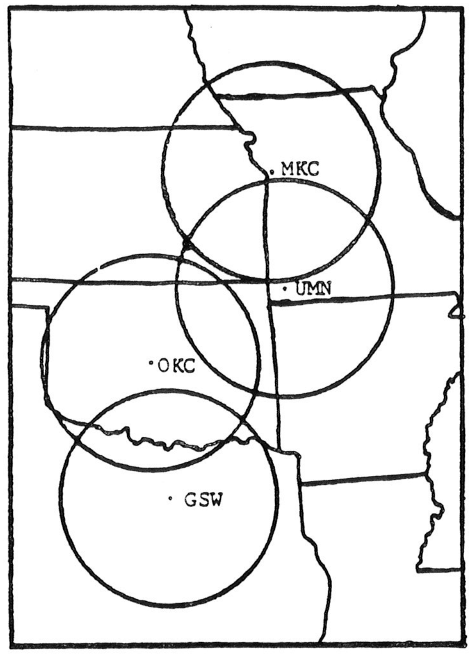

Fig. 1. D/RADEX Test Bed.

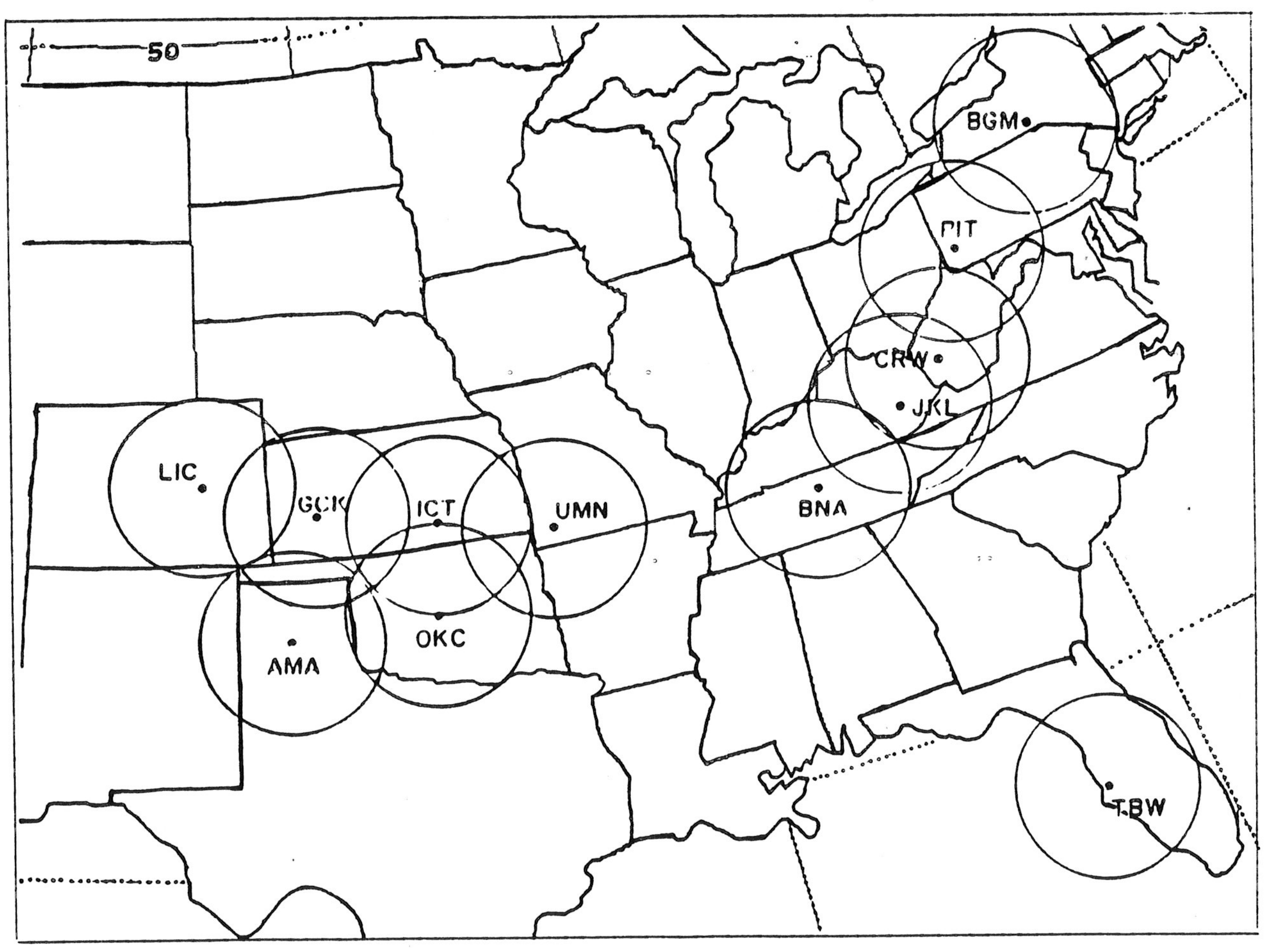

Fig. 2. RADAP II network. Circles represent 125 n.m. surveillance region.

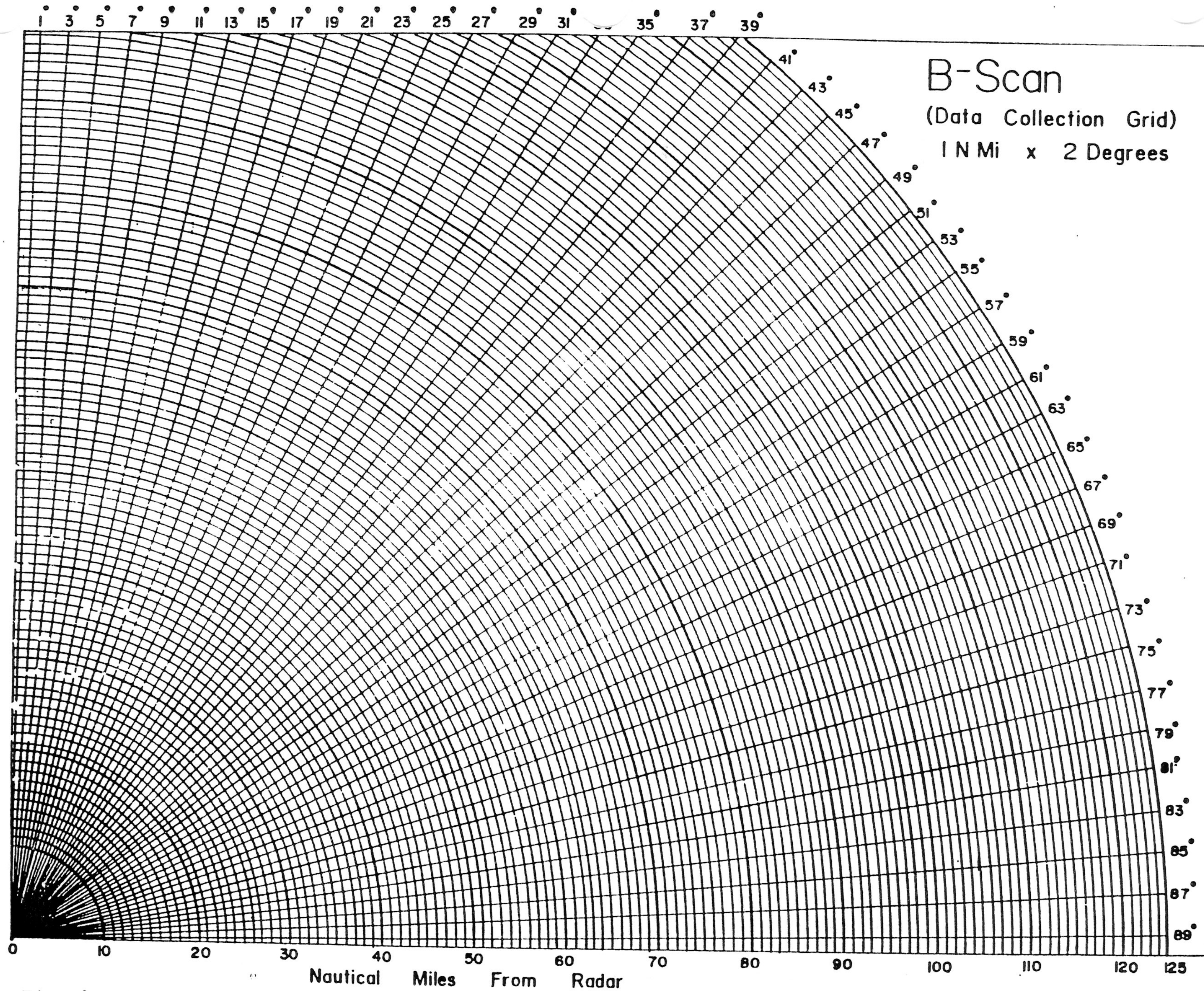

Fig. 3. Diagram illustrating geometry of RADAP II data bin grid.

```
STATION= OKC       DATE= 870503      TIME= 1000      NVAL=  5248

     12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456
  0:                                 1 11 12424DFFFFDBFFFFF658FFFFB565BFFFFFFFFFDEFBDEE6533496A6379999BBBDB66699346611 1
  2:                                          1269993396FF8335EEFFFFFFDEFFFFFFFFCFDDEDBDC9113133333246655666432223322441
  4:                                         11  111  1 34  1149FFF8FFFFFFFFFAC9FCFA8654311535231123399321114342111
  6:                                         331        11     223322BFEFFFFFFFFFFFDA876665AA664544466AA21     733311
  8:                                         11         11           2437DFFFFFFFFFFEEBBEE9BB96553645533     13
 10:                                             111    13                2468868CA5B5AA9633323234511        1
 12:                                             111    24                       11133775544138432311        21
 14:                                                                                                          2
 26:11
 28:33                                                                      111
 30:22                                                                      111
 44:                              333
 46:                              111                                                                             11
 48:                                                                                                              FF
 52:                                                                                                            11
 54:                                                                                                            11
 76:1
146:   22
148:   11
160:                                                                                          11121
162:                                                                                      113467BA954211       1
164:    12                                                                               1326ADFFEEED643444433322
166:    11                                                                               12134697898665ADCFFA995331   111
168:  11                                          43435                                     1221111233478 9CAA78CDD932212
170:  11                                          21212                                          1111133334466AFFECCCA97
172:                                              31321   111       2                                 111123569DFEDDDCC9
174: 22                                         122241  14431    21311                                    123345799AA88A
176: 22                                    221334535652349444 1111  1            111      11121111  122212232234556806
178:222                                    21339CC62DFFCD55441 333  21            112      12333321  111111233111111222
180:122                                111323358871FFFDD2333        11      221          11                          1 1
182:11                                311258806688C2FFD92 22              11111    2211333233311 111111 11
184:1                               63CA5DFFFFD56FAFFA21           21   2444442523511336686845217CC885344
186:                               2E8F9EFEFFFF96D8BF5311 111113131472334 68CCB5968A3334777565562 3DBA954442
188:                              13F7FFFFACC9ABDA87B642 443552333333336677 8AA76876BA335888871221466344323
190:                            344EFFFFFA36646666518653255445565653256566AA6643557DDABBADB8C611 155566212
192:                            667DFEF643332344441 49CB499EE88668353664234442711135436644234812 1441221
194:                            333444443354457 7CC918FDA58877444333312431333 11      3      1111211 21 11
196:                              1434423333233554335381244331                            1   11
198:                              36477111355333332222
200:                          2331376A53234432332122
```

Fig. 4. Radial display of reflectivity categories.

```
           1355 12121 121333222111
204:        333 111     32663344445431
206:       1332221       333 13334321  3332
208.        3332222113    11  13235544224433
210:          223539631      13C3DE755333211
212:          1188888 1112114AE8ECD452443
214:       22   3B9BP  1 11137A7864121111222221
216:       3322 15356        35C9C6314  25557773423133l
218:       23333   23          21211      2266333A11255111
220:       15522   123                              1    111 11
222:       2771      14                                  111  1
224:     112377443
226:    37554CCEE6              11            11
228:    2A31249FFE1 132         333        2344
230:    266 2568BA65321      246622     12
232:    24  44446CCC1 21  BBFF9551    21
234:        3316AEE5215  38ADDCC191    221
236:        555AA884845  4789AA94D8     11 11
238:        22332223543  2334555149       133
240:       221 11223335 33333222 25        33
242:       443 11221243 13322133323        33
244:       111       12  112211111 3
246:        22            11 11
248:        11            11277
250:                        233
262:                         2211
264:            221          1222
266:    12     1441           144                      11
268:    16     14432            122                    22
270:    381      3333           122
272:    252      1221
274:     1
276:      1244                1221
278:       13311              23332
280:        2211      1 121   12333  1211
282:           11   1 112643355111124333233   1 1        111
284:            122C2C   143DDC511   12134AAA5113234    13311333311
286:      11 3888F3F52    58845541    333355446631    11221122131
288:    B421322885B2BC1       24885343234214433444 21   11455
290:    33A34FFAAA99A51       33111194 211 11 2133      22
292:    22666BRARDBB431                1
294:    1224669ADDC9321 21
296:     1349969AA9944111111
298:      14CDD556666666AA77442331
```

Fig. 4. Continued.

```
300:        15DDA68DDB7AABB8BB75442       1
302:        3266445888566573566543138 1211
304:        11221222222 123 111222 26 334122
306:        1122112231311 1            1 111
308:         121221142433 211  11        11
310:         1366333434454444311111
312:          266443333133233212333 2
314:          235542333231211332333421
316:          1255333332532 33344626322
318:          2333344423421 22211313 11
320:         1233447A8AA733 73312211 111331133111
322:        1334424FFFFFF6589D855333 1344431333441
324:       124366327FFFFFD9FFFFF97545354421  11111
326:       11879923AEFFFDEEFFEEEA64464632222211
328:        38A54447CBC4B87554344432353211111
330:         4666665442122212  22221131
332:        1455555533121221 22  23231     1113311
334:        136666331112264333223776343222443355 5
336:       1123883223333AD744455AA8B555F8333355533 1
338:       1224422233858CFFEB98799885CAC9443335522111
340:        35522335D6FFFEFB98775858AB844555344 2211
342:        3543334454 5DFE955558864 8A46444553332211
344:       34888769DEEC6FFF7655886366359553321     1
346:       658DAADD88864FFFA773447379337535 5321  111111
348:       336BAFFF8888BFFF688665555C749853322221333432 1111
350:        3369FFFBEEBFFEBDCC556664586D6442235552232 33222221
352:       1323444288 55DBDFFFFF98FE85A394331332424   24223331111 11      111
354:        211 1113858969BFFFFFFFFB43366951133333   2223445554733 3111 111   1
356:             111353568CFCFFFFFFFC579BC651248884111311333252 54A587993213 31111  111111 211121111
358:                 11117388888FFFFFFCFFFFA337CEFFC323266EEEDEDFFCDFFFFF677438798 33880554808FA675DD5511:
```

```
ISTA= OKC                            IYR= 87                    IJUL= 123
IMMDD=  503                        ITIME= 1000                 IELEV=   5
IRINT= 100                         IMERGR=   60                IMERGA=  29
IALT=  1300                        IORFLG= 0                   IDRFLG= 0
IAPLG= 0                           ISNFLG= 0                   NVAL=  5248
NONZIP=  3222                      IMEAN=   5                  IFLAG= 99
ITRESH=  18 25 30 36 39 41 43 44 46 48 49 51 53 55 57
```

Fig. 4. Continued.