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ILLINOIS STATE WATER SURVEY
Meteorologic Laboratory
at the
University of Illinois
Urbana, Illinois

# INVESTIGATION OP THE QUANTITATIVE DETERMINATION OP POINT AND AREAL PRECIPITATION BY RADAR ECHO MEASUREMENTS

Eighth Quarterly Technical Report
1 July 1963 - 30 September 1963

Sponsored by
U. S. Array Electronics Research and Development Laboratory
Port Monmouth, New Jersey

CONTRACT NO. DA-36-039 SC-87280

DA Task 3A99-07-001-01

AD ______ Accession No. ______

Illinois State Water Survey Division, Urbana, Illinois. INVESTIGATION OF THE QUANTITATIVE DETERMINATION OF POINT AND AREAL PRECIPITATION BY RADAR ECHO MEASUREMENTS - E. A. Mueller and A. L. Sims

Q. Tech. Report No. 8, 1 Jul. 1963 - 30 Sep. 1963 14 pps. (Contract DA-36-039 SC-87280) DA Task 3A99-07-001-01, Unclassified Report.

Two drop cameras were operated in Illinois and one at Flagstaff, Arizona. Data obtained from these installations are being reduced and analyzed.

The rainfall rate-radar reflectivity relationships are summarized. The data from Miami, Florida, has been stratified by synoptic type, rainfall type, and by a measure of the instability.

A brief description of an objective means of coalescence curve fitting is described.

UNCLASSIFIED

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2. Drop Size Distribution
3. Coalescence Theory
4. Contract DA-36-039 SC-87280

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1 July 1963 - 30 September 1963

Signal Corps Contract: DA-36-039 SC-87280

DA Task 3A99-07-001-01

Sponsored by

U. S. Army
Electronics Research and Development Laboratory
Port Monmouth, New Jersey

To record and analyze data on raindrop-size distribution in various parts of the world. These data will be correlated with appropriate radar parameters in order to improve the capability of radar in measuring surface rainfall intensities for Army applications such as radioactive rainout prediction, trafficability, and communications.

Prepared by

A. L. Sims
Meteorologist

E. A. Mueller
Project Engineer

G. E. Stout
Project Director

T. E, Larson, Acting Chief
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# TABLE OP CONTENTS

Page

PURPOSE . . . . . . . . . . . . . . . . . . . . . . . . 1

ABSTRACT . . . . . . . . . . . . . . . . . . . . . . . . 1

PUBLICATIONS, LECTURES, REPORTS, AND CONFERENCES . . . . 2

RADAR OPERATIONAL PROGRAM . . . . . . . . . . . . . . . 2

- CPS-9 . . . . . . . . . . . . . . . . . . . . . . . . 2
- TPS-10 . . . . . . . . . . . . . . . . . . . . . . . . 2
- M-33 . . . . . . . . . . . . . . . . . . . . . . . . . 2

RAINDROP CAMERAS . . . . . . . . . . . . . . . . . . . . 3

- Illinois . . . . . . . . . . . . . . . . . . . . . . . 3
- Arizona . . . . . . . . . . . . . . . . . . . . . . . 3

DATA ANALYSIS . . . . . . . . . . . . . . . . . . . . . 4

- Raindrop Data Reduction . . . . . . . . . . . . . . . 4
- R-Z Relationships . . . . . . . . . . . . . . . . . . 5
- Coalescence Curve Pitting . . . . . . . . . . . . . . 10

SUMMARY AND CONCLUSIONS . . . . . . . . . . . . . . . . 12

PERSONNEL . . . . . . . . . . . . . . . . . . . . . . . 13

## PURPOSE

The object of this research is to study the utility of radar equipment in measuring surface precipitation and to improve radar techniques in measuring precipitation for application by the Army to radioactive rainout prediction, trafficability, and communications. Considerable effort is being directed toward determining the correlation between radar variables and actual rainfall quantities by means of raindrop-size distribution.

## ABSTRACT

The drop camera installation at Flagstaff, Arizona, produced 26 rolls of raindrop data. This data is in general of rather poor quality. The network cameras operating in Illinois produced excellent data for at least seven shower and thundershower situations and three continuous rain cases. These data have been selected for comprehensive analysis. There are other data from the Illinois network which can be utilized if deemed desirable later.

The rainfall rate-radar reflectivity relationships are summarized. The data from Miami, Florida, has been stratified by synoptic type, rainfall type and by a measure of the instability.

A brief description of an objective means of coalescence curve fitting is described.

## PUBLICATIONS, LECTURES, REPORTS, AND CONFERENCES

Between July 5, 1963, and July 13, 1963, Mr. E. A. Mueller was in Flagstaff, Arizona, installing a raindrop camera.

Between August 6, 1963, and August 8, 1963, Mr. A. L. Sims was in Flagstaff, Arizona, to perform drop camera maintenance and visit the cooperative projects in the area.

Mr. Glenn E. Stout visited Flagstaff to supervise the removal of the camera on August 23, 1963.

On August 14 and 15, 1963, Mr. Joseph Walsh of Evans Research and Development Laboratory visited the Meteorological Laboratory. The present status of the contract research was reported.

## RADAR OPERATIONAL PROGRAM

### CPS-9

The CPS-9 has been operated for 243 hours during the period. The slip ring assembly has not as yet been repaired but this will be accomplished during October. No difficulties have been experienced during the quarter.

### TPS-10

The TPS-10 has been used during the quarter for data collection. No difficulties have been experienced.

### M-33

The M-33 track radar is operative and was used to track balloons and for a few vertical reflectivity profiles. This radar has not been used routinely for data collection.

## RAINDROP CAMERAS

### Illinois

Raindrop camera operations in the East Central Illinois Raingage Network were suspended on September 3, 1963. The cameras and electrical systems were returned to the laboratory for storage, and for refurbishing prior to next summer's operations. Also, one of the mirrors was brought in to be resurfaced before next season. The shelters have been left in place for possible future use in these locations.

The cameras in Illinois operated satisfactorily. Only a very little data was missed due to equipment failure. Greater difficulty was encountered in keeping clocks wound and film replaced, due to the remote location of the cameras. This situation can be improved by the installation of electric clocks on all cameras.

A total of 63 rolls of data was collected,, These data were collected on 31 days between April 16 and September 2, 1963.

### Arizona

A camera was operated at Flagstaff, Arizona, from July 12 to August 22, 1963. Considerable difficulty was encountered in this operation. A malfunctioning film magazine spoiled a few rolls at first. It was also observed from the early rolls that the alignment and focus were not satisfactory. This may have been caused by shifting of the shelters in the loose soil. An attempt was made to correct these problems in early August; however, the refocusing was not completely successful. A total of 26 rolls of film was exposed; it is hoped that it may be possible to reduce some data from these rolls, even though the general quality is poor.

The camera appeared to be somewhat poorly located in relation to the rainfall pattern during the summer. Only about six showers of significant rates and amounts occurred at the camera, although many heavy showers occurred in the general area.

On August 23, 1963, the Arizona installation was dismantled. The shelter was stored at the Museum of Northern Arizona Research Center for the winter. The camera and electrical system were returned to the Meteorological Laboratory. The parabolic mirror is now being resurfaced.

## DATA ANALYSIS

### Raindrop Data Reduction

A total of 16 rolls of raindrop data was measured. Pour of these rolls were obtained from Island Beach, New Jersey; six from Coweeta, North Carolina; and six from this summer's operations in Illinois. Both measuring tables have been shifted to Illinois data; it is anticipated that one will be used for the Arizona data soon.

All the Illinois film has been developed and reviewed. Present plans call for measuring 23 rolls of this data. This will cover the seven most promising shower and thundershower situations and three continuous rain situations. For four of the shower and thundershower situations, data from all three cameras and the radars were obtained. Depending on the results of early data analysis, other rolls of the Illinois data may be selected for detailed study.

The Arizona film has been developed and eight rolls have been reviewed preparatory to measuring. Results of attempts to measure these data will determine to what extent the remainder of these data will be reduced.

## R-Z Relationships

Earlier work reported on in Seventh Quarterly Technical Report, under DA-36-039 SC-75055, obtained relationships for Z with R using a different criterium than logarithmic least squares. Further work was undertaken, and in this report is tabulated the best relationships between rainfall rate and radar reflectivity which have been found from the raindrop data. A number of different stratifications of the data were made to investigate the means which produce rainfall estimates with minimum error. All of the stratifications are reported so that a user can select the most convenient, depending upon the data available.

Three methods have been adopted for determining the best estimate of the rainfall rate, R, for a particular value of radar reflectivity, Z. These consist of the standard logarithmic least squares with R dependent; the average value of R for each 1 db interval of Z; and minimizing $\sum_i R_i \left| R_i - R^* \right|$ where R* is the estimate and $R_i$ are observed points. Since the latter two methods do not produce an equation as a final product, tabulated values of R for each Z interval are found in Figures 1, 2, 3, 4, and 5.

In these figures, the column labeled Z is the radar reflectivity defined as $\sum D^6$ over the unit volume of one cubic meter. The units of this column are 10's of $mm^6/m^3$ (first entry Pig. 1 of 11.2 represents 112 $mm^6/m^3$). The Z intervals are one decibel apart and each row contains the data points whose Z values lie from 0.5 db below the indicated value to 0.5 db above the indicated value. It can be noted that some of the intervals are always empty. This is due to the necessity of rounding and recording Z on cards as 000001 and 000002 which are 3 db apart. The second column is the best estimate of the rainfall rate, R*, subject to the minimization of $S = \sum_i R_i \left| R_i - R^* \right|$. This criteria tends to produce estimates of R which are weighted towards the higher rates and, thus, produces a tendency to overestimate more than underestimate. Columns 3 and 5 are the minimum and maximum rainfall rates for each of the Z intervals. The column headed R AVE is the average R defined as $\frac{1}{N} \sum_i^N R_i$, where N represents the number of samples in each interval. The column labeled S is the minimum sum corresponding to the R* reported. The columns labeled UNDER and OVER represent the extremes of error possible within the data set and are defined as

$$(\text{UNDER}) = \frac{R\ MAX - R^*}{R^*}$$

$$(\text{OVER}) = \frac{R^* - R\ MIN}{R^*}$$

The rainfall rate data from Miami and Majuro were rounded to nearest mm/hr and entered on cards before this analysis was performed. It can be noted that a number of the lower Z intervals

# TABLE 1

## CONSTANTS FOR LOGARITHMIC LEAST SQUARES PIT FOR MIAMI ($Z = AR^b$)

| Stratification | Type | A | b |
|---|---|---|---|
| Synoptic | air mass | 323 | 1.42 |
| " | pre-cold front | 280 | 1.49 |
| " | cold front | 198 | 1.54 |
| " | overrunning | 302 | 1.36 |
| " | warm front | 403 | 1.24 |
| " | easterly wave | 296 | 1.35 |
| " | trough aloft | 26l | 1.43 |
| " | pre-cold occlusion | 330 | 1.66 |
| Positive Area Stability | negative | 257 | 1.27 |
| " | zero | 352 | 1.38 |
| " | 1-25 | 358 | 1.31 |
| " | 26-50 | 420 | 1.41 |
| " | 51-100 | 206 | 1.42 |
| " | 101-150 | 313 | 1.39 |
| " | 151-200 | 304 | 1.41 |
| " | 201-300 | 307 | 1.41 |
| " | 301-400 | 295 | 1.36 |
| " | 400 | 264 | 1.40 |
| Storm Type | continuous rain | 322 | 1.34 |
| " | rain showers | 258 | 1.45 |
| " | thunderstorms | 338 | 1.35 |

repeat values of R* = 1.0. It is apparent that if this region is of interest, a recalculation from the original drop size measurements to obtain lower readings of R will be necessary,

TABLE 2

EXAMPLES OP STORM CALCULATIONS USING
THREE METHODS OP PREDICTION

| Date | Syn. Type | PASI Type | Amount mm | Syn. R* | PASI R* | Syn. least sq. |
|---|---|---|---|---|---|---|
| 8/28/57 | Easterly Wave | 300-400 | 31 | 28% hi | 19% hi | 16% hi |
| 5/5/58 | Easterly Wave | 151-200 | 62 | 4% hi | 4% 10 | 5% 10 |
| 5/23/58 | Easterly Wave | 26-50 | 50 | 1% 10 | 4% 10 | 23% 10 |
| 11/27/57 | Warm Front | 200-300 | 44 | 15% 10 | 20% 10 | 27% 10 |
| 12/23/57 | Warm Front | 1-25 | 36 | 10% hi | 10% hi | .4% hi |

Examinations of the tables in the figures 1-5 lead to qualitative verification of the benefits to be derived from stratification of the data. It can be noted that the average OVER and UNDER values listed in Fig. 4 for all of Miami are, in general, larger than the values listed in Pigs. 1 and 2. Admittedly, this is only a qualitative verification because of the sensitivity to the maximum and minimum value in each interval as a function of sample size.

A better measure of the adequacy of these relations can be obtained by selecting a sample storm and computing the rainfall amount using the appropriate relations. The data for this study were, unfortunately, not independent. That is, each of the storms reported in Table 2 were also utilized in the derivation of the equations and figures.

The method adopted for deriving Table 2 consisted of choosing 5 storms averaging about one hour in duration. These storms were then classified according to synoptic type. The Z value for each minute determines an estimated R by means of the appropriate table. It is assumed that this rate represents the one-minute rate which would be measured if a radar had been available for measuring the Z value. The R values are then time integrated to obtain the rainfall quantity as would have been measured by a radar and the particular R-Z relationship. The measured R's from the drop size distributions are time integrated to obtain the rainfall amount which is considered the true amount. This value is listed in amount column in Table 2. The amount calculated from the Z values are then compared with the true values and percentage over and underestimates are listed under the headings which describe the particular R-Z relationship used.

The percentage errors indicate the order of magnitude of accuracy which might be expected in determining rainfall amounts due to drop size variations and assuming no additional error in the radar measurement of Z. It should be pointed out that these accuracies pertain to storm amounts as obtained by the time integration. Individual samples produce errors that are much larger, but fortunately these tend to cancel with the time integration.

It may be noted that, in general, if one of the estimates is high, they all tend to be high. Therefore, one might continue to seek a more appropriate means of stratifying the data with the hope of finding all of the "low storms" grouped together. Efforts to find some common parameter by looking at the "low storms" have failed thus far, but continued effort in this direction will be maintained.

## Coalescence Curve Fitting

In further investigation of the coalescence parameters from the Majuro data, it was felt that the parameters were so subjective because of the fitting technique that conclusions were doubtful. A new attempt to define an objective means of curve fitting was sought. A method has been devised which required knowledge of the location of the mode of the distribution, the value at the mode and the total number of drops.

Consider the equation

$$N_D = \alpha (D-D_o)^2 \quad e^{-\beta(D-D_o)^3} \tag{1}$$

where $D$ = diameter of a drop

$N_D$ = the number of drops of diameter $D$

$D_O$, $\alpha$, $\beta$ are the fitting parameters.

The total number of drops in the distribution is then

$$N_T = \int_0^\infty N_D \quad dD = \int_0^\infty \alpha(D-D_o)^2 \; e^{-\beta(D-D_o)^3} \, dD \tag{2}$$

$$= \frac{\alpha}{3\beta} \quad ,$$

If Equation (1) is differentiated with respect to D, set equal to zero, and solved for D, an expression of the location of the mode is obtained

$$\frac{dN_D}{dD} = 0 = -3\beta({}^*D-D_o)^3 + 2 \qquad (3)$$

so

$$({}^*D-D_o)^3 = \frac{2}{3}$$

If this value for $({}^*D-D_O)^3$ is substituted into (1), the height of mode ${}^*N_D$ is obtained

$${}^*N_D = \alpha\left(\frac{2}{3\beta}\right)^{2/3} e^{-2/3}$$

If it is now assumed that $N_T$ and ${}^*N_D$ can be obtained from the data, (4) and (2) can be solved to find $\alpha$ and $\beta$.

$${}^*N_D = 3N_T\beta\left(\frac{2}{3\beta}\right)^{2/3} e^{-2/3}$$

$$\beta = \frac{e^2}{12}\left(\frac{{}^*N_D}{N_T}\right)^3 \qquad (5)$$

$$\alpha = \frac{e^2}{4}\left(\frac{{}^*N_D}{N_T}\right)^3 N_T \qquad (6)$$

The $D_O$ can then be determined if the location of the mode, $^*D$, is known. Prom (3),

$$({}^*D-D_o)^3 = \frac{2}{3\beta}$$

$$D_o = {}^*D - \frac{2N_T}{{}^*N_D} e^{-2/3} \qquad (7)$$

The problem has now been reduced to an objective scheme for estimating $^*N_D$ and $^*D$ as $N_T$ is easily estimated by summing the individual $N_D$'s.

The method which has been tried so far is inadequate. This consists of determining $^*D$ by performing running averages of N over three intervals, choosing the largest running sum, and then setting $^*D$ to the value of D represented by the center of the three intervals in the maximum sum. The value of $*N_D$ is then chosen as the corresponding $N_D$ to *D. Figure 6 illustrates three curves fitted by this technique. Figure 6a shows a good fit, Figure 6b an acceptable fit, but 6c a very poor fit. The estimated values of $*_D$ and $*N_D$ are both too small. A better fit could have been obtained if *D had been estimated at 1.4 instead of 1.1 and $*N_D$ at 170 instead of 135. Efforts to obtain better estimates of these parameters will be continued.

## SUMMARY AND CONCLUSIONS

The raindrop cameras on the East Central Illinois Network operated well, and sufficient data were obtained to perform analysis on at least seven showers and three continuous rains. The network has been closed for the winter, and the decision as to reopening in the spring has been delayed pending the results of the analysis. The camera data collection at Flagstaff, Arizona, was not completely successful in part because the storms this season missed the camera location and in part because of faulty camera operation. If this phase of the study is continued, it is recommended that a location for the camera be chosen that is much closer to the mountain peaks where the majority of the rainfall occurred.

Results of radar reflectivity-rainfall rate relationships show that better means of data stratification are highly desirable. Since in most cases when a storm is chosen and amounts calculated from the measured Z, the estimates tend to be either all high or all low regardless of which method of R estimation is used, there is a strong likelihood that a better method of stratifying exists. Other means of stratification will be examined.

The procedure outlined for obtaining coalescence curve fitting will be modified. An improved method of estimating the mode location and height will be incorporated. This objective technique will then be used to estimate the coalescence parameters previously reported. It is believed that more order should be apparent in the parameters when they are determined objectively,

## PERSONNEL

The following personnel were engaged in the research during the eighth quarter:

| Name and Title | Starting Date | Hours Worked | Terminated |
|---|---|---|---|
| G. E. Stout<br>Project Director | 10/l/6l | 70 | |
| Eugene A. Mueller<br>Electronic Engineer | 10/l/6l | 510 | |
| Arthur L. Sims<br>Research Assistant | 5/13/63 | 510 | |
| Alfred S. Davis<br>Research Assistant | 6/10/63 | 104 | 8/28/63 |
| Stanley G. Peery<br>Electronics Technician II | 3/1/63 | 510 | |
| Victor Munson<br>Electronics Technician I | 3/11/63 | 340 | 8/31/63 |
| Andre H. Changnon<br>Engineering Assistant | 4/1/63 | | 5/31/63 |

| Name and Title | Starting Date | Hours Worked | Terminated |
|---|---|---|---|
| Robert D. Vogt<br>Scientific Assistant | 8/12/63 | 128 | |
| Marian E. Adair<br>Meteorological Aide I | 9/24/62 | 85 | |
| Edna M. Anderson<br>Meteorological Aide I | 10/l/6l | 510 | |
| Dorothy A. Tew<br>Meteorological Aide I | 10/l/6l | 340 | 8/31/63 |
| Ileah W. Trover<br>Meteorological Aide I | 9/10/62 | 255 | |
| Nazir Ansari<br>Statistical Clerk | 10/l/6l | 121 | 8/2/63 |
| Gerald W. Swanson<br>Statistical Clerk | 9/19/63 | 18 | |
| Michael K. Robinson<br>Laboratory Assistant | 5/27/63 | 184 | 9/16/63 |
| Karen Sue Adair<br>Laboratory Helper | 6/17/63 | 377 | |

N=409 MIAMI PASI NEGATIVE

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 11.2 | 1.0 | 1.0 | 1.0 | 1.0 | 1 | .0 | .00 | .00 |
| 14.1 | | | | | | | | |
| 17.8 | | | | | | | | |
| 22.4 | 1.0 | 1.0 | 1.0 | 1.0 | 12 | .0 | .00 | .00 |
| 28.2 | 1.0 | 1.0 | 1.1 | 2.0 | 17 | 4.0 | 1.00 | .00 |
| 35.5 | | | | | | | | |
| 44.7 | 2.0 | 1.0 | 1.4 | 2.0 | 22 | 13.0 | .00 | .50 |
| 56.2 | 2.0 | 1.0 | 1.5 | 2.0 | 11 | 5.0 | .00 | .50 |
| 70.8 | 2.0 | 1.0 | 1.7 | 3.0 | 11 | 7.0 | .50 | .50 |
| 89.1 | 3.0 | 1.0 | 2.3 | 4.0 | 16 | 22.0 | .33 | .67 |
| 112.2 | 2.0 | 2.0 | 2.4 | 4.0 | 19 | 23.0 | 1.00 | .00 |
| 141.3 | 4.0 | 1.0 | 3.7 | 6.0 | 19 | 65.0 | .50 | .75 |
| 177.8 | 4.0 | 2.0 | 4.3 | 7.0 | 23 | 118.0 | .75 | .50 |
| 223.9 | 4.0 | 3.0 | 4.6 | 9.0 | 34 | 180.0 | 1.25 | .25 |
| 281.8 | 6.0 | 3.0 | 5.3 | 8.0 | 18 | 123.0 | .33 | .50 |
| 354.8 | 7.0 | 2.0 | 6.3 | 11.0 | 26 | 308.0 | .57 | .71 |
| 446.7 | 9.0 | 3.0 | 7.8 | 13.0 | 27 | 442.0 | .44 | .67 |
| 562.3 | 11.0 | 2.0 | 9.5 | 18.0 | 22 | 543.0 | .64 | .82 |
| 707.9 | 11.0 | 3.0 | 10.6 | 16.0 | 16 | 427.0 | .45 | .73 |
| 891.3 | 15.0 | 4.0 | 12.8 | 21.0 | 25 | 1092.0 | .40 | .73 |
| 1122.0 | 14.0 | 4.0 | 12.3 | 22.0 | 16 | 689.0 | .57 | .71 |
| 1412.5 | 24.0 | 12.0 | 20.6 | 29.0 | 9 | 475.0 | .21 | .50 |
| 1778.3 | 33.0 | 13.0 | 22.9 | 37.0 | 11 | 2053.0 | .12 | .61 |
| 2238.7 | 27.0 | 15.0 | 24.4 | 40.0 | 7 | 1108.0 | .48 | .44 |
| 2818.4 | 37.0 | 29.0 | 33.0 | 37.0 | 7 | 232.0 | .00 | .22 |
| 3548.1 | 33.0 | 10.0 | 24.3 | 44.0 | 6 | 1412.0 | .33 | .70 |
| 4466.8 | 38.0 | 25.0 | 36.7 | 47.0 | 4 | 785.0 | .24 | .34 |
| 5623.4 | 44.0 | 19.0 | 36.7 | 47.0 | 4 | 875.0 | .07 | .57 |
| 7079.4 | 87.0 | 61.0 | 74.0 | 87.0 | 2 | 1586.0 | .00 | .30 |
| 8912.5 | 59.0 | 18.0 | 46.4 | 74.0 | 8 | 4954.0 | .25 | .69 |
| 11220.2 | 65.0 | 40.0 | 52.5 | 65.0 | 2 | 1005.0 | .00 | .38 |
| 14125.4 | 99.0 | 63.0 | 81.0 | 99.0 | 2 | 2268.0 | .00 | .36 |
| 17782.8 | 77.0 | 49.0 | 63.0 | 77.0 | 2 | 1372.0 | .00 | .36 |
| 22387.2 | 110.0 | 91.0 | 100.5 | 110.0 | 2 | 1729.0 | .00 | .17 |
| 28183.8 | 130.0 | 81.0 | 140.3 | 210.0 | 3 | 20769.0 | .62 | .38 |
| 35481.3 | 173.0 | 173.0 | 173.0 | 173.0 | 1 | .0 | .00 | .00 |
| 44668.3 | 212.0 | 115.0 | 211.0 | 306.0 | 3 | 39417.0 | .44 | .46 |
| 56234.0 | 319.0 | 319.0 | 319.0 | 319.0 | 1 | .0 | .00 | .00 |
| 70794.5 | 324.0 | 181.0 | 252.5 | 324.0 | 2 | 25883.0 | .00 | .44 |
| 89124.9 | 466.0 | 466.0 | 466.0 | 466.0 | 1 | .0 | .00 | .00 |
| 112201.7 | | | | | | | | |
| 141253.5 | 722.0 | 566.0 | 644.0 | 722.0 | 2 | 88296.0 | .00 | .22 |

N=189 MIAMI PASI 0

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 11.2 | 1.0 | 1.0 | 1.0 | 1.0 | 1 | .0 | .00 | .00 |
| 14.1 | | | | | | | | |
| 17.8 | | | | | | | | |
| 22.4 | 1.0 | 1.0 | 1.0 | 1.0 | 3 | .0 | .00 | .00 |
| 28.2 | 1.0 | 1.0 | 1.0 | 1.0 | 2 | .0 | .00 | .00 |
| 35.5 | | | | | | | | |
| 44.7 | 1.0 | 1.0 | 1.2 | 2.0 | 5 | 2.0 | 1.00 | .00 |
| 56.2 | 2.0 | 1.0 | 1.3 | 2.0 | 3 | 2.0 | .00 | .50 |
| 70.8 | 2.0 | 1.0 | 1.6 | 2.0 | 5 | 2.0 | .00 | .50 |
| 89.1 | 3.0 | 2.0 | 2.5 | 3.0 | 2 | 2.0 | .00 | .33 |
| 112.2 | 2.0 | 1.0 | 2.0 | 3.0 | 6 | 4.0 | .50 | .50 |
| 141.3 | 3.0 | 2.0 | 2.5 | 3.0 | 2 | 2.0 | .00 | .33 |
| 177.8 | 4.0 | 2.0 | 3.5 | 5.0 | 6 | 15.0 | .25 | .50 |
| 223.9 | 4.0 | 2.0 | 3.5 | 5.0 | 14 | 33.0 | .25 | .50 |
| 281.8 | 5.0 | 3.0 | 4.7 | 7.0 | 9 | 53.0 | .40 | .40 |
| 354.8 | 5.0 | 3.0 | 5.3 | 9.0 | 14 | 98.0 | .80 | .40 |
| 446.7 | 6.0 | 4.0 | 5.7 | 9.0 | 15 | 106.0 | .50 | .33 |
| 562.3 | 8.0 | 2.0 | 7.5 | 13.0 | 15 | 236.0 | .62 | .75 |
| 707.9 | 9.0 | 4.0 | 8.1 | 15.0 | 12 | 232.0 | .67 | .56 |
| 891.3 | 9.0 | 7.0 | 9.4 | 19.0 | 10 | 252.0 | 1.11 | .22 |
| 1122.0 | 11.0 | 6.0 | 10.5 | 15.0 | 10 | 188.0 | .36 | .45 |
| 1412.5 | 19.0 | 17.0 | 18.7 | 22.0 | 4 | 134.0 | .16 | .11 |
| 1778.3 | 21.0 | 15.0 | 19.7 | 26.0 | 6 | 348.0 | .24 | .29 |
| 2238.7 | 33.0 | 4.0 | 25.9 | 61.0 | 11 | 3582.0 | .85 | .88 |
| 2818.4 | 27.0 | 10.0 | 24.6 | 37.0 | 14 | 1782.0 | .37 | .63 |
| 3548.1 | 36.0 | 15.0 | 33.7 | 59.0 | 6 | 2123.0 | .64 | .58 |
| 4466.8 | 43.0 | 27.0 | 37.5 | 45.0 | 4 | 862.0 | .05 | .37 |
| 5623.4 | 42.0 | 31.0 | 43.0 | 56.0 | 3 | 1125.0 | .33 | .26 |
| 7079.4 | 59.0 | 59.0 | 59.0 | 59.0 | 1 | .0 | .00 | .00 |
| 8912.5 | 64.0 | 32.0 | 48.0 | 64.0 | 2 | 1024.0 | .00 | .50 |
| 11220.2 | 74.0 | 57.0 | 65.5 | 74.0 | 2 | 969.0 | .00 | .23 |
| 14125.4 | 54.0 | 54.0 | 54.0 | 54.0 | 1 | .0 | .00 | .00 |
| 17782.8 | 34.0 | 34.0 | 34.0 | 34.0 | 1 | .0 | .00 | .00 |

N=370 MIAMI PASI 1-25

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 11.2 | 1.0 | 1.0 | 1.0 | 1.0 | 1 | .0 | .00 | .00 |
| 14.1 | | | | | | | | |
| 17.8 | | | | | | | | |
| 22.4 | 1.0 | 1.0 | 1.0 | 1.0 | 1 | .0 | .00 | .00 |
| 28.2 | 1.0 | 1.0 | 1.0 | 1.0 | 3 | .0 | .00 | .00 |
| 35.5 | | | | | | | | |
| 44.7 | 1.0 | 1.0 | 1.0 | 1.0 | 11 | .0 | .00 | .00 |
| 56.2 | 2.0 | 1.0 | 1.5 | 2.0 | 6 | 3.0 | .00 | .50 |
| 70.8 | 2.0 | 2.0 | 2.3 | 3.0 | 3 | 3.0 | .50 | .00 |
| 89.1 | 2.0 | 1.0 | 1.7 | 2.0 | 7 | 2.0 | .00 | .50 |
| 112.2 | 2.0 | 1.0 | 2.0 | 3.0 | 7 | 4.0 | .50 | .50 |
| 141.3 | 3.0 | 2.0 | 2.4 | 3.0 | 10 | 12.0 | .00 | .33 |
| 177.8 | 3.0 | 2.0 | 3.4 | 5.0 | 16 | 46.0 | .67 | .33 |
| 223.9 | 4.0 | 2.0 | 3.6 | 6.0 | 21 | 60.0 | .50 | .50 |
| 281.8 | 5.0 | 3.0 | 4.6 | 9.0 | 13 | 78.0 | .80 | .40 |
| 354.8 | 6.0 | 2.0 | 5.7 | 10.0 | 19 | 183.0 | .67 | .67 |
| 446.7 | 9.0 | 2.0 | 7.4 | 11.0 | 29 | 398.0 | .22 | .78 |
| 562.3 | 11.0 | 5.0 | 8.7 | 13.0 | 18 | 368.0 | .18 | .55 |
| 707.9 | 10.0 | 6.0 | 9.4 | 16.0 | 29 | 715.0 | .60 | .40 |
| 891.3 | 15.0 | 5.0 | 12.5 | 28.0 | 22 | 1564.0 | .87 | .67 |
| 1122.0 | 15.0 | 9.0 | 13.9 | 24.0 | 20 | 1314.0 | .60 | .40 |
| 1412.5 | 17.0 | 7.0 | 17.2 | 32.0 | 16 | 1982.0 | .88 | .59 |
| 1778.3 | 21.0 | 11.0 | 20.6 | 35.0 | 14 | 2385.0 | .67 | .48 |
| 2238.7 | 37.0 | 10.0 | 27.2 | 41.0 | 18 | 3542.0 | .28 | .69 |
| 2818.4 | 36.0 | 16.0 | 29.8 | 52.0 | 19 | 5897.0 | .44 | .56 |
| 3548.1 | 41.0 | 15.0 | 37.7 | 62.0 | 16 | 7164.0 | .51 | .63 |
| 4466.8 | 54.0 | 13.0 | 43.4 | 72.0 | 13 | 7370.0 | .33 | .76 |
| 5623.4 | 61.0 | 26.0 | 54.7 | 85.0 | 13 | 8026.0 | .39 | .57 |
| 7079.4 | 68.0 | 23.0 | 61.5 | 90.0 | 8 | 5713.0 | .32 | .66 |
| 8912.5 | 81.0 | 20.0 | 64.4 | 98.0 | 7 | 6172.0 | .21 | .75 |
| 11220.2 | 131.0 | 69.0 | 100.0 | 131.0 | 2 | 4278.0 | .00 | .47 |
| 14125.4 | | | | | | | | |
| 17782.8 | 104.0 | 15.0 | 75.5 | 139.0 | 4 | 8840.0 | .34 | .86 |
| 22387.2 | 140.0 | 140.0 | 140.0 | 140.0 | 1 | .0 | .00 | .00 |
| 28183.8 | 127.0 | 127.0 | 127.0 | 127.0 | 1 | .0 | .00 | .00 |
| 35481.3 | 41.0 | 41.0 | 41.0 | 41.0 | 1 | .0 | .00 | .00 |
| 44668.3 | 40.0 | 40.0 | 40.0 | 40.0 | 1 | .0 | .00 | .00 |

N=169 MIAMI PASI 26-50

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 17.8 | | | | | | | | |
| 22.4 | 1.0 | 1.0 | 1.0 | 1.0 | 1 | .0 | .00 | .00 |
| 28.2 | 1.0 | 1.0 | 1.0 | 1.0 | 12 | .0 | .00 | .00 |
| 35.5 | | | | | | | | |
| 44.7 | 1.0 | 1.0 | 1.1 | 2.0 | 19 | 2.0 | 1.00 | .00 |
| 56.2 | 1.0 | 1.0 | 1.3 | 2.0 | 10 | 6.0 | 1.00 | .00 |
| 70.8 | 1.0 | 1.0 | 1.0 | 1.0 | 6 | .0 | .00 | .00 |
| 89.1 | 2.0 | 1.0 | 1.6 | 4.0 | 15 | 24.0 | 1.00 | .50 |
| 112.2 | 2.0 | 1.0 | 1.5 | 2.0 | 6 | 3.0 | .00 | .50 |
| 141.3 | 4.0 | 2.0 | 3.0 | 5.0 | 7 | 21.0 | .25 | .50 |
| 177.8 | 3.0 | 3.0 | 3.5 | 5.0 | 8 | 10.0 | .67 | .00 |
| 223.9 | 4.0 | 2.0 | 3.6 | 7.0 | 8 | 43.0 | .75 | .50 |
| 281.8 | 4.0 | 2.0 | 3.8 | 6.0 | 6 | 27.0 | .50 | .50 |
| 354.8 | 4.0 | 3.0 | 3.5 | 4.0 | 2 | 3.0 | .00 | .25 |
| 446.7 | 4.0 | 3.0 | 4.3 | 6.0 | 3 | 15.0 | .50 | .25 |
| 562.3 | 11.0 | 5.0 | 8.0 | 11.0 | 2 | 30.0 | .00 | .55 |
| 707.9 | 10.0 | 3.0 | 6.5 | 10.0 | 2 | 21.0 | .00 | .70 |
| 891.3 | 14.0 | 7.0 | 10.5 | 14.0 | 2 | 49.0 | .00 | .50 |
| 1122.0 | 20.0 | 20.0 | 20.0 | 20.0 | 1 | .0 | .00 | .00 |
| 1412.5 | 6.0 | 6.0 | 6.0 | 6.0 | 1 | .0 | .00 | .00 |
| 1778.3 | 21.0 | 13.0 | 20.3 | 27.0 | 3 | 266.0 | .29 | .38 |
| 2238.7 | 21.0 | 8.0 | 19.7 | 30.0 | 4 | 395.0 | .43 | .62 |
| 2818.4 | 27.0 | 24.0 | 26.3 | 28.0 | 3 | 100.0 | .04 | .11 |
| 3548.1 | 26.0 | 9.0 | 17.5 | 26.0 | 2 | 153.0 | .00 | .65 |
| 4466.8 | 41.0 | 41.0 | 41.0 | 41.0 | 1 | .0 | .00 | .00 |
| 5623.4 | 38.0 | 37.0 | 40.0 | 45.0 | 3 | 352.0 | .18 | .03 |
| 7079.4 | 43.0 | 43.0 | 43.0 | 43.0 | 1 | .0 | .00 | .00 |
| 8912.5 | 56.0 | 33.0 | 49.3 | 59.0 | 3 | 936.0 | .05 | .41 |
| 11220.2 | | | | | | | | |
| 14125.4 | 80.0 | 55.0 | 76.0 | 106.0 | 4 | 5262.0 | .32 | .31 |
| 17782.8 | 65.0 | 53.0 | 59.0 | 65.0 | 2 | 636.0 | .00 | .18 |
| 22387.2 | 90.0 | 86.0 | 97.3 | 116.0 | 3 | 3360.0 | .29 | .04 |
| 28183.8 | 154.0 | 56.0 | 110.5 | 155.0 | 4 | 11572.0 | .01 | .64 |
| 35481.3 | 176.0 | 77.0 | 137.7 | 192.0 | 4 | 18115.0 | .09 | .56 |
| 44668.3 | 119.0 | 80.0 | 99.5 | 119.0 | 2 | 3120.0 | .00 | .33 |
| 56234.0 | 220.0 | 33.0 | 126.5 | 220.0 | 2 | 6171.0 | .00 | .85 |
| 70794.5 | 104.0 | 93.0 | 127.0 | 184.0 | 3 | 15743.0 | .77 | .11 |
| 89124.9 | 49.0 | 49.0 | 49.0 | 49.0 | 1 | .0 | .00 | .00 |
| 112201.7 | 305.0 | 73.0 | 197.0 | 305.0 | 3 | 36512.0 | .00 | .76 |
| 141253.5 | 82.0 | 82.0 | 82.0 | 82.0 | 1 | .0 | .00 | .00 |
| 177827.6 | 204.0 | 204.0 | 204.0 | 204.0 | 1 | .0 | .00 | .00 |

N=126 MIAMI PASI 51-100

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 17.8 | | | | | | | | |
| 22.4 | 1.0 | 1.0 | 1.0 | 1.0 | 1 | .0 | .00 | .00 |
| 28.2 | 1.0 | 1.0 | 1.0 | 1.0 | 1 | .0 | .00 | .00 |
| 35.5 | | | | | | | | |
| 44.7 | | | | | | | | |
| 56.2 | 2.0 | 2.0 | 2.0 | 2.0 | 1 | .0 | .00 | .00 |
| 70.8 | | | | | | | | |
| 89.1 | 3.0 | 3.0 | 3.0 | 3.0 | 3 | .0 | .00 | .00 |
| 112.2 | 4.0 | 2.0 | 3.4 | 4.0 | 9 | 13.0 | .00 | .50 |
| 141.3 | 4.0 | 3.0 | 3.7 | 4.0 | 6 | 5.0 | .00 | .25 |
| 177.8 | 4.0 | 2.0 | 3.8 | 5.0 | 5 | 9.0 | .25 | .50 |
| 223.9 | 5.0 | 4.0 | 5.0 | 6.0 | 7 | 23.0 | .20 | .20 |
| 281.8 | 7.0 | 3.0 | 6.0 | 8.0 | 7 | 42.0 | .14 | .57 |
| 354.8 | 9.0 | 5.0 | 8.7 | 17.0 | 6 | 103.0 | .89 | .44 |
| 446.7 | 9.0 | 5.0 | 7.5 | 10.0 | 4 | 48.0 | .11 | .44 |
| 562.3 | 11.0 | 7.0 | 9.0 | 11.0 | 2 | 28.0 | .00 | .36 |
| 707.9 | 13.0 | 8.0 | 11.9 | 16.0 | 10 | 246.0 | .23 | .38 |
| 891.3 | 19.0 | 11.0 | 16.3 | 20.0 | 6 | 260.0 | .05 | .42 |
| 1122.0 | 19.0 | 10.0 | 18.1 | 27.0 | 9 | 537.0 | .42 | .47 |
| 1412.5 | 21.0 | 16.0 | 21.0 | 30.0 | 7 | 588.0 | .43 | .24 |
| 1778.3 | 23.0 | 20.0 | 23.7 | 28.0 | 3 | 205.0 | .22 | .13 |
| 2238.7 | 33.0 | 28.0 | 33.3 | 41.0 | 6 | 564.0 | .24 | .15 |
| 2818.4 | 38.0 | 6.0 | 26.5 | 46.0 | 4 | 917.0 | .21 | .84 |
| 3548.1 | 38.0 | 36.0 | 39.2 | 46.0 | 4 | 411.0 | .21 | .05 |
| 4466.8 | 50.0 | 28.0 | 43.0 | 55.0 | 4 | 1320.0 | .10 | .44 |
| 5623.4 | 59.0 | 29.0 | 54.6 | 70.0 | 5 | 2256.0 | .19 | .51 |
| 7079.4 | 52.0 | 41.0 | 52.4 | 65.0 | 5 | 1112.0 | .25 | .21 |
| 8912.5 | 79.0 | 60.0 | 74.7 | 84.0 | 4 | 1784.0 | .06 | .24 |
| 11220.2 | 76.0 | 76.0 | 76.0 | 76.0 | 1 | .0 | .00 | .00 |
| 14125.4 | 115.0 | 115.0 | 115.0 | 115.0 | 1 | .0 | .00 | .00 |
| 17782.8 | 113.0 | 91.0 | 102.0 | 113.0 | 2 | 2002.0 | .00 | .19 |
| 22387.2 | 15.0 | 15.0 | 15.0 | 15.0 | 1 | .0 | .00 | .00 |
| 28183.8 | | | | | | | | |
| 35481.3 | 196.0 | 196.0 | 196.0 | 196.0 | 1 | .0 | .00 | .00 |
| 44668.3 | 153.0 | 153.0 | 153.0 | 153.0 | 1 | .0 | .00 | .00 |

N=150 MIAMI PASI 101-150

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 17.8 | | | | | | | | |
| 22.4 | 1.0 | 1.0 | 1.0 | 1.0 | 5 | .0 | .00 | .00 |
| 28.2 | | | | | | | | |
| 35.5 | | | | | | | | |
| 44.7 | 1.0 | 1.0 | 1.0 | 1.0 | 2 | .0 | .00 | .00 |
| 56.2 | 2.0 | 1.0 | 1.3 | 2.0 | 3 | 2.0 | .00 | .50 |
| 70.8 | 3.0 | 3.0 | 3.0 | 3.0 | 1 | .0 | .00 | .00 |
| 89.1 | 2.0 | 1.0 | 1.8 | 2.0 | 5 | 1.0 | .00 | .50 |
| 112.2 | 3.0 | 2.0 | 3.2 | 5.0 | 5 | 12.0 | .67 | .33 |
| 141.3 | 3.0 | 1.0 | 2.5 | 4.0 | 4 | 8.0 | .33 | .67 |
| 177.8 | 4.0 | 2.0 | 3.4 | 6.0 | 5 | 23.0 | .50 | .50 |
| 223.9 | 4.0 | 2.0 | 3.3 | 4.0 | 6 | 10.0 | .00 | .50 |
| 281.8 | 13.0 | 3.0 | 8.0 | 13.0 | 2 | 30.0 | .00 | .77 |
| 354.8 | 5.0 | 4.0 | 6.0 | 10.0 | 4 | 54.0 | 1.00 | .20 |
| 446.7 | 9.0 | 5.0 | 8.6 | 13.0 | 7 | 112.0 | .44 | .44 |
| 562.3 | 7.0 | 5.0 | 6.7 | 9.0 | 4 | 34.0 | .29 | .29 |
| 707.9 | 12.0 | 9.0 | 11.7 | 16.0 | 4 | 111.0 | .33 | .25 |
| 891.3 | 17.0 | 12.0 | 16.0 | 19.0 | 4 | 114.0 | .12 | .29 |
| 1122.0 | 15.0 | 8.0 | 13.9 | 18.0 | 8 | 313.0 | .20 | .47 |
| 1412.5 | 20.0 | 12.0 | 19.1 | 23.0 | 8 | 313.0 | .15 | .40 |
| 1778.3 | 24.0 | 10.0 | 19.8 | 27.0 | 6 | 561.0 | .12 | .58 |
| 2238.7 | 25.0 | 19.0 | 22.0 | 25.0 | 2 | 114.0 | .00 | .24 |
| 2818.4 | 26.0 | 10.0 | 20.2 | 28.0 | 4 | 369.0 | .08 | .62 |
| 3548.1 | 45.0 | 42.0 | 45.2 | 51.0 | 4 | 518.0 | .13 | .07 |
| 4466.8 | 56.0 | 8.0 | 43.6 | 63.0 | 5 | 1603.0 | .12 | .86 |
| 5623.4 | 69.0 | 52.0 | 63.3 | 69.0 | 3 | 884.0 | .00 | .25 |
| 7079.4 | 52.0 | 34.0 | 50.7 | 80.0 | 6 | 4534.0 | .54 | .35 |
| 8912.5 | 69.0 | 42.0 | 59.5 | 78.0 | 4 | 2816.0 | .13 | .39 |
| 11220.2 | 82.0 | 46.0 | 69.0 | 93.0 | 5 | 4889.0 | .13 | .46 |
| 14125.4 | 94.0 | 81.0 | 87.5 | 94.0 | 2 | 1053.0 | .00 | .14 |
| 17782.8 | 112.0 | 64.0 | 103.0 | 124.0 | 4 | 4563.0 | .11 | .43 |
| 22387.2 | 171.0 | 70.0 | 128.3 | 214.0 | 6 | 36916.0 | .25 | .59 |
| 28183.8 | 135.0 | 94.0 | 130.6 | 162.0 | 8 | 16942.0 | .20 | .30 |
| 35481.3 | 177.0 | 154.0 | 186.7 | 233.0 | 7 | 34016.0 | .32 | .13 |
| 44668.3 | 230.0 | 156.0 | 208.5 | 289.0 | 4 | 39884.0 | .26 | .32 |
| 56234.0 | 180.0 | 180.0 | 180.0 | 180.0 | 1 | .0 | .00 | .00 |
| 70794.5 | | | | | | | | |
| 89124.9 | 282.0 | 282.0 | 282.0 | 282.0 | 1 | .0 | .00 | .00 |
| 112201.7 | 400.0 | 400.0 | 400.0 | 400.0 | 1 | .0 | .00 | .00 |

**KEY**

**Z = RADAR REFLECTIVITY IN $10\,mm^6/m^3$**
**$R^*$ = BEST ESTIMATE OF R BASED ON THE MINIMUM $\Sigma R_i\,|R^* - R_i|$ IN mm/hr.**
**R MIN = MINIMUM RATE IN EACH Z INTERVAL mm/hr.**
**R AVE = AVERAGE RATE IN EACH Z INTERVAL mm/hr.**
**R MAX = MAXIMUM RATE IN EACH Z INTERVAL mm/hr.**

**N = NUMBER OF ONE CUBIC METER SAMPLES IN EACH Z INTERVAL**
**$S = \Sigma\ R_i\,|R^* - R_i|$**
**UNDER = MAXIMUM POSSIBLE UNDERESTIMATE DEFINED AS $\dfrac{R\,MAX - R^*}{R^*}$**
**OVER = MAXIMUM POSSIBLE OVERESTIMATE DEFINED AS $\dfrac{R^* - R\,MIN}{R^*}$**

FIG. 1 TABLES OF RAINFALL RATE VERSUS RADAR REFLECTIVITY FOR DIFFERENT POSITIVE AREA STABILITY INDICES (PASI) FOR MIAMI, FLORIDA.

N=402 MIAMI PASI 151-200

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 11.2 | 1.0 | 1.0 | 1.0 | 1.0 | 3 | .0 | .00 | .00 |
| 14.1 | | | | | | | | |
| 17.8 | | | | | | | | |
| 22.4 | 1.0 | 1.0 | 1.0 | 1.0 | 7 | .0 | .00 | .00 |
| 28.2 | 1.0 | 1.0 | 1.1 | 2.0 | 9 | 2.0 | 1.00 | .00 |
| 35.5 | | | | | | | | |
| 44.7 | 1.0 | 1.0 | 1.1 | 2.0 | 11 | 2.0 | 1.00 | .00 |
| 56.2 | 2.0 | 1.0 | 1.6 | 3.0 | 11 | 8.0 | .50 | .50 |
| 70.8 | 2.0 | 1.0 | 1.7 | 3.0 | 9 | 11.0 | .50 | .50 |
| 89.1 | 3.0 | 1.0 | 2.2 | 4.0 | 13 | 20.0 | .33 | .67 |
| 112.2 | 3.0 | 1.0 | 2.7 | 5.0 | 23 | 38.0 | .67 | .67 |
| 141.3 | 3.0 | 1.0 | 2.6 | 4.0 | 15 | 26.0 | .33 | .67 |
| 177.8 | 4.0 | 1.0 | 3.4 | 6.0 | 24 | 87.0 | .50 | .75 |
| 223.9 | 5.0 | 1.0 | 4.1 | 9.0 | 24 | 128.0 | .80 | .80 |
| 281.8 | 6.0 | 3.0 | 5.6 | 8.0 | 16 | 86.0 | .33 | .50 |
| 354.8 | 7.0 | 3.0 | 6.6 | 10.0 | 28 | 286.0 | .43 | .57 |
| 446.7 | 8.0 | 3.0 | 7.2 | 12.0 | 26 | 283.0 | .50 | .62 |
| 562.3 | 12.0 | 3.0 | 9.6 | 14.0 | 14 | 282.0 | .17 | .75 |
| 707.9 | 11.0 | 6.0 | 11.3 | 19.0 | 21 | 652.0 | .73 | .45 |
| 891.3 | 14.0 | 5.0 | 12.9 | 19.0 | 19 | 679.0 | .36 | .64 |
| 1122.0 | 16.0 | 4.0 | 13.2 | 22.0 | 12 | 556.0 | .37 | .75 |
| 1412.5 | 22.0 | 17.0 | 21.1 | 24.0 | 7 | 316.5 | .09 | .23 |
| 1778.3 | 25.0 | 5.0 | 19.8 | 30.0 | 10 | 788.0 | .20 | .80 |
| 2238.7 | 32.0 | 6.0 | 25.5 | 39.0 | 10 | 1591.0 | .22 | .81 |
| 2818.4 | 74.0 | 7.0 | 36.0 | 74.0 | 4 | 3122.0 | .00 | .91 |
| 3548.1 | 37.0 | 12.0 | 31.5 | 58.0 | 10 | 2730.0 | .57 | .68 |
| 4466.8 | 46.0 | 37.0 | 46.6 | 55.0 | 7 | 1884.0 | .20 | .20 |
| 5623.4 | 38.0 | 14.0 | 36.4 | 76.0 | 7 | 4103.0 | 1.00 | .63 |
| 7079.4 | 77.0 | 18.0 | 59.6 | 80.0 | 7 | 4646.0 | .04 | .77 |
| 8912.5 | 75.0 | 16.0 | 66.8 | 98.0 | 9 | 7656.0 | .31 | .79 |
| 11220.2 | 93.0 | 18.0 | 66.6 | 95.0 | 5 | 4866.0 | .02 | .81 |
| 14125.4 | 102.0 | 60.0 | 108.7 | 221.0 | 7 | 33641.0 | 1.17 | .41 |
| 17782.8 | 88.0 | 28.0 | 77.8 | 123.0 | 6 | 9355.0 | .40 | .68 |
| 22387.2 | 142.0 | 106.0 | 131.7 | 155.0 | 4 | 8063.0 | .09 | .25 |
| 28183.8 | 206.0 | 41.0 | 149.7 | 219.0 | 8 | 37604.0 | .06 | .80 |
| 35481.3 | 220.0 | 54.0 | 173.1 | 249.0 | 7 | 44712.0 | .13 | .75 |
| 44668.3 | 206.0 | 39.0 | 160.4 | 301.0 | 8 | 94457.0 | .46 | .81 |
| 56234.0 | | | | | | | | |
| 70794.5 | | | | | | | | |
| 89124.9 | | | | | | | | |
| 112201.7 | | | | | | | | |
| 141253.5 | 168.0 | 168.0 | 168.0 | 168.0 | 1 | .0 | .00 | -.00 |

N=255 MIAMI PASI 201-300

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 11.2 | 1.0 | 1.0 | 1.0 | 1.0 | 2 | .0 | .00 | .00 |
| 14.1 | | | | | | | | |
| 17.8 | | | | | | | | |
| 22.4 | 1.0 | 1.0 | 1.0 | 1.0 | 2 | .0 | .00 | .00 |
| 28.2 | 1.0 | 1.0 | 1.0 | 1.0 | 3 | .0 | .00 | .00 |
| 35.5 | | | | | | | | |
| 44.7 | 1.0 | 1.0 | 1.1 | 2.0 | 16 | 2.0 | 1.00 | .00 |
| 56.2 | 1.0 | 1.0 | 1.2 | 2.0 | 4 | 2.0 | 1.00 | .00 |
| 70.8 | 2.0 | 2.0 | 2.0 | 2.0 | 2 | .0 | .00 | .00 |
| 89.1 | 3.0 | 1.0 | 2.1 | 4.0 | 12 | 20.0 | .33 | .67 |
| 112.2 | 2.0 | 1.0 | 2.2 | 3.0 | 9 | 15.0 | .50 | .50 |
| 141.3 | 5.0 | 2.0 | 3.3 | 5.0 | 6 | 22.0 | .00 | .60 |
| 177.8 | 4.0 | 2.0 | 3.7 | 7.0 | 10 | 43.0 | .75 | .50 |
| 223.9 | 6.0 | 5.0 | 5.7 | 7.0 | 6 | 22.0 | .17 | .17 |
| 281.8 | 6.0 | 4.0 | 6.1 | 9.0 | 8 | 61.0 | .50 | .33 |
| 354.8 | 7.0 | 2.0 | 7.0 | 12.0 | 7 | 100.0 | .71 | .71 |
| 446.7 | 11.0 | 5.0 | 8.0 | 11.0 | 2 | 30.0 | .00 | .55 |
| 562.3 | 10.0 | 3.0 | 7.9 | 12.0 | 12 | 185.0 | .20 | .70 |
| 707.9 | 9.0 | 5.0 | 8.7 | 13.0 | 10 | 144.0 | .44 | .44 |
| 891.3 | 17.0 | 9.0 | 15.1 | 21.0 | 8 | 364.0 | .24 | .47 |
| 1122.0 | 19.0 | 10.0 | 17.7 | 26.0 | 14 | 1032.0 | .37 | .47 |
| 1412.5 | 21.0 | 12.0 | 19.0 | 30.0 | 7 | 586.0 | .43 | .43 |
| 1778.3 | 25.0 | 11.0 | 22.3 | 36.0 | 14 | 1862.0 | .44 | .56 |
| 2238.7 | 30.0 | 22.0 | 28.7 | 33.0 | 4 | 275.0 | .10 | .27 |
| 2818.4 | 33.0 | 4.0 | 24.2 | 44.0 | 14 | 2622.0 | .33 | .88 |
| 3548.1 | 36.0 | 8.0 | 25.4 | 37.0 | 5 | 809.0 | .03 | .78 |
| 4466.8 | 48.0 | 20.0 | 37.2 | 55.0 | 5 | 1944.0 | .15 | .58 |
| 5623.4 | 45.0 | 29.0 | 44.9 | 66.0 | 7 | 2450.0 | .47 | .36 |
| 7079.4 | 63.0 | 24.0 | 53.4 | 72.0 | 8 | 4538.0 | .14 | .62 |
| 8912.5 | 64.0 | 24.0 | 56.9 | 98.0 | 13 | 13470.0 | .53 | .62 |
| 11220.2 | 79.0 | 32.0 | 72.7 | 121.0 | 9 | 12404.0 | .53 | .59 |
| 14125.4 | 79.0 | 46.0 | 71.3 | 90.0 | 6 | 4600.0 | .14 | .42 |
| 17782.8 | 110.0 | 38.0 | 102.6 | 166.0 | 9 | 25009.0 | .51 | .65 |
| 22387.2 | 121.0 | 78.0 | 111.7 | 145.0 | 7 | 12750.0 | .20 | .36 |
| 28183.8 | 134.0 | 91.0 | 121.6 | 156.0 | 5 | 11344.0 | .16 | .32 |
| 35481.3 | 126.0 | 123.0 | 124.5 | 126.0 | 2 | 369.0 | .00 | .02 |
| 44668.3 | 168.0 | 80.0 | 147.3 | 194.0 | 3 | 12084.0 | .15 | .52 |
| 56234.0 | 284.0 | 160.0 | 273.0 | 375.0 | 3 | 53965.0 | .32 | .44 |
| 70794.5 | 71.0 | 71.0 | 71.0 | 71.0 | 1 | .0 | .00 | .00 |

N=211 MIAMI PASI 301-400

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 11.2 | 1.0 | 1.0 | 1.0 | 1.0 | 2 | .0 | .00 | .00 |
| 14.1 | | | | | | | | |
| 17.8 | | | | | | | | |
| 22.4 | 1.0 | 1.0 | 1.0 | 1.0 | 4 | .0 | .00 | .00 |
| 28.2 | 1.0 | 1.0 | 1.0 | 1.0 | 2 | .0 | .00 | .00 |
| 35.5 | | | | | | | | |
| 44.7 | 1.0 | 1.0 | 1.0 | 1.0 | 9 | .0 | .00 | .00 |
| 56.2 | 2.0 | 2.0 | 2.0 | 2.0 | 2 | .0 | .00 | .00 |
| 70.8 | 2.0 | 1.0 | 1.5 | 2.0 | 2 | 1.0 | .00 | .50 |
| 89.1 | 2.0 | 1.0 | 1.9 | 3.0 | 7 | 9.0 | .50 | .50 |
| 112.2 | 3.0 | 1.0 | 2.6 | 4.0 | 5 | 8.0 | .33 | .67 |
| 141.3 | 4.0 | 2.0 | 3.2 | 4.0 | 4 | 7.0 | .00 | .50 |
| 177.8 | 5.0 | 2.0 | 3.6 | 6.0 | 5 | 24.0 | .20 | .60 |
| 223.9 | 6.0 | 3.0 | 5.2 | 7.0 | 8 | 30.0 | .17 | .50 |
| 281.8 | 6.0 | 3.0 | 5.1 | 8.0 | 7 | 44.0 | .33 | .50 |
| 354.8 | 7.0 | 4.0 | 6.4 | 10.0 | 14 | 134.0 | .43 | .43 |
| 446.7 | 8.0 | 5.0 | 7.9 | 13.0 | 14 | 107.0 | .62 | .37 |
| 562.3 | 11.0 | 5.0 | 9.4 | 13.0 | 13 | 260.0 | .18 | .55 |
| 707.9 | 13.0 | 6.0 | 11.2 | 15.0 | 14 | 360.0 | .15 | .54 |
| 891.3 | 12.0 | 6.0 | 12.0 | 24.0 | 10 | 490.0 | 1.00 | .50 |
| 1122.0 | 17.0 | 3.0 | 15.4 | 22.0 | 14 | 706.0 | .29 | .82 |
| 1412.5 | 22.0 | 10.0 | 19.2 | 28.0 | 10 | 684.0 | .27 | .55 |
| 1778.3 | 28.0 | 13.0 | 25.1 | 35.0 | 11 | 1468.0 | .25 | .54 |
| 2238.7 | 27.0 | 20.0 | 24.7 | 27.0 | 4 | 190.0 | .00 | .26 |
| 2818.4 | 39.0 | 17.0 | 35.4 | 51.0 | 9 | 2808.0 | .31 | .56 |
| 3548.1 | 51.0 | 24.0 | 45.0 | 52.0 | 6 | 1212.0 | .02 | .53 |
| 4466.8 | 83.0 | 26.0 | 55.3 | 88.0 | 6 | 6846.0 | .06 | .69 |
| 5623.4 | 63.0 | 30.0 | 60.0 | 73.0 | 5 | 2430.0 | .16 | .52 |
| 7079.4 | 77.0 | 76.0 | 76.5 | 77.0 | 2 | 76.0 | .00 | .01 |
| 8912.5 | 77.0 | 65.0 | 78.3 | 93.0 | 3 | 2268.0 | .21 | .16 |
| 11220.2 | 88.0 | 69.0 | 84.0 | 95.0 | 3 | 1976.0 | .08 | .22 |
| 14125.4 | 124.0 | 73.0 | 101.0 | 138.0 | 5 | 12267.0 | .11 | .41 |
| 17782.8 | | | | | | | | |
| 22387.2 | 124.0 | 98.0 | 125.8 | 151.0 | 5 | 12169.0 | .22 | .21 |
| 28183.8 | 117.0 | 116.0 | 139.7 | 186.0 | 3 | 12950.0 | .59 | .01 |
| 35481.3 | 216.0 | 171.0 | 193.5 | 216.0 | 2 | 7695.0 | .00 | .21 |
| 44668.3 | 110.0 | 110.0 | 110.0 | 110.0 | 1 | .0 | .00 | .00 |

N=877 MIAMI CONTINUOUS RAIN

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 11.2 | 1.0 | 1.0 | 1.0 | 1.0 | 3 | .0 | .00 | .00 |
| 14.1 | | | | | | | | |
| 17.8 | | | | | | | | |
| 22.4 | 1.0 | 1.0 | 1.0 | 1.0 | 17 | .0 | .00 | .00 |
| 28.2 | 1.0 | 1.0 | 1.0 | 2.0 | 29 | 2.0 | 1.00 | .00 |
| 35.5 | | | | | | | | |
| 44.7 | 1.0 | 1.0 | 1.3 | 2.0 | 42 | 22.0 | 1.00 | .00 |
| 56.2 | 2.0 | 1.0 | 1.5 | 2.0 | 26 | 12.0 | .00 | .50 |
| 70.8 | 2.0 | 1.0 | 1.7 | 4.0 | 24 | 29.0 | 1.00 | .50 |
| 89.1 | 2.0 | 1.0 | 2.0 | 4.0 | 39 | 59.0 | 1.00 | .50 |
| 112.2 | 3.0 | 1.0 | 2.6 | 6.0 | 47 | 112.0 | 1.00 | .67 |
| 141.3 | 4.0 | 1.0 | 3.1 | 6.0 | 47 | 138.0 | .50 | .75 |
| 177.8 | 4.0 | 1.0 | 3.8 | 7.0 | 46 | 174.0 | .75 | .75 |
| 223.9 | 4.0 | 2.0 | 4.2 | 9.0 | 62 | 319.0 | 1.25 | .50 |
| 281.8 | 6.0 | 2.0 | 5.4 | 10.0 | 40 | 299.0 | .67 | .67 |
| 354.8 | 7.0 | 2.0 | 6.7 | 12.0 | 65 | 786.0 | .71 | .71 |
| 446.7 | 8.0 | 2.0 | 7.4 | 13.0 | 68 | 1040.0 | .62 | .75 |
| 562.3 | 10.0 | 2.0 | 9.2 | 18.0 | 45 | 977.0 | .80 | .80 |
| 707.9 | 12.0 | 3.0 | 11.0 | 16.0 | 48 | 1168.0 | .33 | .75 |
| 891.3 | 15.0 | 4.0 | 13.0 | 21.0 | 47 | 2012.0 | .40 | .73 |
| 1122.0 | 18.0 | 4.0 | 14.8 | 24.0 | 38 | 2411.0 | .33 | .78 |
| 1412.5 | 24.0 | 7.0 | 21.2 | 32.0 | 30 | 2732.0 | .33 | .71 |
| 1778.3 | 29.0 | 10.0 | 24.2 | 37.0 | 23 | 3692.0 | .28 | .66 |
| 2238.7 | 33.0 | 7.0 | 28.0 | 41.0 | 17 | 3304.0 | .24 | .79 |
| 2818.4 | 38.0 | 23.0 | 34.4 | 52.0 | 10 | 2820.0 | .37 | .39 |
| 3548.1 | 50.0 | 10.0 | 39.7 | 62.0 | 13 | 5254.0 | .24 | .80 |
| 4466.8 | 52.0 | 13.0 | 45.2 | 72.0 | 12 | 7378.0 | .38 | .75 |
| 5623.4 | 72.0 | 47.0 | 69.8 | 87.0 | 9 | 4888.0 | .21 | .35 |
| 7079.4 | 83.0 | 25.0 | 68.7 | 90.0 | 4 | 2542.0 | .08 | .70 |
| 8912.5 | 77.0 | 18.0 | 67.7 | 117.0 | 12 | 14642.0 | .52 | .77 |
| 11220.2 | 93.0 | 50.0 | 71.5 | 93.0 | 2 | 2150.0 | .00 | .46 |
| 14125.4 | 124.0 | 88.0 | 113.2 | 138.0 | 6 | 10331.0 | .11 | .29 |
| 17782.8 | 139.0 | 77.0 | 108.0 | 139.0 | 2 | 4774.0 | .00 | .45 |
| 22387.2 | 151.0 | 74.0 | 112.5 | 151.0 | 2 | 5698.0 | .00 | .51 |
| 28183.8 | 42.0 | 41.0 | 41.5 | 42.0 | 2 | 41.0 | .00 | .02 |
| 35481.3 | 216.0 | 171.0 | 193.5 | 216.0 | 2 | 7695.0 | .00 | .21 |

N=662 MIAMI RAIN SHOWERS

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 11.2 | 1.0 | 1.0 | 1.0 | 1.0 | 7 | .0 | .00 | .00 |
| 14.1 | | | | | | | | |
| 17.8 | | | | | | | | |
| 22.4 | 1.0 | 1.0 | 1.0 | 1.0 | 14 | .0 | .00 | .00 |
| 28.2 | 1.0 | 1.0 | 1.0 | 1.0 | 21 | .0 | .00 | .00 |
| 35.5 | | | | | | | | |
| 44.7 | 1.0 | 1.0 | 1.1 | 2.0 | 31 | 4.0 | 1.00 | .00 |
| 56.2 | 2.0 | 1.0 | 2.1 | 9.0 | 17 | 73.0 | 3.50 | .50 |
| 70.8 | 2.0 | 1.0 | 2.0 | 3.0 | 4 | 4.0 | .50 | .50 |
| 89.1 | 3.0 | 1.0 | 2.3 | 4.0 | 21 | 30.0 | .33 | .67 |
| 112.2 | 3.0 | 1.0 | 2.5 | 4.0 | 22 | 24.0 | .33 | .67 |
| 141.3 | 4.0 | 2.0 | 3.3 | 5.0 | 11 | 40.0 | .25 | .50 |
| 177.8 | 4.0 | 2.0 | 4.0 | 7.0 | 25 | 131.0 | .75 | .50 |
| 223.9 | 5.0 | 3.0 | 4.7 | 9.0 | 30 | 184.0 | .80 | .40 |
| 281.8 | 6.0 | 3.0 | 5.9 | 13.0 | 23 | 236.0 | 1.17 | .50 |
| 354.8 | 7.0 | 2.0 | 6.0 | 10.0 | 28 | 276.0 | .43 | .71 |
| 446.7 | 9.0 | 4.0 | 8.1 | 13.0 | 36 | 594.0 | .44 | .56 |
| 562.3 | 11.0 | 3.0 | 9.2 | 14.0 | 35 | 684.0 | .27 | .73 |
| 707.9 | 10.0 | 5.0 | 9.9 | 19.0 | 37 | 1180.0 | .90 | .50 |
| 891.3 | 19.0 | 3.0 | 14.0 | 28.0 | 30 | 2014.0 | .47 | .84 |
| 1122.0 | 18.0 | 4.0 | 16.1 | 27.0 | 34 | 2432.0 | .50 | .78 |
| 1412.5 | 20.0 | 6.0 | 17.8 | 30.0 | 21 | 1663.0 | .50 | .70 |
| 1778.3 | 25.0 | 9.0 | 22.8 | 36.0 | 37 | 4454.0 | .44 | .64 |
| 2238.7 | 33.0 | 8.0 | 26.3 | 61.0 | 26 | 6448.0 | .85 | .76 |
| 2818.4 | 34.0 | 16.0 | 30.8 | 51.0 | 29 | 7897.0 | .50 | .53 |
| 3548.1 | 36.0 | 15.0 | 33.2 | 59.0 | 24 | 6443.0 | .64 | .58 |
| 4466.8 | 52.0 | 23.0 | 45.9 | 83.0 | 15 | 7370.0 | .60 | .56 |
| 5623.4 | 53.0 | 26.0 | 49.8 | 85.0 | 22 | 13390.0 | .60 | .51 |
| 7079.4 | 46.0 | 23.0 | 41.0 | 59.0 | 10 | 3846.0 | .28 | .50 |
| 8912.5 | 64.0 | 25.0 | 53.9 | 90.0 | 10 | 7647.0 | .41 | .61 |
| 11220.2 | 76.0 | 23.0 | 63.2 | 131.0 | 9 | 15683.0 | .72 | .70 |
| 14125.4 | 74.0 | 51.0 | 69.0 | 110.0 | 7 | 9013.0 | .49 | .31 |
| 17782.8 | 110.0 | 15.0 | 67.1 | 123.0 | 10 | 18729.0 | .12 | .86 |
| 22387.2 | 130.0 | 130.0 | 130.0 | 130.0 | 1 | .0 | .00 | .00 |
| 28183.8 | 153.0 | 94.0 | 123.5 | 153.0 | 2 | 5546.0 | .00 | .39 |
| 35481.3 | 196.0 | 41.0 | 148.5 | 213.0 | 6 | 17464.0 | .09 | .79 |
| 44668.3 | 153.0 | 40.0 | 96.5 | 153.0 | 2 | 4529.0 | .00 | .74 |
| 56234.0 | 216.0 | 160.0 | 197.7 | 217.0 | 3 | 9177.0 | .00 | .26 |
| 70794.5 | | | | | | | | |
| 89124.9 | 145.0 | 49.0 | 97.0 | 145.0 | 2 | 4704.0 | .00 | .66 |
| 112201.7 | | | | | | | | |
| 141253.5 | 469.0 | 469.0 | 469.0 | 469.0 | 1 | .0 | .00 | .00 |

N=869 MIAMI THUNDERSTORMS

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 11.2 | | | | | | | | |
| 14.1 | | | | | | | | |
| 17.8 | | | | | | | | |
| 22.4 | 1.0 | 1.0 | 1.0 | 1.0 | 9 | .0 | .00 | .00 |
| 28.2 | 1.0 | 1.0 | 1.2 | 2.0 | 12 | 4.0 | 1.00 | .00 |
| 35.5 | | | | | | | | |
| 44.7 | 1.0 | 1.0 | 1.1 | 2.0 | 30 | 4.0 | 1.00 | .00 |
| 56.2 | 1.0 | 1.0 | 1.2 | 2.0 | 10 | 4.0 | 1.00 | .00 |
| 70.8 | 2.0 | 1.0 | 1.7 | 3.0 | 12 | 7.0 | .50 | .50 |
| 89.1 | 2.0 | 1.0 | 1.7 | 4.0 | 21 | 24.0 | 1.00 | .50 |
| 112.2 | 3.0 | 1.0 | 2.5 | 5.0 | 24 | 40.0 | .67 | .67 |
| 141.3 | 3.0 | 1.0 | 2.6 | 4.0 | 20 | 36.0 | .33 | .67 |
| 177.8 | 4.0 | 1.0 | 3.3 | 6.0 | 32 | 89.0 | .50 | .75 |
| 223.9 | 4.0 | 1.0 | 3.9 | 7.0 | 35 | 134.0 | .75 | .75 |
| 281.8 | 5.0 | 3.0 | 4.9 | 14.0 | 22 | 254.0 | 1.80 | .40 |
| 354.8 | 5.0 | 3.0 | 5.7 | 10.0 | 26 | 272.0 | 1.00 | .40 |
| 446.7 | 7.0 | 3.0 | 6.6 | 11.0 | 30 | 346.0 | .57 | .57 |
| 562.3 | 9.0 | 3.0 | 7.9 | 13.0 | 24 | 452.0 | .44 | .67 |
| 707.9 | 11.0 | 3.0 | 9.9 | 16.0 | 35 | 896.0 | .45 | .73 |
| 891.3 | 13.0 | 4.0 | 11.5 | 20.0 | 32 | 1318.0 | .54 | .69 |
| 1122.0 | 14.0 | 3.0 | 13.1 | 22.0 | 34 | 1363.0 | .57 | .79 |
| 1412.5 | 20.0 | 10.0 | 18.2 | 30.0 | 19 | 1169.0 | .50 | .50 |
| 1778.3 | 20.0 | 5.0 | 17.1 | 35.0 | 27 | 3320.0 | .75 | .75 |
| 2238.7 | 29.0 | 6.0 | 25.6 | 39.0 | 27 | 3220.0 | .34 | .79 |
| 2818.4 | 31.0 | 4.0 | 25.7 | 74.0 | 33 | 9298.0 | 1.39 | .87 |
| 3548.1 | 41.0 | 8.0 | 34.9 | 60.0 | 30 | 10280.0 | .46 | .80 |
| 4466.8 | 46.0 | 8.0 | 42.8 | 88.0 | 29 | 13798.0 | .91 | .83 |
| 5623.4 | 51.0 | 14.0 | 45.3 | 76.0 | 29 | 15536.0 | .49 | .73 |
| 7079.4 | 65.0 | 18.0 | 66.2 | 87.0 | 33 | 21098.0 | .34 | .72 |
| 8912.5 | 69.0 | 16.0 | 61.8 | 98.0 | 37 | 33114.0 | .42 | .77 |
| 11220.2 | 79.0 | 18.0 | 76.3 | 121.0 | 23 | 24692.0 | .53 | .77 |
| 14125.4 | 90.0 | 46.0 | 90.9 | 221.0 | 23 | 52937.0 | 1.46 | .49 |
| 17782.8 | 104.0 | 28.0 | 94.1 | 166.0 | 20 | 51200.0 | .60 | .73 |
| 22387.2 | 120.0 | 15.0 | 113.5 | 214.0 | 30 | 95530.0 | .78 | .87 |
| 28183.8 | 154.0 | 41.0 | 137.6 | 238.0 | 32 | 166924.0 | .55 | .73 |
| 35481.3 | 181.0 | 54.0 | 160.0 | 249.0 | 22 | 132506.0 | .38 | .70 |
| 44668.3 | 212.0 | 39.0 | 170.8 | 306.0 | 22 | 244334.0 | .44 | .82 |
| 56234.0 | 284.0 | 33.0 | 235.2 | 375.0 | 6 | 86373.0 | .32 | .88 |
| 70794.5 | 203.0 | 71.0 | 189.9 | 359.0 | 8 | 132584.0 | .77 | .65 |
| 89124.9 | 466.0 | 282.0 | 374.0 | 466.0 | 2 | 51888.0 | .00 | .39 |
| 112201.7 | 305.0 | 73.0 | 247.7 | 400.0 | 4 | 74532.0 | .31 | .76 |
| 141253.5 | 566.0 | 82.0 | 384.5 | 727.0 | 4 | 219184.0 | .28 | .86 |
| 177827.6 | 204.0 | 204.0 | 204.0 | 204.0 | 1 | .0 | .00 | 00 |

**KEY**

Z = RADAR REFLECTIVITY IN 10 $mm^6/m^3$

$R^*$ = BEST ESTIMATE OF R BASED ON THE MINIMUM $\Sigma R_i (R^* - R_i)$ IN mm/hr.

R MIN = MINIMUM RATE IN EACH Z INTERVAL mm/hr.

R AVE = AVERAGE RATE IN EACH Z INTERVAL mm/hr.

R MAX = MAXIMUM RATE IN EACH Z INTERVAL mm/hr.

N = NUMBER OF ONE CUBIC METER SAMPLES IN EACH Z INTERVAL

S = $\Sigma R (R^* - R_i)$

UNDER = MAXIMUM POSSIBLE UNDERESTIMATE DEFINED AS $\frac{R\,MAX - R^*}{R^*}$

OVER = MAXIMUM POSSIBLE OVERESTIMATE DEFINED AS $\frac{R^* - R\,MIN}{R^*}$

FIG. 2 TABLES OF RAINFALL RATE VERSUS RADAR REFLECTIVITY FOR DIFFERENT POSITIVE AREA STABILITY INDICES (PASI) CONTINUED FROM FIG 1 AND FOR DIFFERENT RAIN TYPES FOR MIAMI, FLORIDA.

N=515 MIAMI EASTERLY WAVE

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 11.2 | 1.0 | 1.0 | 1.0 | 1.0 | 2 | .0 | .00 | .00 |
| 14.1 | | | | | | | | |
| 17.8 | | | | | | | | |
| 22.4 | 1.0 | 1.0 | 1.0 | 1.0 | 9 | .0 | .00 | .00 |
| 28.2 | 1.0 | 1.0 | 1.0 | 1.0 | 1 | .0 | .00 | .00 |
| 35.5 | | | | | | | | |
| 44.7 | 1.0 | 1.0 | 1.0 | 2.0 | 21 | 2.0 | 1.00 | .00 |
| 56.2 | 2.0 | 1.0 | 1.5 | 2.0 | 11 | 5.0 | .00 | .50 |
| 70.8 | 2.0 | 1.0 | 1.9 | 4.0 | 7 | 15.0 | 1.00 | .50 |
| 89.1 | 2.0 | 1.0 | 2.0 | 3.0 | 22 | 27.0 | .50 | .50 |
| 112.2 | 3.0 | 1.0 | 2.8 | 6.0 | 20 | 55.0 | 1.00 | .67 |
| 141.3 | 4.0 | 2.0 | 3.4 | 5.0 | 7 | 19.0 | .25 | .50 |
| 177.8 | 4.0 | 2.0 | 3.7 | 6.0 | 15 | 64.0 | .50 | .50 |
| 223.9 | 5.0 | 2.0 | 4.7 | 7.0 | 15 | 73.0 | .40 | .60 |
| 281.8 | 6.0 | 3.0 | 7.0 | 14.0 | 15 | 283.0 | 1.33 | .50 |
| 354.8 | 7.0 | 4.0 | 6.8 | 10.0 | 25 | 222.0 | .43 | .43 |
| 446.7 | 9.0 | 5.0 | 8.2 | 13.0 | 25 | 303.0 | .44 | .44 |
| 562.3 | 11.0 | 4.0 | 9.7 | 14.0 | 32 | 583.0 | .27 | .64 |
| 707.9 | 14.0 | 6.0 | 11.9 | 17.0 | 25 | 729.0 | .21 | .57 |
| 891.3 | 15.0 | 3.0 | 13.7 | 24.0 | 31 | 1344.0 | .60 | .80 |
| 1122.0 | 18.0 | 4.0 | 16.6 | 26.0 | 34 | 2144.0 | .44 | .78 |
| 1412.5 | 21.0 | 10.0 | 19.9 | 30.0 | 25 | 1722.0 | .43 | .52 |
| 1778.3 | 26.0 | 9.0 | 25.0 | 36.0 | 26 | 3175.0 | .38 | .65 |
| 2238.7 | 27.0 | 4.0 | 25.0 | 38.0 | 13 | 2384.0 | .41 | .85 |
| 2818.4 | 38.0 | 10.0 | 33.6 | 51.0 | 13 | 3445.0 | .34 | .74 |
| 3548.1 | 44.0 | 14.0 | 38.1 | 60.0 | 19 | 5881.0 | .36 | .68 |
| 4466.8 | 55.0 | 11.0 | 47.3 | 83.0 | 15 | 8433.0 | .51 | .80 |
| 5623.4 | 71.0 | 29.0 | 59.7 | 87.0 | 15 | 11178.0 | .23 | .59 |
| 7079.4 | 69.0 | 25.0 | 57.9 | 83.0 | 9 | 6765.0 | .20 | .64 |
| 8912.5 | 82.0 | 42.0 | 76.1 | 117.0 | 13 | 12343.0 | .43 | .49 |
| 11220.2 | 82.0 | 32.0 | 70.9 | 95.0 | 7 | 5327.0 | .16 | .61 |
| 14125.4 | 101.0 | 73.0 | 99.5 | 138.0 | 11 | 23728.0 | .37 | .28 |
| 17782.8 | 149.0 | 38.0 | 85.3 | 149.0 | 3 | 9739.0 | .00 | .74 |
| 22387.2 | 151.0 | 74.0 | 129.4 | 214.0 | 7 | 37295.0 | .42 | .51 |
| 28183.8 | 156.0 | 41.0 | 127.8 | 238.0 | 9 | 51343.0 | .53 | .74 |
| 35481.3 | 205.0 | 154.0 | 191.2 | 233.0 | 5 | 28784.0 | .14 | .25 |
| 44668.3 | 257.0 | 110.0 | 221.5 | 289.0 | 4 | 31628.0 | .12 | .57 |
| 56234.0 | | | | | | | | |
| 70794.5 | 359.0 | 203.0 | 281.0 | 359.0 | 2 | 31665.0 | .00 | .43 |

N=446 MIAMI AIR MASS

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 11.2 | | | | | | | | |
| 14.1 | | | | | | | | |
| 17.8 | | | | | | | | |
| 22.4 | 1.0 | 1.0 | 1.0 | 1.0 | 6 | .0 | .00 | .00 |
| 28.2 | 1.0 | 1.0 | 1.1 | 2.0 | 8 | 2.0 | 1.00 | .00 |
| 35.5 | | | | | | | | |
| 44.7 | 1.0 | 1.0 | 1.1 | 2.0 | 14 | 2.0 | 1.00 | .00 |
| 56.2 | 2.0 | 1.0 | 2.2 | 9.0 | 10 | 68.0 | 3.50 | .50 |
| 70.8 | 1.0 | 1.0 | 1.2 | 2.0 | 6 | 2.0 | 1.00 | .00 |
| 89.1 | 3.0 | 1.0 | 2.2 | 4.0 | 14 | 20.0 | .33 | .67 |
| 112.2 | 3.0 | 1.0 | 2.4 | 4.0 | 17 | 24.0 | .33 | .67 |
| 141.3 | 3.0 | 1.0 | 2.5 | 4.0 | 20 | 32.0 | .33 | .67 |
| 177.8 | 4.0 | 1.0 | 3.4 | 7.0 | 21 | 78.0 | .75 | .75 |
| 223.9 | 5.0 | 1.0 | 4.6 | 6.0 | 18 | 60.0 | .20 | .80 |
| 281.8 | 5.0 | 2.0 | 4.9 | 8.0 | 16 | 92.0 | .60 | .60 |
| 354.8 | 8.0 | 3.0 | 6.0 | 10.0 | 18 | 234.0 | .25 | .62 |
| 446.7 | 8.0 | 3.0 | 7.1 | 10.0 | 25 | 213.0 | .25 | .62 |
| 562.3 | 10.0 | 3.0 | 8.1 | 13.0 | 16 | 297.0 | .30 | .70 |
| 707.9 | 11.0 | 5.0 | 10.0 | 15.0 | 24 | 564.0 | .36 | .55 |
| 891.3 | 14.0 | 5.0 | 12.7 | 19.0 | 10 | 391.0 | .36 | .64 |
| 1122.0 | 14.0 | 3.0 | 12.0 | 19.0 | 11 | 446.0 | .36 | .79 |
| 1412.5 | 18.0 | 12.0 | 17.6 | 21.0 | 5 | 243.0 | .17 | .33 |
| 1778.3 | 23.0 | 5.0 | 15.6 | 30.0 | 9 | 1124.0 | .30 | .78 |
| 2238.7 | 30.0 | 6.0 | 25.1 | 39.0 | 11 | 1468.0 | .30 | .80 |
| 2818.4 | 32.0 | 6.0 | 24.6 | 74.0 | 13 | 5179.0 | 1.31 | .81 |
| 3548.1 | 46.0 | 12.0 | 33.8 | 58.0 | 12 | 4682.0 | .26 | .74 |
| 4466.8 | 53.0 | 20.0 | 46.3 | 88.0 | 10 | 6624.0 | .66 | .62 |
| 5623.4 | 52.0 | 15.0 | 48.1 | 76.0 | 8 | 4093.0 | .46 | .71 |
| 7079.4 | 63.0 | 18.0 | 48.1 | 80.0 | 14 | 12956.0 | .27 | .71 |
| 8912.5 | 64.0 | 16.0 | 58.0 | 98.0 | 13 | 11824.0 | .53 | .75 |
| 11220.2 | 78.0 | 18.0 | 60.7 | 95.0 | 14 | 14910.0 | .22 | .77 |
| 14125.4 | 102.0 | 51.0 | 95.5 | 221.0 | 11 | 42435.0 | 1.17 | .50 |
| 17782.8 | 94.0 | 28.0 | 83.9 | 123.0 | 12 | 18465.0 | .31 | .70 |
| 22387.2 | 124.0 | 15.0 | 117.6 | 159.0 | 14 | 25136.0 | .28 | .88 |
| 28183.8 | 153.0 | 41.0 | 140.8 | 219.0 | 16 | 83256.0 | .43 | .73 |
| 35481.3 | 199.0 | 54.0 | 178.5 | 249.0 | 13 | 80340.0 | .25 | .73 |
| 44668.3 | 206.0 | 39.0 | 159.8 | 301.0 | 10 | 109730.0 | .46 | .81 |
| 56234.0 | 216.0 | 160.0 | 193.2 | 217.0 | 4 | 15657.0 | .00 | .26 |
| 70794.5 | | | | | | | | |
| 89124.9 | 282.0 | 145.0 | 213.5 | 282.0 | 2 | 19865.0 | .00 | .49 |
| 112201.7 | 400.0 | 400.0 | 400.0 | 400.0 | 1 | .0 | .00 | .00 |
| 141253.5 | 469.0 | 168.0 | 318.5 | 469.0 | 2 | 90568.0 | .00 | .64 |

N=176 MIAMI OVERRUNNING

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 11.2 | 1.0 | 1.0 | 1.0 | 1.0 | 2 | .0 | .00 | .00 |
| 14.1 | | | | | | | | |
| 17.8 | | | | | | | | |
| 22.4 | 1.0 | 1.0 | 1.0 | 1.0 | 5 | .0 | .00 | .00 |
| 28.2 | 1.0 | 1.0 | 1.0 | 1.0 | 9 | .0 | .00 | .00 |
| 35.5 | | | | | | | | |
| 44.7 | 1.0 | 1.0 | 1.2 | 2.0 | 17 | 8.0 | 1.00 | .00 |
| 56.2 | 2.0 | 1.0 | 1.9 | 3.0 | 7 | 5.0 | .50 | .50 |
| 70.8 | 2.0 | 1.0 | 1.7 | 2.0 | 6 | 1.0 | .00 | .50 |
| 89.1 | 2.0 | 2.0 | 2.0 | 2.0 | 2 | .0 | .00 | .00 |
| 112.2 | 3.0 | 2.0 | 2.6 | 3.0 | 8 | 6.0 | .00 | .33 |
| 141.3 | 4.0 | 2.0 | 2.7 | 4.0 | 3 | 8.0 | .00 | .50 |
| 177.8 | 5.0 | 2.0 | 4.1 | 6.0 | 10 | 44.0 | .20 | .60 |
| 223.9 | 4.0 | 2.0 | 4.2 | 9.0 | 14 | 101.0 | 1.25 | .50 |
| 281.8 | 6.0 | 3.0 | 5.7 | 9.0 | 15 | 110.0 | .50 | .50 |
| 354.8 | 7.0 | 2.0 | 5.6 | 9.0 | 15 | 134.0 | .29 | .71 |
| 446.7 | 10.0 | 2.0 | 7.5 | 12.0 | 10 | 157.0 | .20 | .80 |
| 562.3 | 14.0 | 7.0 | 12.0 | 14.0 | 4 | 62.0 | .00 | .50 |
| 707.9 | 12.0 | 5.0 | 11.6 | 19.0 | 10 | 326.0 | .58 | .58 |
| 891.3 | 14.0 | 8.0 | 13.9 | 28.0 | 11 | 787.0 | 1.00 | .43 |
| 1122.0 | 11.0 | 10.0 | 10.7 | 12.0 | 4 | 12.0 | .09 | .09 |
| 1412.5 | 22.0 | 14.0 | 20.6 | 24.0 | 5 | 223.0 | .09 | .36 |
| 1778.3 | 29.0 | 25.0 | 28.0 | 30.0 | 3 | 130.0 | .03 | .14 |
| 2238.7 | 39.0 | 7.0 | 28.6 | 40.0 | 5 | 858.0 | .03 | .82 |
| 2818.4 | 37.0 | 29.0 | 33.0 | 37.0 | 2 | 232.0 | .00 | .22 |
| 3548.1 | 41.0 | 23.0 | 36.0 | 44.0 | 3 | 545.0 | .07 | .44 |
| 4466.8 | 52.0 | 52.0 | 52.0 | 52.0 | 1 | .0 | .00 | .00 |
| 5623.4 | 47.0 | 33.0 | 40.0 | 47.0 | 2 | 462.0 | .00 | .30 |
| 7079.4 | | | | | | | | |
| 8912.5 | 65.0 | 59.0 | 66.0 | 74.0 | 3 | 1023.0 | .14 | .09 |
| 11220.2 | | | | | | | | |
| 14125.4 | 99.0 | 99.0 | 99.0 | 99.0 | 1 | .0 | .00 | .00 |
| 17782.8 | 77.0 | 77.0 | 77.0 | 77.0 | 1 | .0 | .00 | .00 |

N=337 MIAMI WARM FRONTAL

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 11.2 | | | | | | | | |
| 14.1 | | | | | | | | |
| 17.8 | | | | | | | | |
| 22.4 | 1.0 | 1.0 | 1.0 | 1.0 | 3 | .0 | .00 | .00 |
| 28.2 | 1.0 | 1.0 | 1.0 | 1.0 | 3 | .0 | .00 | .00 |
| 35.5 | | | | | | | | |
| 44.7 | 1.0 | 1.0 | 1.0 | 1.0 | 2 | .0 | .00 | .00 |
| 56.2 | 1.0 | 1.0 | 1.2 | 2.0 | 5 | 2.0 | 1.00 | .00 |
| 70.8 | 2.0 | 2.0 | 2.0 | 2.0 | 1 | .0 | .00 | .00 |
| 89.1 | 2.0 | 1.0 | 1.9 | 3.0 | 9 | 5.0 | .50 | .50 |
| 112.2 | 2.0 | 2.0 | 2.0 | 2.0 | 7 | .0 | .00 | .00 |
| 141.3 | 3.0 | 2.0 | 2.4 | 3.0 | 13 | 12.0 | .00 | .33 |
| 177.8 | 3.0 | 2.0 | 3.4 | 5.0 | 14 | 35.0 | .67 | .33 |
| 223.9 | 4.0 | 2.0 | 3.9 | 6.0 | 17 | 45.0 | .50 | .50 |
| 281.8 | 5.0 | 4.0 | 5.2 | 7.0 | 5 | 29.0 | .40 | .20 |
| 354.8 | 7.0 | 3.0 | 6.5 | 10.0 | 13 | 145.0 | .43 | .57 |
| 446.7 | 8.0 | 4.0 | 7.6 | 13.0 | 25 | 373.0 | .62 | .50 |
| 562.3 | 9.0 | 2.0 | 8.2 | 13.0 | 21 | 375.0 | .44 | .78 |
| 707.9 | 11.0 | 4.0 | 10.2 | 16.0 | 25 | 516.0 | .45 | .64 |
| 891.3 | 15.0 | 5.0 | 12.8 | 22.0 | 17 | 960.0 | .47 | .67 |
| 1122.0 | 19.0 | 8.0 | 15.9 | 27.0 | 21 | 1635.0 | .42 | .58 |
| 1412.5 | 19.0 | 7.0 | 19.1 | 32.0 | 15 | 1540.0 | .68 | .63 |
| 1778.3 | 26.0 | 11.0 | 22.9 | 35.0 | 15 | 2242.0 | .35 | .58 |
| 2238.7 | 33.0 | 16.0 | 29.2 | 41.0 | 20 | 3915.0 | .24 | .52 |
| 2818.4 | 36.0 | 19.0 | 31.5 | 52.0 | 20 | 5507.0 | .44 | .47 |
| 3548.1 | 41.0 | 28.0 | 42.2 | 62.0 | 14 | 5934.0 | .51 | .32 |
| 4466.8 | 54.0 | 13.0 | 46.0 | 72.0 | 15 | 7385.0 | .33 | .76 |
| 5623.4 | 63.0 | 31.0 | 60.4 | 85.0 | 13 | 5312.0 | .35 | .51 |
| 7079.4 | 68.0 | 48.0 | 68.0 | 90.0 | 7 | 4523.0 | .32 | .29 |
| 8912.5 | 81.0 | 67.0 | 81.2 | 98.0 | 5 | 3552.0 | .21 | .17 |
| 11220.2 | 76.0 | 69.0 | 92.0 | 131.0 | 3 | 7688.0 | .72 | .09 |
| 14125.4 | | | | | | | | |
| 17782.8 | 113.0 | 91.0 | 111.7 | 139.0 | 4 | 5552.0 | .23 | .19 |
| 22387.2 | 140.0 | 140.0 | 140.0 | 140.0 | 1 | .0 | .00 | .00 |
| 28183.8 | 127.0 | 94.0 | 110.5 | 127.0 | 2 | 3102.0 | .00 | .26 |
| 35481.3 | 196.0 | 196.0 | 196.0 | 196.0 | 1 | .0 | .00 | .00 |
| 44668.3 | 153.0 | 153.0 | 153.0 | 153.0 | 1 | .0 | .00 | .00 |

N=702 MIAMI PRE-COLD FRONTAL

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 11.2 | 1.0 | 1.0 | 1.0 | 1.0 | 4 | .0 | .00 | .00 |
| 14.1 | | | | | | | | |
| 17.8 | | | | | | | | |
| 22.4 | 1.0 | 1.0 | 1.0 | 1.0 | 8 | .0 | .00 | .00 |
| 28.2 | 1.0 | 1.0 | 1.1 | 2.0 | 24 | 4.0 | 1.00 | .00 |
| 35.5 | | | | | | | | |
| 44.7 | 1.0 | 1.0 | 1.2 | 2.0 | 42 | 16.0 | 1.00 | .00 |
| 56.2 | 2.0 | 1.0 | 1.4 | 2.0 | 16 | 10.0 | .00 | .50 |
| 70.8 | 2.0 | 1.0 | 1.9 | 3.0 | 16 | 18.0 | .50 | .50 |
| 89.1 | 2.0 | 1.0 | 1.9 | 4.0 | 27 | 36.0 | 1.00 | .50 |
| 112.2 | 3.0 | 1.0 | 2.4 | 5.0 | 25 | 44.0 | .67 | .67 |
| 141.3 | 4.0 | 2.0 | 3.5 | 6.0 | 28 | 94.0 | .50 | .50 |
| 177.8 | 4.0 | 1.0 | 3.9 | 7.0 | 33 | 140.0 | .75 | .75 |
| 223.9 | 4.0 | 2.0 | 4.1 | 9.0 | 54 | 238.0 | 1.25 | .50 |
| 281.8 | 4.0 | 3.0 | 4.4 | 8.0 | 26 | 142.0 | 1.00 | .25 |
| 354.8 | 6.0 | 2.0 | 5.8 | 11.0 | 35 | 394.0 | .83 | .67 |
| 446.7 | 8.0 | 4.0 | 7.0 | 13.0 | 39 | 622.0 | .62 | .50 |
| 562.3 | 10.0 | 2.0 | 8.7 | 18.0 | 29 | 641.0 | .80 | .80 |
| 707.9 | 9.0 | 3.0 | 8.8 | 16.0 | 33 | 744.0 | .78 | .67 |
| 891.3 | 13.0 | 4.0 | 11.8 | 21.0 | 37 | 1818.0 | .62 | .69 |
| 1122.0 | 14.0 | 7.0 | 12.8 | 22.0 | 30 | 1367.0 | .57 | .50 |
| 1412.5 | 22.0 | 6.0 | 17.7 | 30.0 | 16 | 1926.0 | .36 | .73 |
| 1778.3 | 20.0 | 8.0 | 18.8 | 37.0 | 31 | 4475.0 | .85 | .60 |
| 2238.7 | 21.0 | 8.0 | 21.3 | 34.0 | 18 | 2650.0 | .62 | .62 |
| 2818.4 | 27.0 | 10.0 | 25.9 | 46.0 | 15 | 2798.0 | .70 | .63 |
| 3548.1 | 28.0 | 9.0 | 25.8 | 45.0 | 13 | 2646.0 | .61 | .68 |
| 4466.8 | 39.0 | 8.0 | 33.6 | 55.0 | 9 | 2680.0 | .41 | .79 |
| 5623.4 | 45.0 | 26.0 | 42.5 | 69.0 | 13 | 6748.0 | .53 | .42 |
| 7079.4 | 56.0 | 23.0 | 54.4 | 80.0 | 13 | 8383.0 | .43 | .59 |
| 8912.5 | 65.0 | 18.0 | 51.0 | 87.0 | 17 | 15800.0 | .34 | .72 |
| 11220.2 | 121.0 | 65.0 | 93.0 | 121.0 | 2 | 3640.0 | .00 | .46 |
| 14125.4 | 94.0 | 55.0 | 82.3 | 115.0 | 7 | 10858.0 | .22 | .41 |
| 17782.8 | 121.0 | 15.0 | 84.0 | 166.0 | 7 | 20064.0 | .37 | .88 |
| 22387.2 | 91.0 | 67.0 | 100.0 | 171.0 | 8 | 22140.0 | .88 | .26 |
| 28183.8 | 155.0 | 56.0 | 130.4 | 210.0 | 5 | 23254.0 | .35 | .64 |
| 35481.3 | 176.0 | 41.0 | 118.4 | 192.0 | 5 | 23650.0 | .09 | .77 |
| 44668.3 | 80.0 | 40.0 | 79.7 | 119.0 | 3 | 6241.0 | .49 | .50 |
| 56234.0 | 319.0 | 33.0 | 246.2 | 375.0 | 5 | 62358.0 | .18 | .90 |
| 70794.5 | 104.0 | 93.0 | 127.0 | 184.0 | 3 | 15743.0 | .77 | .11 |
| 89124.9 | 49.0 | 49.0 | 49.0 | 49.0 | 1 | .0 | .00 | .00 |
| 112201.7 | 305.0 | 73.0 | 197.0 | 305.0 | 3 | 36532.0 | .00 | .76 |
| 141253.5 | 82.0 | 82.0 | 82.0 | 82.0 | 1 | .0 | .00 | .00 |
| 177827.6 | 204.0 | 204.0 | 204.0 | 204.0 | 1 | .0 | .00 | .00 |

N=183 MIAMI COLD FRONTAL

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 11.2 | 1.0 | 1.0 | 1.0 | 1.0 | 1 | .0 | .00 | .00 |
| 14.1 | | | | | | | | |
| 17.8 | | | | | | | | |
| 22.4 | 1.0 | 1.0 | 1.0 | 1.0 | 1 | .0 | .00 | .00 |
| 28.2 | 1.0 | 1.0 | 1.0 | 1.0 | 2 | .0 | .00 | .00 |
| 35.5 | | | | | | | | |
| 44.7 | 2.0 | 2.0 | 2.0 | 2.0 | 1 | .0 | .00 | .00 |
| 56.2 | 2.0 | 1.0 | 1.7 | 2.0 | 3 | 1.0 | .00 | .50 |
| 70.8 | 2.0 | 1.0 | 1.7 | 2.0 | 4 | 1.0 | .00 | .50 |
| 89.1 | 3.0 | 1.0 | 2.5 | 4.0 | 4 | 8.0 | .33 | .67 |
| 112.2 | 4.0 | 3.0 | 3.5 | 4.0 | 10 | 15.0 | .00 | .25 |
| 141.3 | 4.0 | 2.0 | 3.3 | 4.0 | 9 | 14.0 | .00 | .50 |
| 177.8 | 4.0 | 3.0 | 3.9 | 5.0 | 7 | 11.0 | .25 | .25 |
| 223.9 | 5.0 | 3.0 | 5.1 | 7.0 | 9 | 48.0 | .40 | .40 |
| 281.8 | 8.0 | 5.0 | 7.0 | 9.0 | 9 | 67.0 | .12 | .37 |
| 354.8 | 9.0 | 5.0 | 8.3 | 12.0 | 10 | 106.0 | .33 | .44 |
| 446.7 | 10.0 | 5.0 | 8.6 | 13.0 | 8 | 163.0 | .30 | .50 |
| 562.3 | 11.0 | 5.0 | 9.2 | 12.0 | 9 | 158.0 | .09 | .55 |
| 707.9 | 13.0 | 6.0 | 11.9 | 16.0 | 8 | 192.0 | .23 | .54 |
| 891.3 | 18.0 | 7.0 | 13.3 | 19.0 | 6 | 276.0 | .06 | .61 |
| 1122.0 | 16.0 | 6.0 | 14.9 | 21.0 | 8 | 337.0 | .31 | .62 |
| 1412.5 | 21.0 | 17.0 | 21.0 | 25.0 | 5 | 210.0 | .19 | .19 |
| 1778.3 | 19.0 | 11.0 | 17.2 | 21.0 | 5 | 210.0 | .11 | .42 |
| 2238.7 | 34.0 | 33.0 | 42.7 | 61.0 | 3 | 1680.0 | .79 | .03 |
| 2818.4 | 30.0 | 4.0 | 23.8 | 44.0 | 13 | 2550.0 | .47 | .87 |
| 3548.1 | 37.0 | 8.0 | 31.8 | 59.0 | 6 | 1937.0 | .59 | .78 |
| 4466.8 | 36.0 | 27.0 | 35.7 | 45.0 | 4 | 683.0 | .25 | .25 |
| 5623.4 | 42.0 | 39.0 | 44.8 | 56.0 | 5 | 1036.0 | .33 | .07 |
| 7079.4 | 59.0 | 49.0 | 57.3 | 64.0 | 3 | 810.0 | .08 | .17 |
| 8912.5 | 64.0 | 26.0 | 55.1 | 98.0 | 8 | 7729.0 | .53 | .59 |
| 11220.2 | 74.0 | 35.0 | 70.6 | 101.0 | 6 | 5295.0 | .36 | .53 |
| 14125.4 | 54.0 | 46.0 | 63.5 | 90.0 | 3 | 3608.0 | .67 | .15 |
| 17782.8 | 138.0 | 34.0 | 85.7 | 138.0 | 3 | 8041.0 | .00 | .75 |
| 22387.2 | 79.0 | 78.0 | 78.5 | 79.0 | 2 | 78.0 | .00 | .01 |
| 28183.8 | 156.0 | 91.0 | 123.5 | 156.0 | 2 | 5915.0 | .00 | .42 |
| 35481.3 | 126.0 | 123.0 | 124.5 | 126.0 | 2 | 369.0 | .00 | .02 |
| 44668.3 | 168.0 | 80.0 | 147.3 | 194.0 | 3 | 12084.0 | .15 | .52 |
| 56234.0 | | | | | | | | |
| 70794.5 | 71.0 | 71.0 | 71.0 | 71.0 | 1 | .0 | .00 | .00 |

**KEY**

**Z = RADAR REFLECTIVITY IN $10\ \mathrm{mm}^6/\mathrm{m}^3$**

**$R^*$ = BEST ESTIMATE OF R BASED ON THE MINIMUM $\Sigma\ R_i(R^*-R_i)$ IN mm/hr**

**R MIN = MINIMUM RATE IN EACH Z INTERVAL mm/hr.**

**R AVE = AVERAGE RATE IN EACH Z INTERVAL mm/hr.**

**R MAX = MAXIMUM RATE IN EACH Z INTERVAL mm/hr.**

**N = NUMBER OF ONE CUBIC METER SAMPLES IN EACH Z INTERVAL**

**$S = \Sigma\ R(R^*-R_i)$**

**UNDER = MAXIMUM POSSIBLE UNDERESTIMATE DEFINED AS $\frac{R\,MAX-R^*}{R^*}$**

**OVER = MAXIMUM POSSIBLE OVERESTIMATE DEFINED AS $\frac{R^*-R\,MIN}{R^*}$**

FIG. 3 TABLES OF RAINFALL RATE VERSUS RADAR REFLECTIVITY FOR SYNOPTIC TYPES FOR MIAMI, FLORIDA.

N=2368 NORTH CAROLINA

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 1.1 | .1 | .0 | .1 | .2 | 31 | .1 | 1.00 | 1.00 |
| 1.4 | | | | | | | | |
| 1.8 | | | | | | | | |
| 2.2 | .2 | .1 | .1 | .2 | 31 | .2 | .00 | .50 |
| 2.8 | .2 | .1 | .2 | .4 | 29 | .3 | 1.00 | .50 |
| 3.5 | | | | | | | | |
| 4.5 | .3 | .2 | .3 | .8 | 44 | 1.6 | 1.67 | .33 |
| 5.6 | .4 | .2 | .4 | .7 | 21 | .9 | .75 | .50 |
| 7.1 | .5 | .2 | .4 | .6 | 13 | .4 | .20 | .60 |
| 8.9 | .5 | .2 | .4 | .9 | 29 | 1.6 | .80 | .60 |
| 11.2 | .7 | .3 | .6 | 1.3 | 46 | 6.6 | .86 | .57 |
| 14.1 | .8 | .2 | .7 | 1.7 | 51 | 8.1 | 1.12 | .75 |
| 17.8 | .9 | .3 | .8 | 1.8 | 57 | 11.5 | 1.00 | .67 |
| 22.4 | 1.2 | .4 | 1.0 | 2.1 | 79 | 25.8 | .75 | .67 |
| 28.2 | 1.4 | .5 | 1.3 | 2.5 | 71 | 33.7 | .79 | .64 |
| 35.5 | 1.7 | .3 | 1.6 | 3.0 | 83 | 57.2 | .76 | .82 |
| 44.7 | 2.0 | .6 | 1.8 | 4.2 | 85 | 90.2 | 1.10 | .70 |
| 56.2 | 2.3 | .7 | 2.1 | 4.4 | 94 | 124.9 | .91 | .70 |
| 70.8 | 2.7 | .9 | 2.5 | 5.8 | 77 | 172.0 | 1.15 | .67 |
| 89.1 | 3.0 | .7 | 2.8 | 5.1 | 101 | 230.3 | .70 | .77 |
| 112.2 | 3.7 | 1.7 | 3.5 | 7.4 | 117 | 389.9 | 1.00 | .54 |
| 141.3 | 4.3 | 1.0 | 4.0 | 9.5 | 123 | 607.4 | 1.21 | .77 |
| 177.8 | 5.3 | 1.1 | 4.9 | 10.6 | 149 | 1062.3 | 1.00 | .79 |
| 223.9 | 6.3 | 1.9 | 5.8 | 12.8 | 129 | 1394.8 | 1.03 | .70 |
| 281.8 | 7.8 | 2.8 | 6.9 | 14.9 | 123 | 1696.2 | .91 | .64 |
| 354.8 | 8.6 | 2.2 | 7.8 | 17.8 | 103 | 1720.4 | 1.07 | .74 |
| 446.7 | 10.7 | 1.5 | 9.6 | 20.4 | 90 | 2417.7 | .91 | .86 |
| 562.3 | 12.1 | 2.9 | 10.9 | 21.2 | 91 | 2851.7 | .75 | .76 |
| 707.9 | 15.0 | 5.7 | 13.8 | 29.0 | 94 | 4713.7 | .93 | .62 |
| 891.3 | 17.7 | 8.3 | 16.4 | 30.0 | 72 | 4694.3 | .69 | .53 |
| 1122.0 | 20.0 | 4.3 | 17.7 | 26.7 | 64 | 4431.7 | .33 | .78 |
| 1412.5 | 21.5 | 7.5 | 20.1 | 30.3 | 56 | 4603.2 | .41 | .65 |
| 1778.3 | 26.9 | 7.3 | 24.6 | 43.5 | 43 | 5825.7 | .62 | .73 |
| 2238.7 | 30.0 | 8.1 | 26.6 | 39.4 | 37 | 4951.3 | .31 | .73 |
| 2818.4 | 39.1 | 19.0 | 37.5 | 52.3 | 29 | 5860.7 | .34 | .51 |
| 3548.1 | 44.7 | 20.7 | 38.7 | 53.7 | 19 | 5124.6 | .20 | .54 |
| 4466.8 | 48.3 | 12.9 | 44.8 | 69.9 | 12 | 5497.7 | .45 | .73 |
| 5623.4 | 63.0 | 25.4 | 54.8 | 101.2 | 22 | 20455.0 | .61 | .60 |
| 7079.4 | 62.4 | 35.0 | 55.3 | 67.2 | 7 | 2958.5 | .08 | .44 |
| 8912.5 | 71.3 | 29.4 | 62.5 | 105.1 | 12 | 10833.4 | .47 | .59 |
| 11220.2 | 121.3 | 38.6 | 105.2 | 136.0 | 10 | 18996.7 | .12 | .68 |
| 14125.4 | 140.4 | 83.3 | 123.8 | 165.3 | 7 | 20655.1 | .18 | .41 |
| 17782.8 | 154.1 | 35.9 | 109.5 | 176.6 | 6 | 20137.8 | .15 | .77 |
| 22387.2 | 217.4 | 99.7 | 177.8 | 266.1 | 5 | 40667.7 | .22 | .54 |
| 28183.8 | 101.0 | 58.1 | 79.5 | 101.0 | 2 | 2492.5 | .00 | .42 |
| 35481.3 | 67.7 | 40.6 | 54.1 | 67.7 | 2 | 1100.3 | .00 | .40 |

N=2688 ALASKA

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 1.1 | .1 | .1 | .1 | .2 | 70 | .1 | 1.00 | -.00 |
| 1.4 | | | | | | | | |
| 1.8 | | | | | | | | |
| 2.2 | .2 | .1 | .2 | .3 | 137 | .8 | .50 | .50 |
| 2.8 | .3 | .1 | .2 | .5 | 115 | 1.7 | .67 | .67 |
| 3.5 | | | | | | | | |
| 4.5 | .3 | .1 | .3 | .6 | 199 | 4.8 | 1.00 | .67 |
| 5.6 | .4 | .1 | .4 | .9 | 103 | 4.1 | 1.25 | .75 |
| 7.1 | .5 | .2 | .5 | .8 | 71 | 3.5 | .60 | .60 |
| 8.9 | .5 | .2 | .5 | .8 | 119 | 5.9 | .60 | .60 |
| 11.2 | .6 | .3 | .6 | 1.0 | 107 | 12.7 | .67 | .50 |
| 14.1 | .8 | .2 | .7 | 1.4 | 131 | 15.8 | .75 | .75 |
| 17.8 | .8 | .3 | .8 | 1.7 | 164 | 23.6 | 1.12 | .62 |
| 22.4 | 1.0 | .4 | 1.0 | 2.1 | 177 | 37.1 | 1.10 | .60 |
| 28.2 | 1.2 | .4 | 1.1 | 2.4 | 149 | 43.5 | 1.00 | .67 |
| 35.5 | 1.3 | .3 | 1.2 | 2.9 | 150 | 61.3 | 1.23 | .77 |
| 44.7 | 1.6 | .6 | 1.5 | 3.1 | 156 | 73.3 | .94 | .62 |
| 56.2 | 1.9 | .9 | 1.7 | 3.5 | 142 | 117.4 | .84 | .53 |
| 70.8 | 2.1 | .7 | 2.0 | 3.7 | 137 | [illegible] | .76 | .67 |
| 89.1 | 2.3 | .8 | 2.2 | 4.4 | 114 | [illegible] | .91 | .65 |
| 112.2 | 3.0 | .7 | 2.8 | 7.8 | 111 | 273.6 | 1.60 | .77 |
| 141.3 | 3.3 | 1.1 | 3.2 | 7.6 | 64 | 211.6 | 1.30 | .67 |
| 177.8 | 3.8 | .8 | 3.5 | 8.9 | 62 | 243.8 | 1.34 | .79 |
| 223.9 | 4.2 | 2.0 | 3.8 | 6.7 | 36 | 129.9 | .60 | .52 |
| 281.8 | 5.2 | 1.9 | 4.7 | 9.3 | 32 | 239.0 | .79 | .63 |
| 354.8 | 5.3 | 2.1 | 5.2 | 10.9 | 28 | 225.4 | 1.06 | .60 |
| 446.7 | 4.9 | 1.4 | 4.3 | 6.5 | 9 | 36.6 | .33 | .67 |
| 562.3 | 8.0 | 2.4 | 3.8 | 19.7 | 12 | 345.3 | 1.46 | .70 |
| 707.9 | 9.3 | 2.7 | 8.1 | 12.0 | 7 | 112.5 | .29 | .71 |
| 891.3 | 9.8 | 4.1 | 7.9 | 9.6 | 4 | 31.9 | .00 | .57 |
| 1122.0 | 11.4 | 3.9 | 8.8 | 11.4 | 5 | 66.9 | .00 | .66 |
| 1412.5 | 13.0 | 5.2 | 13.6 | 25.7 | 6 | 394.6 | .98 | .60 |
| 1778.3 | 14.1 | 3.9 | 10.3 | 16.0 | 4 | 119.9 | .13 | .72 |
| 2238.7 | 16.6 | 15.7 | 15.9 | 18.5 | 3 | 49.3 | .11 | .05 |
| 2818.4 | 9.2 | 9.2 | 9.2 | 9.2 | 1 | .0 | .00 | -.00 |
| 3548.1 | 6.5 | 6.5 | 6.5 | 6.5 | 1 | .0 | .00 | -.00 |
| 4466.8 | | | | | | | | |
| 5623.4 | | | | | | | | |
| 7079.4 | | | | | | | | |
| 8912.5 | | | | | | | | |
| 11220.2 | 9.2 | 9.2 | 9.2 | 9.2 | 1 | .3 | .00 | -.00 |

N=1706 OREGON

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 1.1 | .1 | .1 | .1 | .1 | 3 | .0 | .00 | -.00 |
| 1.4 | | | | | | | | |
| 1.8 | | | | | | | | |
| 2.2 | .1 | .1 | .1 | .1 | 4 | .3 | .00 | -.00 |
| 2.8 | .1 | .1 | .1 | .2 | 7 | .0 | 1.00 | -.00 |
| 3.5 | | | | | | | | |
| 4.5 | .2 | .1 | .2 | .5 | 10 | .2 | 1.50 | .50 |
| 5.6 | .3 | .1 | .2 | .6 | 6 | .3 | 1.00 | .67 |
| 7.1 | .6 | .2 | .5 | .7 | 7 | .4 | .17 | .67 |
| 8.9 | .6 | .2 | .6 | .7 | 20 | .7 | .17 | .67 |
| 11.2 | .6 | .2 | .6 | .8 | 38 | 2.1 | .33 | .67 |
| 14.1 | .7 | .2 | .7 | 1.5 | 67 | 7.0 | 1.14 | .71 |
| 17.8 | .7 | .2 | .7 | 1.6 | 94 | 11.7 | 1.29 | .71 |
| 22.4 | .8 | .3 | .8 | 1.8 | 158 | 27.1 | 1.25 | .62 |
| 28.2 | 1.0 | .4 | .9 | 1.8 | 109 | 22.6 | .80 | .60 |
| 35.5 | 1.1 | .5 | 1.1 | 2.3 | 130 | 33.7 | 1.09 | .55 |
| 44.7 | 1.3 | .5 | 1.2 | 2.5 | 130 | 46.6 | .92 | .62 |
| 56.2 | 1.5 | .6 | 1.5 | 3.9 | 101 | 72.0 | 1.60 | .60 |
| 70.8 | 1.7 | .8 | 1.7 | 3.7 | 112 | 70.8 | 1.18 | .53 |
| 89.1 | 2.2 | .9 | 2.1 | 5.1 | 106 | 137.0 | 1.32 | .59 |
| 112.2 | 2.4 | 1.1 | 2.3 | 4.9 | 104 | 149.8 | 1.04 | .54 |
| 141.3 | 2.8 | .9 | 2.7 | 6.0 | 76 | 145.3 | 1.14 | .68 |
| 177.8 | 3.5 | 1.2 | 3.3 | 7.1 | 87 | 252.4 | 1.03 | .66 |
| 223.9 | 4.1 | 1.4 | 3.7 | 6.5 | 66 | 223.1 | .59 | .66 |
| 281.8 | 4.7 | 1.7 | 4.4 | 8.5 | 64 | 359.4 | .81 | .64 |
| 354.8 | 6.1 | 1.8 | 5.4 | 10.3 | 56 | 465.7 | .69 | .70 |
| 446.7 | 5.6 | 1.7 | 5.6 | 14.5 | 35 | 486.5 | 1.59 | .70 |
| 562.3 | 6.5 | 2.6 | 6.5 | 19.9 | 34 | 692.9 | 2.06 | .60 |
| 707.9 | 8.0 | 3.0 | 7.5 | 12.6 | 27 | 415.3 | .57 | .62 |
| 891.3 | 10.8 | 2.6 | 8.6 | 18.4 | 20 | 504.3 | .70 | .76 |
| 1122.0 | 11.1 | 2.7 | 9.5 | 15.6 | 20 | 574.3 | .41 | .76 |
| 1412.5 | 10.8 | 6.2 | 9.6 | 12.2 | 5 | 68.6 | .13 | .43 |
| 1778.3 | 24.2 | 7.0 | 14.4 | 26.1 | 5 | 410.5 | .08 | .71 |
| 2238.7 | 7.7 | 5.3 | 7.2 | 8.5 | 3 | 19.5 | .10 | .31 |
| 2818.4 | 21.5 | 21.5 | 21.5 | 21.5 | 1 | .0 | .00 | -.00 |
| 3548.1 | 24.0 | 13.4 | 18.7 | 24.0 | 2 | 142.0 | .00 | .44 |
| 4466.8 | | | | | | | | |
| 5623.4 | 4.2 | 4.2 | 4.2 | 4.2 | 1 | .0 | .00 | -.00 |

N=1079 INDONESIA

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 1.1 | .1 | .1 | .1 | .2 | 47 | .1 | 1.00 | -.00 |
| 1.4 | | | | | | | | |
| 1.8 | | | | | | | | |
| 2.2 | .2 | .1 | .1 | .3 | 45 | .3 | .50 | .50 |
| 2.8 | .2 | .1 | .2 | .3 | 24 | .2 | .50 | .50 |
| 3.5 | | | | | | | | |
| 4.5 | .3 | .1 | .3 | .5 | 50 | .9 | .67 | .67 |
| 5.6 | .4 | .2 | .3 | .6 | 20 | .7 | .50 | .50 |
| 7.1 | .4 | .2 | .4 | .6 | 29 | .7 | .50 | .50 |
| 8.9 | .4 | .2 | .4 | .8 | 44 | 2.1 | 1.00 | .50 |
| 11.2 | .5 | .2 | .5 | 1.0 | 59 | 4.5 | 1.00 | .60 |
| 14.1 | .7 | .2 | .6 | 1.1 | 41 | 4.0 | .57 | .71 |
| 17.8 | .8 | .3 | .7 | 1.0 | 46 | 4.2 | .25 | .62 |
| 22.4 | .9 | .4 | .8 | 1.6 | 72 | 12.6 | .78 | .56 |
| 28.2 | 1.0 | .4 | .9 | 1.9 | 55 | 14.1 | .90 | .60 |
| 35.5 | 1.2 | .4 | 1.1 | 1.8 | 63 | 17.0 | .50 | .67 |
| 44.7 | 1.5 | .6 | 1.4 | 2.6 | 50 | 25.3 | .73 | .60 |
| 56.2 | 1.6 | .5 | 1.5 | 2.9 | 49 | 30.2 | .81 | .69 |
| 70.8 | 2.1 | .8 | 1.8 | 3.1 | 56 | 46.5 | .48 | .62 |
| 89.1 | 2.2 | .9 | 2.0 | 3.3 | 54 | 56.8 | .50 | .59 |
| 112.2 | 2.7 | 1.0 | 2.4 | 4.0 | 65 | 78.2 | .48 | .63 |
| 141.3 | 3.0 | 1.5 | 2.9 | 5.0 | 53 | 112.3 | .67 | .50 |
| 177.8 | 3.9 | 1.3 | 3.7 | 6.2 | 71 | 219.0 | .59 | .67 |
| 223.9 | 4.4 | 1.4 | 4.1 | 7.1 | 64 | 249.9 | .61 | .68 |
| 281.8 | 5.0 | 1.1 | 4.8 | 10.4 | 62 | 373.7 | 1.08 | .78 |
| 354.8 | 6.4 | 1.6 | 6.0 | 9.3 | 61 | 468.2 | .45 | .75 |
| 446.7 | 7.6 | 1.3 | 7.0 | 11.7 | 45 | 517.5 | .54 | .83 |
| 562.3 | 9.1 | 1.9 | 8.0 | 12.8 | 54 | 784.3 | .41 | .79 |
| 707.9 | 10.7 | 5.6 | 10.3 | 17.5 | 38 | 1511.4 | .64 | .49 |
| 891.3 | 13.3 | 4.0 | 11.0 | 17.8 | 49 | 1418.8 | .34 | .70 |
| 1122.0 | 15.7 | 3.9 | 14.4 | 26.8 | 44 | 2229.5 | .71 | .75 |
| 1412.5 | 19.2 | 5.0 | 16.8 | 26.8 | 38 | 2489.6 | .40 | .74 |
| 1778.3 | 22.4 | 7.0 | 20.3 | 29.3 | 44 | 3513.6 | .31 | .69 |
| 2238.7 | 25.7 | 6.7 | 23.1 | 40.5 | 44 | 5525.7 | .58 | .74 |
| 2818.4 | 30.1 | 6.0 | 26.7 | 44.2 | 48 | 6265.5 | .47 | .80 |
| 3548.1 | 33.1 | 7.5 | 29.5 | 43.9 | 45 | 7753.9 | .33 | .77 |
| 4466.8 | 38.8 | 11.8 | 35.4 | 50.6 | 43 | 9773.6 | .30 | .70 |
| 5623.4 | 49.8 | 13.2 | 41.4 | 67.0 | 45 | 17928.0 | .35 | .73 |
| 7079.4 | 49.0 | 12.2 | 45.9 | 78.2 | 36 | 18292.7 | .60 | .75 |
| 8912.5 | 61.7 | 17.8 | 54.1 | 81.2 | 27 | 16394.3 | .32 | .72 |
| 11220.2 | 79.7 | 15.9 | 65.7 | 151.4 | 25 | 48959.0 | .90 | .80 |
| 14125.4 | 104.5 | 28.7 | 84.1 | 136.6 | 10 | 19098.0 | .31 | .73 |
| 17782.8 | 86.8 | 10.7 | 65.0 | 181.8 | 14 | 35079.7 | 1.09 | .88 |
| 22387.2 | 118.0 | 18.7 | 75.5 | 203.8 | 10 | 40516.5 | .72 | .84 |
| 28183.8 | 282.0 | 133.5 | 207.7 | 282.0 | 2 | 19874.7 | .00 | .53 |
| 35481.3 | 74.6 | 40.7 | 70.0 | 94.7 | 3 | 3283.2 | .27 | .45 |
| 44668.3 | 125.5 | 58.7 | 125.6 | 148.5 | 3 | 5881.5 | .15 | .44 |
| 56234.0 | 72.3 | 72.3 | 72.3 | 72.3 | 1 | .0 | .00 | -.00 |
| 70794.5 | 126.5 | 83.6 | 104.9 | 126.5 | 2 | 3594.5 | .00 | .34 |
| 89124.9 | | | | | | | | |
| 112201.7 | 123.8 | 123.8 | 123.8 | 123.8 | 1 | .0 | .00 | -.00 |

N=2461 MAJURO

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 1.1 | | | | | | | | |
| 1.4 | | | | | | | | |
| 1.8 | | | | | | | | |
| 2.2 | | | | | | | | |
| 2.8 | | | | | | | | |
| 3.5 | | | | | | | | |
| 4.5 | | | | | | | | |
| 5.6 | | | | | | | | |
| 7.1 | | | | | | | | |
| 8.9 | | | | | | | | |
| 11.2 | 1.0 | 1.0 | 1.0 | 2.0 | 112 | 2.0 | 1.00 | -.00 |
| 14.1 | | | | | | | | |
| 17.8 | | | | | | | | |
| 22.4 | 1.0 | 1.0 | 1.1 | 2.0 | 179 | 32.3 | 1.00 | -.00 |
| 28.2 | 1.0 | 1.0 | 1.4 | 8.0 | 129 | 174.0 | 7.00 | -.00 |
| 35.5 | | | | | | | | |
| 44.7 | 2.0 | 1.0 | 1.8 | 8.0 | 190 | 259.3 | 3.00 | .50 |
| 56.2 | 3.0 | 1.0 | 2.6 | 5.0 | 71 | 103.3 | .67 | .67 |
| 70.8 | 3.0 | 1.0 | 2.5 | 5.0 | 64 | 142.0 | .67 | .67 |
| 89.1 | 3.0 | 1.0 | 2.9 | 6.0 | 109 | 300.0 | 1.00 | .67 |
| 112.2 | 4.0 | 1.0 | 3.7 | 7.0 | 140 | 570.0 | .75 | .75 |
| 141.3 | 5.0 | 1.0 | 4.4 | 9.0 | 120 | 752.0 | .80 | .80 |
| 177.8 | 6.0 | 2.0 | 5.1 | 12.0 | 124 | 1066.0 | 1.00 | .67 |
| 223.9 | 7.0 | 2.0 | 5.0 | 12.0 | 143 | 1610.0 | .71 | .71 |
| 281.8 | 9.0 | 2.0 | 7.6 | 14.0 | 98 | 1478.0 | .56 | .78 |
| 354.8 | 10.0 | 2.0 | 8.7 | 15.0 | 106 | 2147.3 | .50 | .80 |
| 446.7 | 13.0 | 3.0 | 10.6 | 20.0 | 118 | 3438.0 | .54 | .77 |
| 562.3 | 14.0 | 4.0 | 12.4 | 21.0 | 104 | 3634.0 | .50 | .71 |
| 707.9 | 18.0 | 4.0 | 15.6 | 25.0 | 92 | 4321.0 | .39 | .78 |
| 891.3 | 21.0 | 5.0 | 19.1 | 29.0 | 74 | 4560.0 | .38 | .76 |
| 1122.0 | 24.0 | 7.0 | 21.6 | 32.0 | 87 | 6567.0 | .33 | .71 |
| 1412.5 | 29.0 | 10.0 | 25.9 | 37.0 | 67 | 6784.0 | .28 | .66 |
| 1778.3 | 33.0 | 4.0 | 29.3 | 47.0 | 63 | 9936.0 | .42 | .88 |
| 2238.7 | 37.0 | 16.0 | 35.9 | 52.0 | 59 | 9412.7 | .41 | .57 |
| 2818.4 | 44.0 | 7.0 | 41.4 | 59.0 | 41 | 9111.0 | .34 | .84 |
| 3548.1 | 51.0 | 13.0 | 48.4 | 67.0 | 47 | 13140.0 | .31 | .75 |
| 4466.8 | 55.0 | 7.0 | 52.8 | 80.0 | 33 | 14290.0 | .45 | .87 |
| 5623.4 | 65.0 | 23.0 | 55.6 | 86.0 | 24 | 17842.0 | .32 | .65 |
| 7079.4 | 77.0 | 16.0 | 70.9 | 96.0 | 25 | 17946.0 | .25 | .79 |
| 8912.5 | 86.0 | 53.0 | 83.1 | 102.0 | 14 | 12237.0 | .19 | .38 |
| 11220.2 | 93.0 | 75.0 | 90.5 | 102.0 | 8 | 4280.0 | .10 | .19 |
| 14125.4 | 129.0 | 86.0 | 117.6 | 149.0 | 10 | 22276.0 | .16 | .33 |
| 17782.8 | 121.0 | 89.0 | 121.5 | 171.0 | 8 | 21422.0 | .41 | .26 |
| 22387.2 | 123.0 | 113.0 | 118.0 | 123.0 | 2 | 1130.0 | .00 | .08 |
| 28183.8 | 248.0 | 177.0 | 212.5 | 248.0 | 2 | 12567.0 | .00 | .29 |
| 35481.3 | | | | | | | | |

N=2506 MIAMI

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 1.1 | | | | | | | | |
| 1.4 | | | | | | | | |
| 1.8 | | | | | | | | |
| 2.2 | | | | | | | | |
| 2.8 | | | | | | | | |
| 3.5 | | | | | | | | |
| 4.5 | | | | | | | | |
| 5.6 | | | | | | | | |
| 7.1 | | | | | | | | |
| 8.9 | | | | | | | | |
| 11.2 | 1.0 | 1.0 | 1.0 | 1.0 | 10 | .0 | .00 | -.00 |
| 14.1 | | | | | | | | |
| 17.8 | | | | | | | | |
| 22.4 | 1.0 | 1.0 | 1.0 | 1.0 | 41 | .0 | .00 | -.00 |
| 28.2 | 1.0 | 1.0 | 1.0 | 2.0 | 65 | 6.0 | 1.00 | -.00 |
| 35.5 | | | | | | | | |
| 44.7 | 1.0 | 1.0 | 1.1 | 2.0 | 104 | 30.0 | 1.00 | -.00 |
| 56.2 | 2.0 | 1.0 | 1.6 | 9.0 | 55 | 95.0 | 3.50 | .50 |
| 70.8 | 2.0 | 1.0 | 1.7 | 4.0 | 43 | 41.0 | 1.00 | .50 |
| 89.1 | 2.0 | 1.0 | 2.0 | 4.0 | 85 | 121.0 | 1.00 | .50 |
| 112.2 | 3.0 | 1.0 | 2.5 | 6.0 | 96 | 182.0 | 1.00 | .67 |
| 141.3 | 3.0 | 1.0 | 3.0 | 6.0 | 81 | 226.0 | 1.00 | .67 |
| 177.8 | 4.0 | 1.0 | 3.7 | 7.0 | 105 | 390.0 | .75 | .75 |
| 223.9 | 5.0 | 1.0 | 4.3 | 9.0 | 134 | 680.0 | .80 | .80 |
| 281.8 | 6.0 | 2.0 | 5.4 | 14.0 | 90 | 832.0 | 1.33 | .67 |
| 354.8 | 7.0 | 2.0 | 6.3 | 12.0 | 125 | 1458.0 | .71 | .71 |
| 446.7 | 8.0 | 2.0 | 7.4 | 13.0 | 139 | 2086.0 | .62 | .75 |
| 562.3 | 10.0 | 2.0 | 9.0 | 18.0 | 116 | 2379.0 | .80 | .80 |
| 707.9 | 11.0 | 3.0 | 10.4 | 19.0 | 128 | 3620.0 | .73 | .73 |
| 891.3 | 15.0 | 3.0 | 12.8 | 28.0 | 115 | 5826.0 | .87 | .80 |
| 1122.0 | 17.0 | 3.0 | 14.5 | 27.0 | 111 | 6892.0 | .59 | .82 |
| 1412.5 | 21.0 | 6.0 | 19.2 | 32.0 | 72 | 6238.0 | .52 | .71 |
| 1778.3 | 25.0 | 5.0 | 21.2 | 37.0 | 90 | 12504.0 | .48 | .80 |
| 2238.7 | 31.0 | 4.0 | 26.3 | 61.0 | 72 | 13964.0 | .97 | .87 |
| 2818.4 | 33.0 | 4.0 | 28.3 | 74.0 | 76 | 21358.0 | 1.24 | .88 |
| 3548.1 | 41.0 | 8.0 | 34.8 | 62.0 | 69 | 25390.0 | .51 | .80 |
| 4466.8 | 48.0 | 8.0 | 43.7 | 88.0 | 59 | 30340.0 | .83 | .83 |
| 5623.4 | 55.0 | 14.0 | 50.8 | 87.0 | 61 | 41818.0 | .58 | .75 |
| 7079.4 | 65.0 | 18.0 | 56.5 | 90.0 | 50 | 37740.0 | .38 | .72 |
| 8912.5 | 70.0 | 16.0 | 61.0 | 117.0 | 60 | 60039.0 | .67 | .77 |
| 11220.2 | 78.0 | 18.0 | 68.5 | 131.0 | 34 | 43422.0 | .68 | .77 |
| 14125.4 | 91.0 | 46.0 | 90.4 | 221.0 | 36 | 82434.0 | 1.43 | .49 |
| 17782.8 | 110.0 | 15.0 | 86.5 | 166.0 | 32 | 76729.0 | .51 | .86 |
| 22387.2 | 121.0 | 15.0 | 113.9 | 214.0 | 33 | 104806.0 | .77 | .88 |
| 28183.8 | 153.0 | 41.0 | 131.5 | 238.0 | 36 | 181824.0 | .56 | .73 |
| 35481.3 | 192.0 | 41.0 | 167.1 | 249.0 | 28 | 161610.0 | .30 | .79 |
| 44668.3 | 206.0 | 39.0 | 164.6 | 306.0 | 24 | 259215.0 | .49 | .81 |
| 56234.0 | 220.0 | 33.0 | 222.7 | 375.0 | 9 | 132368.0 | .70 | .85 |
| 70794.5 | 203.0 | 71.0 | 189.9 | 359.0 | 8 | 132584.0 | .77 | .65 |
| 89124.9 | 282.0 | 49.0 | 235.5 | 466.0 | 4 | 117026.0 | .65 | .83 |
| 112201.7 | 305.0 | 73.0 | 247.7 | 400.0 | 4 | 74532.0 | .31 | .76 |
| 141253.5 | 566.0 | 82.0 | 401.4 | 722.0 | 5 | 264677.0 | .28 | .86 |
| 177827.9 | 204.0 | 204.0 | 204.0 | 204.0 | 1 | .0 | .00 | -.00 |

**KEY**

**Z = RADAR REFLECTIVITY IN 10mm$^6$/m$^3$**
**R$^*$ = BEST ESTIMATE OF R BASED ON THE MINIMUM $\Sigma$ R$_i$(R$^*$−R$_i$) IN mm/hr.**
**R MIN = MINIMUM RATE IN EACH Z INTERVAL mm/hr.**
**R AVE = AVERAGE RATE IN EACH Z INTERVAL mm/hr.**
**R MAX = MAXIMUM RATE IN EACH Z INTERVAL mm/hr.**

**N = NUMBER OF ONE CUBIC METER SAMPLES IN EACH Z INTERVAL**
**S = $\Sigma$ R (R$^*$−R$_i$)**
**UNDER = MAXIMUM POSSIBLE UNDERESTIMATE DEFINED AS** $\frac{\text{R MAX}-\text{R}^*}{\text{R}^*}$
**OVER = MAXIMUM POSSIBLE OVERESTIMATE DEFINED AS** $\frac{\text{R}^*-\text{R MIN}}{\text{R}^*}$

FIG. 4 TABLES OF R-Z COMPARISONS FOR NON-STRATIFIED DATA FROM ALASKA. OREGON, FLORIDA, INDONESIA, MAJURO, AND NORTH CAROLINA.

N=366 MAJURO PASI 1-75

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 1.1 | | | | | | | | |
| 1.4 | | | | | | | | |
| 1.8 | | | | | | | | |
| 2.2 | | | | | | | | |
| 2.8 | | | | | | | | |
| 3.5 | | | | | | | | |
| 4.5 | | | | | | | | |
| 5.6 | | | | | | | | |
| 7.1 | | | | | | | | |
| 8.9 | | | | | | | | |
| 11.2 | 1.0 | 1.0 | 1.0 | 1.0 | 8 | .0 | .00 | -.00 |
| 14.1 | | | | | | | | |
| 17.8 | | | | | | | | |
| 22.4 | 1.0 | 1.0 | 1.2 | 2.0 | 10 | 4.0 | 1.00 | -.00 |
| 28.2 | 1.0 | 1.0 | 1.2 | 2.0 | 11 | 6.0 | 1.00 | -.00 |
| 35.5 | | | | | | | | |
| 44.7 | 2.0 | 1.0 | 2.1 | 3.0 | 17 | 19.0 | .50 | .50 |
| 56.2 | 2.0 | 1.0 | 1.8 | 3.0 | 5 | 5.0 | .50 | .50 |
| 70.8 | 3.0 | 1.0 | 2.1 | 4.0 | 8 | 14.0 | .33 | .67 |
| 89.1 | 3.0 | 2.0 | 2.7 | 4.0 | 13 | 12.0 | .33 | .33 |
| 112.2 | 4.0 | 2.0 | 3.3 | 6.0 | 26 | 76.0 | .50 | .50 |
| 141.3 | 3.0 | 2.0 | 3.4 | 6.0 | 14 | 42.0 | 1.00 | .33 |
| 177.8 | 5.0 | 3.0 | 4.5 | 8.0 | 21 | 163.0 | .60 | .40 |
| 223.9 | 6.0 | 3.0 | 5.1 | 9.0 | 27 | 153.0 | .50 | .50 |
| 281.8 | 6.0 | 2.0 | 5.4 | 9.0 | 15 | 111.0 | .50 | .67 |
| 354.8 | 8.0 | 3.0 | 7.4 | 12.0 | 17 | 304.0 | .50 | .62 |
| 446.7 | 9.0 | 4.0 | 8.5 | 16.0 | 23 | 548.0 | .78 | .56 |
| 562.3 | 14.0 | 5.0 | 11.4 | 20.0 | 15 | 552.0 | .43 | .64 |
| 707.9 | 18.0 | 7.0 | 16.1 | 23.0 | 14 | 647.0 | .28 | .61 |
| 891.3 | 19.0 | 9.0 | 18.8 | 27.0 | 13 | 646.0 | .42 | .53 |
| 1122.0 | 20.0 | 7.0 | 19.4 | 28.0 | 17 | 1312.0 | .40 | .65 |
| 1412.5 | 27.0 | 19.0 | 26.0 | 33.0 | 13 | 922.0 | .22 | .30 |
| 1778.3 | 30.0 | 4.0 | 25.1 | 41.0 | 16 | 2619.0 | .37 | .87 |
| 2238.7 | 37.0 | 27.0 | 36.0 | 49.0 | 11 | 1844.0 | .32 | .27 |
| 2818.4 | 44.0 | 7.0 | 36.9 | 50.0 | 14 | 2958.0 | .14 | .84 |
| 3548.1 | 53.0 | 46.0 | 52.7 | 60.0 | 9 | 1535.0 | .13 | .13 |
| 4466.8 | 60.0 | 42.0 | 52.8 | 60.0 | 6 | 1903.0 | .00 | .30 |
| 5623.4 | 62.0 | 23.0 | 47.9 | 76.0 | 8 | 5297.0 | .23 | .63 |
| 7079.4 | 69.0 | 16.0 | 54.0 | 73.0 | 6 | 3224.0 | .06 | .77 |
| 8912.5 | 81.0 | 72.0 | 79.7 | 86.0 | 3 | 1373.0 | .06 | .11 |
| 11220.2 | 93.0 | 75.0 | 90.0 | 102.0 | 3 | 2260.0 | .10 | .19 |
| 14125.4 | 96.0 | 86.0 | 91.0 | 96.0 | 2 | 860.0 | .00 | .10 |
| 17782.8 | 111.0 | 110.0 | 114.0 | 121.0 | 3 | 1323.0 | .09 | .01 |
| 22387.2 | 123.0 | 113.0 | 118.0 | 123.0 | 2 | 1130.0 | .00 | .08 |

N=518 MAJURO PASI 76-100

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 1.1 | | | | | | | | |
| 1.4 | | | | | | | | |
| 1.8 | | | | | | | | |
| 2.2 | | | | | | | | |
| 2.8 | | | | | | | | |
| 3.5 | | | | | | | | |
| 4.5 | | | | | | | | |
| 5.6 | | | | | | | | |
| 7.1 | | | | | | | | |
| 8.9 | | | | | | | | |
| 11.2 | 1.0 | 1.0 | 1.0 | 1.0 | 13 | .0 | .00 | -.00 |
| 14.1 | | | | | | | | |
| 17.8 | | | | | | | | |
| 22.4 | 1.0 | 1.0 | 1.1 | 2.0 | 44 | 5.0 | 1.00 | -.00 |
| 28.2 | 2.0 | 1.0 | 1.5 | 3.0 | 29 | 17.0 | .50 | .50 |
| 35.5 | | | | | | | | |
| 44.7 | 3.0 | 1.0 | 2.1 | 4.0 | 27 | 45.0 | .33 | .67 |
| 56.2 | 3.0 | 2.0 | 2.8 | 4.0 | 11 | 15.0 | .33 | .33 |
| 70.8 | 3.0 | 1.0 | 2.8 | 5.0 | 11 | 34.0 | .67 | .67 |
| 89.1 | 4.0 | 2.0 | 3.3 | 5.0 | 15 | 51.0 | .25 | .50 |
| 112.2 | 4.0 | 2.0 | 3.7 | 7.0 | 22 | 77.0 | .75 | .50 |
| 141.3 | 4.0 | 1.0 | 4.2 | 7.0 | 25 | 165.0 | .75 | .75 |
| 177.8 | 6.0 | 2.0 | 5.4 | 9.0 | 26 | 143.0 | .50 | .67 |
| 223.9 | 7.0 | 3.0 | 5.6 | 11.0 | 28 | 315.0 | .57 | .57 |
| 281.8 | 9.0 | 4.0 | 8.5 | 12.0 | 13 | 173.0 | .33 | .56 |
| 354.8 | 11.0 | 3.0 | 8.8 | 13.0 | 15 | 292.0 | .18 | .73 |
| 446.7 | 13.0 | 6.0 | 11.4 | 17.0 | 9 | 143.0 | .31 | .54 |
| 562.3 | 13.0 | 4.0 | 11.5 | 17.0 | 19 | 534.0 | .31 | .69 |
| 707.9 | 18.0 | 4.0 | 14.7 | 24.0 | 15 | 342.0 | .33 | .78 |
| 891.3 | 21.0 | 7.0 | 18.9 | 29.0 | 18 | 1225.0 | .38 | .67 |
| 1122.0 | 24.0 | 9.0 | 21.4 | 32.0 | 17 | 1531.0 | .33 | .62 |
| 1412.5 | 27.0 | 10.0 | 24.3 | 31.0 | 13 | 1115.0 | .15 | .63 |
| 1778.3 | 31.0 | 15.0 | 29.7 | 42.0 | 13 | 1273.0 | .35 | .52 |
| 2238.7 | 36.0 | 21.0 | 36.0 | 48.0 | 11 | 2213.0 | .33 | .42 |
| 2818.4 | 44.0 | 24.0 | 42.7 | 52.0 | 9 | 1705.0 | .18 | .45 |
| 3548.1 | 50.0 | 22.0 | 46.7 | 55.0 | 12 | 2112.0 | .10 | .56 |
| 4466.8 | 59.0 | 45.0 | 57.0 | 68.0 | 7 | 2512.0 | .15 | .24 |
| 5623.4 | 76.0 | 25.0 | 58.6 | 86.0 | 5 | 4445.0 | .13 | .67 |
| 7079.4 | 82.0 | 47.0 | 77.9 | 94.0 | 7 | 5301.0 | .15 | .43 |
| 8912.5 | 88.0 | 62.0 | 84.0 | 102.0 | 3 | 3043.0 | .16 | .30 |
| 11220.2 | 88.0 | 88.0 | 88.0 | 88.0 | 1 | .0 | .00 | -.00 |
| 14125.4 | 137.0 | 135.0 | 140.3 | 149.0 | 3 | 2393.0 | .09 | .01 |
| 17782.8 | 171.0 | 89.0 | 130.0 | 171.0 | 2 | 7294.0 | .00 | .48 |
| 22387.2 | | | | | | | | |
| 28183.8 | 248.0 | 177.0 | 212.5 | 248.0 | 2 | 12567.0 | .00 | .29 |
| 35481.3 | | | | | | | | |
| 44668.4 | 270.0 | 151.0 | 210.5 | 270.0 | 2 | 17754.0 | .00 | .44 |

N=413 MAJURO PASI 101-135

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 1.1 | | | | | | | | |
| 1.4 | | | | | | | | |
| 1.8 | | | | | | | | |
| 2.2 | | | | | | | | |
| 2.8 | | | | | | | | |
| 3.5 | | | | | | | | |
| 4.5 | | | | | | | | |
| 5.6 | | | | | | | | |
| 7.1 | | | | | | | | |
| 8.9 | | | | | | | | |
| 11.2 | 1.0 | 1.0 | 1.0 | 2.0 | 28 | 2.0 | 1.00 | -.00 |
| 14.1 | | | | | | | | |
| 17.8 | | | | | | | | |
| 22.4 | 1.0 | 1.0 | 1.1 | 2.0 | 22 | 3.0 | 1.00 | -.00 |
| 28.2 | 2.0 | 1.0 | 1.6 | 6.0 | 24 | 42.0 | 2.00 | .50 |
| 35.5 | | | | | | | | |
| 44.7 | 2.0 | 1.0 | 1.9 | 3.0 | 27 | 34.0 | .50 | .50 |
| 56.2 | 3.0 | 1.0 | 2.2 | 5.0 | 17 | 32.0 | .67 | .67 |
| 70.8 | 3.0 | 1.0 | 2.7 | 4.0 | 15 | 28.0 | .33 | .67 |
| 89.1 | 3.0 | 1.0 | 2.8 | 6.0 | 19 | 74.0 | 1.00 | .67 |
| 112.2 | 5.0 | 1.0 | 3.5 | 6.0 | 23 | 94.0 | .20 | .80 |
| 141.3 | 5.0 | 2.0 | 4.6 | 8.0 | 27 | 182.0 | .60 | .60 |
| 177.8 | 6.0 | 2.0 | 4.6 | 8.0 | 19 | 139.0 | .33 | .67 |
| 223.9 | 7.0 | 3.0 | 6.3 | 11.0 | 23 | 305.0 | .57 | .57 |
| 281.8 | 9.0 | 4.0 | 8.7 | 14.0 | 25 | 473.0 | .56 | .56 |
| 354.8 | 10.0 | 4.0 | 8.8 | 13.0 | 18 | 317.0 | .30 | .60 |
| 446.7 | 12.0 | 7.0 | 11.6 | 18.0 | 25 | 624.0 | .50 | .42 |
| 562.3 | 14.0 | 13.0 | 14.9 | 20.0 | 16 | 407.0 | .43 | .07 |
| 707.9 | 17.0 | 9.0 | 16.9 | 25.0 | 20 | 685.0 | .47 | .47 |
| 891.3 | 20.0 | 14.0 | 19.4 | 25.0 | 13 | 523.0 | .25 | .30 |
| 1122.0 | 24.0 | 13.0 | 21.4 | 27.0 | 14 | 889.0 | .12 | .46 |
| 1412.5 | 29.0 | 23.0 | 27.7 | 33.0 | 10 | 813.0 | .14 | .21 |
| 1778.3 | 31.0 | 23.0 | 31.6 | 38.0 | 7 | 684.0 | .23 | .26 |
| 2238.7 | 36.0 | 16.0 | 33.5 | 40.0 | 10 | 1227.0 | .11 | .56 |
| 2818.4 | 37.0 | 30.0 | 39.0 | 50.0 | 3 | 860.0 | .35 | .19 |
| 3548.1 | 54.0 | 28.0 | 47.0 | 59.0 | 3 | 1023.0 | .09 | .48 |
| 4466.8 | 62.0 | 62.0 | 62.0 | 62.0 | 1 | .0 | .00 | -.00 |
| 5623.4 | 61.0 | 48.0 | 54.5 | 61.0 | 2 | 624.0 | .00 | .21 |
| 7079.4 | 73.0 | 73.0 | 73.0 | 73.0 | 1 | .0 | .00 | -.00 |
| 8912.5 | | | | | | | | |
| 11220.2 | 82.0 | 82.0 | 82.0 | 82.0 | 1 | .0 | .00 | -.00 |

N=322 MAJURO PASI 136-150

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 1.1 | | | | | | | | |
| 1.4 | | | | | | | | |
| 1.8 | | | | | | | | |
| 2.2 | | | | | | | | |
| 2.8 | | | | | | | | |
| 3.5 | | | | | | | | |
| 4.5 | | | | | | | | |
| 5.6 | | | | | | | | |
| 7.1 | | | | | | | | |
| 8.9 | | | | | | | | |
| 11.2 | 1.0 | 1.0 | 1.0 | 1.0 | 11 | .0 | .00 | -.00 |
| 14.1 | | | | | | | | |
| 17.8 | | | | | | | | |
| 22.4 | 1.0 | 1.0 | 1.2 | 2.0 | 24 | 13.0 | 1.00 | -.00 |
| 28.2 | 2.0 | 1.0 | 1.6 | 3.0 | 14 | 13.0 | .50 | .50 |
| 35.5 | | | | | | | | |
| 44.7 | 2.0 | 1.0 | 2.0 | 3.0 | 18 | 23.0 | .50 | .50 |
| 56.2 | 3.0 | 2.0 | 2.7 | 3.0 | 7 | 4.0 | .00 | .33 |
| 70.8 | 4.0 | 2.0 | 3.3 | 4.0 | 10 | 17.0 | .00 | .50 |
| 89.1 | 3.0 | 2.0 | 3.3 | 5.0 | 10 | 23.0 | .67 | .33 |
| 112.2 | 4.0 | 2.0 | 4.3 | 7.0 | 26 | 73.0 | .75 | .50 |
| 141.3 | 6.0 | 4.0 | 5.6 | 7.0 | 8 | 25.0 | .17 | .33 |
| 177.8 | 6.0 | 2.0 | 5.5 | 9.0 | 10 | 85.0 | .50 | .67 |
| 223.9 | 7.0 | 3.0 | 7.2 | 10.0 | 25 | 188.0 | .43 | .57 |
| 281.8 | 9.0 | 3.0 | 8.4 | 11.0 | 14 | 163.0 | .22 | .67 |
| 354.8 | 11.0 | 5.0 | 10.0 | 15.0 | 18 | 406.0 | .36 | .55 |
| 446.7 | 13.0 | 4.0 | 10.2 | 16.0 | 20 | 523.0 | .23 | .69 |
| 562.3 | 14.0 | 5.0 | 11.5 | 19.0 | 24 | 845.0 | .36 | .64 |
| 707.9 | 13.0 | 5.0 | 10.9 | 20.0 | 14 | 704.0 | .54 | .62 |
| 891.3 | 21.0 | 5.0 | 15.6 | 28.0 | 8 | 706.0 | .33 | .76 |
| 1122.0 | 24.0 | 11.0 | 21.8 | 28.0 | 13 | 817.0 | .17 | .54 |
| 1412.5 | 29.0 | 11.0 | 24.1 | 35.0 | 10 | 1504.0 | .21 | .62 |
| 1778.3 | 34.0 | 12.0 | 29.2 | 47.0 | 13 | 2503.0 | .38 | .65 |
| 2238.7 | 44.0 | 33.0 | 40.7 | 45.0 | 3 | 408.0 | .02 | .25 |
| 2818.4 | 46.0 | 42.0 | 45.2 | 48.0 | 4 | 307.0 | .04 | .09 |
| 3548.1 | 51.0 | 13.0 | 46.6 | 67.0 | 8 | 3414.0 | .31 | .75 |
| 4466.8 | 52.0 | 46.0 | 52.6 | 61.0 | 5 | 927.0 | .17 | .12 |
| 5623.4 | 65.0 | 35.0 | 58.3 | 75.0 | 3 | 1800.0 | .15 | .46 |
| 7079.4 | 77.0 | 77.0 | 77.0 | 77.0 | 1 | .0 | .00 | -.00 |
| 8912.5 | 99.0 | 99.0 | 99.0 | 99.0 | 1 | .0 | .00 | -.00 |

N=452 MAJURO PASI 151-215

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 1.1 | | | | | | | | |
| 1.4 | | | | | | | | |
| 1.8 | | | | | | | | |
| 2.2 | | | | | | | | |
| 2.8 | | | | | | | | |
| 3.5 | | | | | | | | |
| 4.5 | | | | | | | | |
| 5.6 | | | | | | | | |
| 7.1 | | | | | | | | |
| 8.9 | | | | | | | | |
| 11.2 | 1.0 | 1.0 | 1.0 | 1.0 | 19 | .0 | .00 | -.00 |
| 14.1 | | | | | | | | |
| 17.8 | | | | | | | | |
| 22.4 | 1.0 | 1.0 | 1.0 | 2.0 | 31 | 2.0 | 1.00 | -.00 |
| 28.2 | 1.0 | 1.0 | 1.2 | 2.0 | 25 | 13.0 | 1.00 | -.00 |
| 35.5 | | | | | | | | |
| 44.7 | 2.0 | 1.0 | 1.7 | 8.0 | 53 | 93.0 | 3.00 | .50 |
| 56.2 | 3.0 | 1.0 | 2.8 | 4.0 | 16 | 22.0 | .33 | .67 |
| 70.8 | 3.0 | 1.0 | 2.3 | 5.0 | 13 | 32.0 | .67 | .67 |
| 89.1 | 3.0 | 1.0 | 2.6 | 4.0 | 28 | 58.0 | .33 | .67 |
| 112.2 | 4.0 | 1.0 | 3.5 | 7.0 | 29 | 133.0 | .75 | .75 |
| 141.3 | 5.0 | 2.0 | 4.5 | 9.0 | 27 | 158.0 | .80 | .60 |
| 177.8 | 6.0 | 2.0 | 4.8 | 10.0 | 27 | 216.0 | .67 | .67 |
| 223.9 | 6.0 | 2.0 | 5.4 | 12.0 | 22 | 275.0 | 1.00 | .67 |
| 281.8 | 7.0 | 2.0 | 6.0 | 10.0 | 16 | 176.0 | .43 | .71 |
| 354.8 | 9.0 | 2.0 | 7.2 | 15.0 | 19 | 364.0 | .67 | .78 |
| 446.7 | 14.0 | 3.0 | 10.0 | 20.0 | 27 | 977.0 | .43 | .79 |
| 562.3 | 14.0 | 5.0 | 11.6 | 21.0 | 16 | 620.0 | .50 | .64 |
| 707.9 | 20.0 | 14.0 | 18.5 | 21.0 | 12 | 398.0 | .05 | .30 |
| 891.3 | 23.0 | 7.0 | 21.7 | 28.0 | 10 | 474.0 | .22 | .70 |
| 1122.0 | 24.0 | 17.0 | 22.9 | 27.0 | 9 | 514.0 | .12 | .29 |
| 1412.5 | 29.0 | 10.0 | 27.9 | 37.0 | 10 | 1332.0 | .28 | .66 |
| 1778.3 | 31.0 | 22.0 | 30.6 | 36.0 | 8 | 763.0 | .16 | .29 |
| 2238.7 | 38.0 | 29.0 | 36.7 | 42.0 | 8 | 904.0 | .11 | .24 |
| 2818.4 | 49.0 | 37.0 | 48.0 | 59.0 | 6 | 1504.0 | .20 | .24 |
| 3548.1 | 44.0 | 40.0 | 45.6 | 51.0 | 5 | 958.0 | .16 | .09 |
| 4466.8 | 51.0 | 7.0 | 35.2 | 52.0 | 4 | 983.0 | .02 | .86 |
| 5623.4 | 49.0 | 49.0 | 49.0 | 49.0 | 1 | .0 | .00 | -.00 |
| 7079.4 | 85.0 | 70.0 | 77.5 | 85.0 | 2 | 1050.0 | .00 | .18 |
| 8912.5 | 97.0 | 94.0 | 95.5 | 97.0 | 2 | 282.0 | .00 | .03 |
| 11220.2 | 92.0 | 92.0 | 92.0 | 92.0 | 1 | .0 | .00 | -.00 |
| 14125.4 | 129.0 | 91.0 | 114.2 | 144.0 | 4 | 8966.0 | .12 | .29 |
| 17782.8 | 133.0 | 92.0 | 112.5 | 133.0 | 2 | 3772.0 | .00 | .31 |

N=460 MAJURO PASI GREATER THAN 216

| Z | R* | R MIN | R AVE | R MAX | N | S | UNDER | OVER |
|---|---|---|---|---|---|---|---|---|
| 1.1 | | | | | | | | |
| 1.4 | | | | | | | | |
| 1.8 | | | | | | | | |
| 2.2 | | | | | | | | |
| 2.8 | | | | | | | | |
| 3.5 | | | | | | | | |
| 4.5 | | | | | | | | |
| 5.6 | | | | | | | | |
| 7.1 | | | | | | | | |
| 8.9 | | | | | | | | |
| 11.2 | 1.0 | 1.0 | 1.0 | 1.0 | 27 | .0 | .00 | -.00 |
| 14.1 | | | | | | | | |
| 17.8 | | | | | | | | |
| 22.4 | 1.0 | 1.0 | 1.1 | 2.0 | 48 | 5.0 | 1.00 | -.00 |
| 28.2 | 1.0 | 1.0 | 1.3 | 3.0 | 26 | 18.0 | 2.00 | -.00 |
| 35.5 | | | | | | | | |
| 44.7 | 2.0 | 1.0 | 1.6 | 4.0 | 40 | 45.0 | 1.00 | .50 |
| 56.2 | 3.0 | 1.0 | 2.7 | 4.0 | 15 | 18.0 | .33 | .67 |
| 70.8 | 3.0 | 2.0 | 2.7 | 4.0 | 7 | 10.0 | .33 | .33 |
| 89.1 | 4.0 | 1.0 | 3.0 | 5.0 | 27 | 83.0 | .25 | .75 |
| 112.2 | 5.0 | 1.0 | 4.1 | 7.0 | 20 | 93.0 | .40 | .80 |
| 141.3 | 6.0 | 1.0 | 4.7 | 8.0 | 19 | 118.0 | .33 | .83 |
| 177.8 | 7.0 | 3.0 | 6.0 | 12.0 | 21 | 234.0 | .71 | .57 |
| 223.9 | 8.0 | 2.0 | 6.5 | 11.0 | 18 | 253.0 | .37 | .75 |
| 281.8 | 9.0 | 4.0 | 8.3 | 12.0 | 18 | 246.0 | .33 | .56 |
| 354.8 | 10.0 | 5.0 | 10.2 | 14.0 | 19 | 345.0 | .40 | .50 |
| 446.7 | 13.0 | 10.0 | 13.1 | 17.0 | 14 | 304.0 | .31 | .23 |
| 562.3 | 15.0 | 10.0 | 14.3 | 21.0 | 15 | 426.0 | .40 | .33 |
| 707.9 | 17.0 | 12.0 | 16.2 | 20.0 | 16 | 462.0 | .18 | .29 |
| 891.3 | 20.0 | 14.0 | 19.4 | 26.0 | 12 | 671.0 | .30 | .30 |
| 1122.0 | 24.0 | 15.0 | 23.6 | 31.0 | 17 | 1238.0 | .29 | .37 |
| 1412.5 | 23.0 | 12.0 | 24.0 | 33.0 | 6 | 672.0 | .43 | .48 |
| 1778.3 | 37.0 | 22.0 | 33.4 | 47.0 | 9 | 1740.0 | .27 | .41 |
| 2238.7 | 38.0 | 21.0 | 35.7 | 52.0 | 11 | 2217.0 | .37 | .45 |
| 2818.4 | 42.0 | 34.0 | 42.6 | 49.0 | 5 | 1075.0 | .17 | .19 |
| 3548.1 | 54.0 | 29.0 | 49.9 | 65.0 | 10 | 2895.0 | .20 | .46 |
| 4466.8 | 55.0 | 36.0 | 55.9 | 80.0 | 10 | 6020.0 | .45 | .35 |
| 5623.4 | 72.0 | 32.0 | 65.0 | 80.0 | 5 | 2265.0 | .11 | .56 |
| 7079.4 | 81.0 | 36.0 | 74.7 | 96.0 | 8 | 4486.0 | .19 | .56 |
| 8912.5 | 81.0 | 53.0 | 76.4 | 95.0 | 5 | 3462.0 | .17 | .35 |
| 11220.2 | 97.0 | 95.0 | 96.0 | 97.0 | 2 | 190.0 | .00 | .02 |
| 14125.4 | 116.0 | 116.0 | 116.0 | 116.0 | 1 | .0 | .00 | -.00 |
| 17782.8 | 145.0 | 145.0 | 145.0 | 145.0 | 1 | .0 | .00 | -.00 |

**** ALL INPUT DATA HAVE BEEN PROCESSED.
AT LCC 10005

**KEY**

**Z = RADAR REFLECTIVITY IN $10\,mm^6/m^3$**
**R = BEST ESTIMATE OF R BASED ON THE MINIMUM $\Sigma R_i (R^* - R_i)$ IN mm/hr.**
**R MIN = MINIMUM RATE IN EACH Z INTERVAL mm/hr.**
**R AVE = AVERAGE RATE IN EACH Z INTERVAL mm/hr.**
**R MAX = MAXIMUM RATE IN EACH Z INTERVAL mm/hr.**

**N = NUMBER OF ONE CUBIC METER SAMPLES IN EACH Z INTERVAL**
**$S = \Sigma\ R\,(R^* - R_i)$**
**UNDER = MAXIMUM POSSIBLE UNDERESTIMATE DEFINED AS $\frac{R\,MAX - R^*}{R^*}$**
**OVER = MAXIMUM POSSIBLE OVERESTIMATE DEFINED AS $\frac{R^* - R\,MIN}{R^*}$**

FIG. 5 TABLES OF RAINFALL RATE VERSUS RADAR REFLECTIVITY FOR DIFFERENT POSITIVE AREA STABILITY INDICES (PASI) FOR MAJURO.

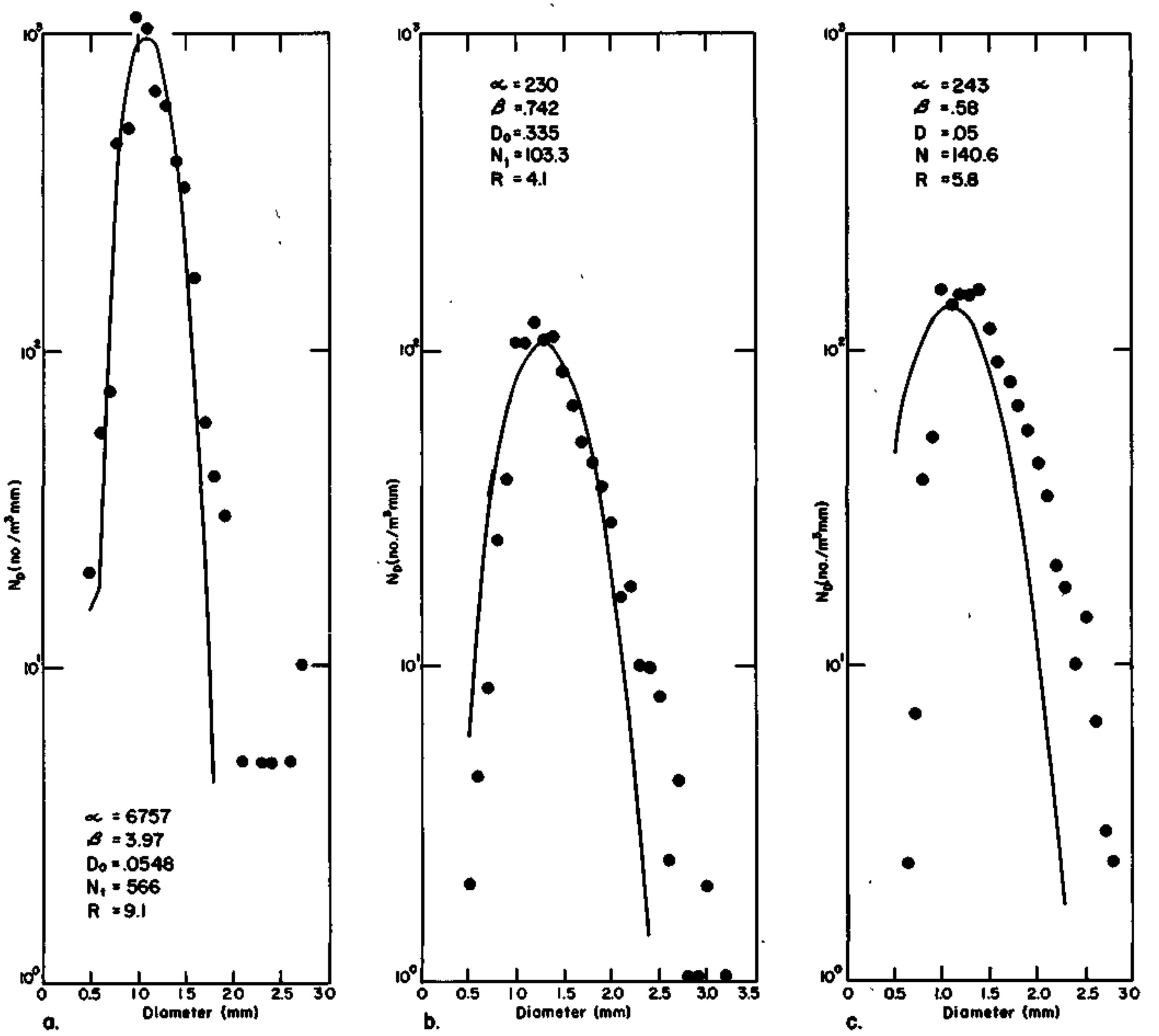

FIG.6 EXAMPLES OF COALESCENCE CURVE FITTING BY AN OBJECTIVE METHOD.

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## STUDY OP MEASUREMENT OP INTENSITY OP SURFACE PRECIPITATION BY RADAR RETURNS

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