NOAA Technical Memorandum ERL WMPO-37

RAINDROP SIZE DISTRIBUTIONS AND Z-R RELATIONSHIPS MEASURED ON THE NOAA DC-6 AND THE SHIP RESEARCHER WITHIN THE GATE B-SCALE ARRAY

John B. Cunning
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Weather Modification Program Office
Boulder, Colorado
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RAINDROP SIZE DISTRIBUTIONS AND Z-R RELATIONSHIPS MEASURED ON THE NOAA DC-6 AND THE NOAA SHIP *RESEARCHER* WITHIN THE GATE B-SCALE ARRAY

John B. Cunning and Robert I. Sax

A better understanding of how the precipitation budget operates in tropical convective systems is a prime objective of the GATE research effort. Measurement of rainfall rate with shipboard radar is the principle method by which precipitation output from tropical clouds that develop within the GATE B-scale array will be determined. Knowledge of the relationship between radar reflectivity (Z) and rainfall rate (R) is essential for an accurate interpretation of precipitation data derived through the use of radar technology. The Z-R relationship is determined through application of a least-squares linear regression to data points derived by appropriate integration of the third and sixth moments of a series of raindrop size spectra.

Drop spectra measurements were obtained during GATE by means of a foil impactor operated at cloud-base level on board the NOAA DC-6 aircraft and a surface-based raindrop distrometer operated on the flying bridge of the NOAA ship "Researcher." A total of 107 and 137 Z-R data points are available from the foil impactor and distrometer data respectively. These represent showers occurring on 12 days in the case of the foil data, and on 8 days in the case of the distrometer data. The best-fit Z-R relationship for the cloud-base aircraft foil data showed little variability from day to day or on the basis of stratification by rain rate. For all foil data combined, the best-fit Z-R relationship was found to have the form:

$$Z = 170R^{1.52}$$

which gives, for example, rain rates of 66, 15, and 3 mm hr^{-1} for Z values of 50, 40, and 30 db respectively.

Drop spectra measurements derived from the distrometer data required the application of a correction scheme to the small end of the distribution because of the apparent insensitivity of that device for detecting small drops in the shipboard noise environment. These corrections led to appreciable changes in the rain rates computed through a mass integration of the drop spectra and, for that reason, the Z-R relationship derived from the distrometer data, provided in the text, must be regarded with some suspicion.

Discussion of the use of a cumulative distribution function to transform drop spectra derived from the foil data is provided in an appendix. The advantage of this technique lies in the alleviation of sampling volume problems occurring at the large end of the drop size distribution.

1. INTRODUCTION

The release of latent heat of condensation is one of the primary energy sources available to drive the tropical weather machine. The way that this energy source is utilized locally within a tropical area cannot be determined without detailed knowledge of the water budget within cloud systems. As stated by Weickmann (1973), three essential parameters must be measured:

a) the rate of condensation and deposition (production of liquid water or ice) occurring within a cloud system, which determines the amount of latent heat taken from the environment,

b) the precipitation of water, which determines the quantity of latent heat released by the cloud system,

c) the amount of water remaining within the cloud system.

From these considerations it followed that a project such as the GARP Atlantic Tropical Experiment (GATE), which had as a goal the understanding of tropical convective processes, required a cloud physics subprogram to investigate the degree to which nature utilizes the available condensational energy within mesoscale cloud systems. Some important parameters to be measured included influx of water vapor through cloud base, in-cloud water content at various levels, entrainment characteristics, and precipitation rates, distributions, and amounts.

The GATE Project gave researchers the opportunity to investigate tropical convective processes on a subsynoptic scale over an oceanic region well removed (500 to 1000 km) from any major land mass (fig. 1). Quantitative radar measurements were used within the GATE B-scale array to provide information about hydrometeor water content within convective systems and on total precipitation amounts. The shipboard radars used in GATE were principally C-band with wavelengths of 5.6 cm. Since, for a 5.6-cm wavelength, the Rayleigh scattering approximation is valid for all but the largest of raindrops, the radar reflectivity, Z, can be computed from the expression

$$Z = \int N\ (D) D^6\ dD \qquad (1)$$

where N (D) is the drop concentration per unit volume, D is the drop diameter, and Z is expressed in the units $mm^6\ m^{-3}$. The rainfall rate R ($mm\ hr^{-1}$) can be calculated from the equation

$$R = \frac{\pi}{6} \int N\ (D) D^3 \rho V_t dD \qquad (2)$$

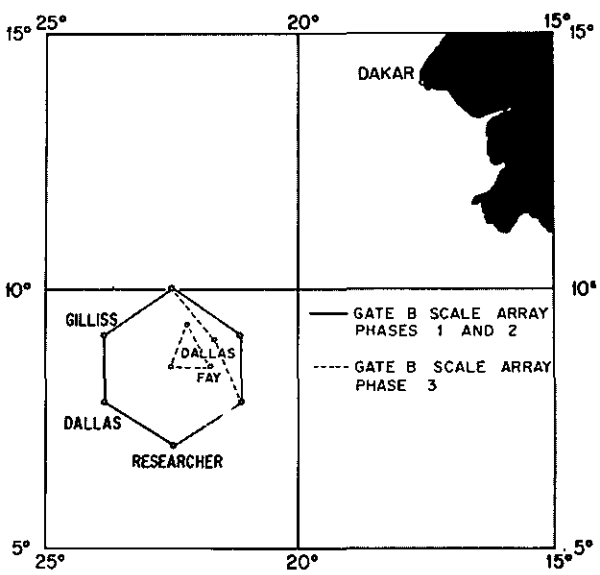

Figure 1. Location of GATE B-scale array and participating ships.

where ρ is the density of water and V_t is the terminal velocity of raindrops of diameter D. An understanding of the relationship between Z and R is of fundamental importance for the quantitative determination of rainfall rates from radar.

This paper discusses drop size distributions obtained by both an airborne foil impactor and a shipborne distrometer and provides an analysis of the relationship between radar reflectivity and rainfall rate within the GATE B-scale array.

2. VARIABILITY OF Z-R RELATIONSHIPS

It has been established by many investigators that a relationship of the form $Z = aR^b$, with Z and R both functions of the drop size distribution, can be used for a variety of rainfall types in a number of geographical locations. Table 1, a summary of previously published Z-R relationships from different regions of the world, shows that the coefficient a has been found to vary from 17 to 730 and that the exponent b has been found to vary from 1.16 to 2.87. More strikingly, for an arbitrary value of Z of 10^5 mm^6 m^{-3} (50 dB), the corresponding rainfall rate is found to range from 10 mm hr^{-1} to 270 mm hr^{-1}. Even if the several extreme values of a and/or b are ignored, the range of rainfall rate R when Z is 50 dB is still about an order of magnitude. It is not surprising that stratification by geographical location (e.g., maritime, continental, or tropical) and shower type (convective or stratiform) is a necessary first step in determining applicability of a particular Z-R relationship.

Since many of the formulations in table 1 were derived from data based upon minimal drop sampling volumes, Z-R variability from shower to shower or day to day, or both, may have not been reflected. Measurements to determine the Z-R variability within a given area or rainfall regime should be made repeatedly to enable accurate computations of rainfall rates. It is also likely that measurements obtained on the periphery of the rain shower core (either in terms of space or time) may not be representative and may serve to add noise to the data. Table 2 contains data from Stout and Mueller (1968), derived from surface drop camera measurements, that show variability of the Z-R relationship at Miami as a function of rainfall type, synoptic condition, and instability criteria.[1] In the case of the last parameter, the rain rate for an arbitrary Z value of 50 dB ranges from 48 mm hr^{-1} for an instability category of 7 to 110 mm hr^{-1} for an instability category of 10 (lowest instability stratification). The maximum variability when rainfall is stratified as to type or synoptic condition is about a factor of 2, which can still provide appreciable differences at a Z value of 50 dB. This serves to emphasize the highly variable nature of drop distribution data and points to the need for a determination of the Z-R relationship for a particular set of known meteorological and geographical parameters.

[1]Defined by Stout and Mueller (1968) as the amount of energy required to lift a parcel of air through the troposphere; results of calculations were grouped and stratified into 10 categories in descending order of instability.

Table 1. Various Published Z-R Relationships (from Battan, 1973, with changes)

Equation	Reference	Location	Remarks	R(mm hr^{-1}) for Z=50 db
$320R^{1.44}$	Wexler, R. (1947)	Washington, D.C.	8 rain intensities, each a mean of about 10 storms of same intensity	54
$214R^{1.58}$	Wexler (1948)	Washington, D.C.	98 storms--original data	49
$224R^{1.54}$		Ynyslas, Great Britain	5 rainstorms	53
$630R^{1.45}$		Shoeburyness, England	4 rainstorms	33
$208R^{1.53}$		Hawaii	50 storms, orographic rain	57
$190R^{1.72}$	Marshall, Langille, and Palmer (1947)	Various locations	Various types of rain	38
$220R^{1.60}$	Marshall and Palmer (1948)	Various locations	Various types of rain	46
$295R^{1.61}$	Hood (1950)	Canada	270 samples, 7 rainstorms; light rain 1-3 mm/hr; heavy thunderstorms 50 mm/hr	37
$180R^{1.55}$	Boucher (1951)	Cambridge, Mass.	63 rain samples, widespread rain both uniform and variable; showers and thunderstorms	59
$127R^{2.87}$	Higgs (1952)	Australia	Showers, 8 months of observation	10
$17R^{1.55}$	Blanchard (1953)	Hawaii	Orographic rain within cloud	270
$31R^{1.71}$			Orographic rain at cloud base	113
$290R^{1.41}$			Nonorographic rain--thunderstorms	63
$127R^{2.29}$	Twomey (1953)	Sydney, Australia	Rain rates 0.2-9.0 mm hr^{-1}	18
$396R^{1.35}$	Jones (1955)	Central Illinois	1,270 1-minute observations--all rains	60
$486R^{1.37}$			560 1-minute observations--thunderstorms	49
$380R^{1.24}$			330 1-minute observations--rain showers	89
$313R^{1.25}$			380 1-minute observations--continuous rain	100

Table 1. Various Published Z-R Relationships (from Battan, 1973, with changes) (continued)

Equation	Reference	Location	Remarks	$R(mm\ hr^{-1})$ for Z=50 db
$150R^{1.54}$	Litvinov (1956)	Mount El'brus, USSR	Rain (melted granular snow and strongly granulated particles), 344 spectra, 6 rains	68
$257R^{1.55}$			Rain (melted snow of average granulation), 367 spectra, 7 rains	47
$398R^{1.47}$			Rain (melted non-granulated snow), 140 spectra, 4 rains	43
$162R^{1.16}$	Atlas and Chmela (1957)	Lexington, Mass.	Stratiform rains, 16 April 1954	254
$215R^{1.34}$			Stratiform rains, 23 April 1954	98
$350R^{1.42}$			Stratiform rains, 27 April 1954	54
$310R^{1.34}$			Stratiform rains, 28 April 1954	74
$220R^{1.54}$	Sal'man (1957)	Near Leningrad, USSR	Showers and steady rain	53
$303R^{1.70}$	Shupiatskii (1957)	Near Moscow, USSR	Various types of rain, R < 7 mm/hr	30
$405R^{1.49}$			Various types of rain, 7 < R < 60 mm/hr	40
$289R^{1.59}$			Various types of rain, R > 60 mm/hr	40
$109R^{1.64}$	Ramana Murty and Gupta (1959)	Kandia, India	Orographic, Monsoon rains	64
$342R^{1.42}$		Delhi, India	Nonorographic, Monsoon rains	55
$700R^{1.60}$	Imai (1960)	Tokyo, Japan	One day, probably warm rain	22
$300R^{1.60}$			One day continuous rain	38
$200R^{1.50}$			Air mass showers	63
$200R^{1.50}$			Prewarm frontal rain	63
$219R^{1.41}$	Sivaramakrishnan (1961)	Poona, India	Thunderstorms	77
$68R^{1.94}$			Steady rains	43
$67R^{1.92}$			Warm rains	45
$204R^{1.70}$	Muchnik (1961)	Kiev, USSR	Showers and steady rains	38

Table 1. Various Published Z-R Relationships (from Battan, 1973, with changes) (continued)

Equation	Reference	Location	Remarks	$R(mm\ hr^{-1})$ for Z=50 db
$204R^{1.52}$	Andrews (1961)	London, England	Continuous	59
$280R^{1.46}$			Showers	56
$280R^{1.71}$			Thunderstorm	31
$215R^{1.60}$			All types	46
$205R^{1.48}$	Fujiwara (1965)	Mostly Miami, Florida	Continuous rain	65
$300R^{1.37}$			Rainshowers	69
$450R^{1.46}$			Thunderstorms	40
$300R^{1.40}$	Gerrish and Hiser (1965)	Florida	Summer convection	63
$184R^{1.28}$	Diem (1966)	Various locations		137
$278R^{1.30}$		Entebbe, Uganda		92
$240R^{1.30}$		Lwire, Congo		104
$176R^{1.18}$		Palma		216
$151R^{1.36}$		Barza, Italy		119
$179R^{1.25}$		Karlsruhe, Germany	Spring	158
$227R^{1.31}$		Karlsruhe, Germany	Summer	104
$178R^{1.25}$		Karlsruhe, Germany	Fall	158
$150R^{1.23}$		Karlsruhe, Germany	Winter	198
$137R^{1.36}$		Axel Heiberg Land		127
$330R^{1.41}$	Gorelik et al. (1967)	Chernozem (near Moscow)	About 10 days, 20,000 samples on filter paper, all types of rain	58
$298R^{1.46}$		Vashnevo (5 km away)		54
$520R^{1.81}$	Foote (1966)	Tucson, Arizona	32 showers and thunderstorms on mountain peak, 2,500 meters	18
$730R^{1.55}$	Doumoulin and Cogombles (1966)	France	Measured on 12 March 1964	24
$255R^{1.45}$			Measured on 4 September 1964	61
$426R^{1.50}$			107 drop-size distributions	38

Table 1. Various Published Z-R Relationships (from Battan, 1973, with changes) (continued)

Equation	Reference	Location	Remarks	$R(mm\ hr^{-1})$ for Z=50 db
$286R^{1.43}$		Miami, Florida		60
$221R^{1.32}$	Mueller and Sims (1966)	Majuro, Marshall Islands		103
$301R^{1.64}$		Corvallis, Oregon		34
$311R^{1.44}$		Bogar, Indonesia		55
$267R^{1.54}$	Stout and Mueller (1968)	Woody Island, Alaska		47
$230R^{1.40}$		Franklin, North Carolina		77
$372R^{1.47}$		Champaign, Illinois		45
$593R^{1.61}$		Flagstaff, Arizona		24
$256R^{1.41}$		Island Beach, N.J.		69
$140R^{1.50}$	Joss et al. (1970)	Locarno-Monti, Switzerland	Drizzle	80
$250R^{1.50}$			Widespread rain	54
$500R^{1.50}$			Thunderstorm rain	34
$257R^{1.33}$	Merceret (1973)	Atlantic Ocean	Convection within tropical storm	89
$420R^{1.31}$			Felice; near cloud base	65
$365R^{1.41}$	Cunning (1976)	South Florida	Cloud base measurements in summer convection	54

Table 2. Z-R Relationships for Miami Area Stratified as to Rainfall Type, Synoptic Condition, and Thermodynamic Instability Criteria (from Stout and Mueller, 1968)

Stratification	Equation	Correlation coefficient	Minutes of data	R(mm hr^{-1}) for Z=50 db
A. Rain type				
Continuous	$322R^{1.33}$	0.94	911	75
Showers	$250R^{1.47}$	0.95	696	59
Thunderstorms	$224R^{1.51}$	0.94	902	57
B. Synoptic class				
Air mass	$323R^{1.42}$	0.98	467	58
Pre-cold front	$280R^{1.49}$	0.95	744	52
Cold front	$198R^{1.54}$	0.95	187	57
Warm front	$403R^{1.24}$	0.96	341	85
Overrunning	$302R^{1.36}$	0.94	196	71
Easterly wave	$296R^{1.35}$	0.97	536	75
Trough aloft	$261R^{1.43}$	0.97	80	64
Pre-cold occlusion	$330R^{1.66}$	0.91	40	31
C. Instability				
1 (highest)	$264R^{1.40}$	0.97	136	69
2	$295R^{1.36}$	0.97	286	73
3	$307R^{1.41}$	0.97	367	61
4	$304R^{1.41}$	0.96	416	61
5	$313R^{1.39}$	0.98	133	63
6	$206R^{1.42}$	0.97	117	78
7	$420R^{1.41}$	0.97	161	48
8	$358R^{1.31}$	0.95	559	74
9	$352R^{1.38}$	0.95	238	60
10 (lowest)	$257R^{1.27}$	0.96	167	110

3. MEASUREMENT PROGRAM

3.1 Motivation for Experimental Design

The calculation of a Z-R relationship that would be appropriate for the oceanic region encompassed by the GATE B-scale array requires that the size distribution of raindrops be measured on shipboard and/or from aircraft operating within that area. Since spectra measurements contain high natural spatial and temporal variability (primarily because of sampling volume limitations of instrumentation currently in use), it is important to compensate for possible error by calculating ensemble averages from a sample size that is large enough for statistical significance. Furthermore, it is absolutely necessary that the shower core, not just the periphery, be sampled for the computation of a meaningful Z-R relationship.

Garstang (1969) showed that during the 1968 Barbados Experiment the NOAA ship *Discoverer,* stationed in the eastern tropical North Atlantic near Barbados from August 4 to 27 was in a significant shower (greater than 2.5 mm hr^{-1} of rainfall) on only 10% of the experimental days. Holle (1968) found, however, that precipitation from at least one cloud within a 30-km radius of the *R/V Crawford* stationed in the tropical Atlantic near Barbados in the summer of 1963 occurred during 60% of all hours having supporting photographic data. This indicates that, although the occurrence of a shower directly overhead at a given location in the tropical ocean is a rather rare event, the occurrence of precipitation within a surrounding extended area is a frequent event. Thus, measurement from a highly mobile instrumented platform, such as an aircraft, should be used in conjunction with those from one or more fixed-ship platforms to obtain a large ensemble average of drop size distributions over an oceanic area.

3.2 The Aircraft Program

The U. S. aircraft program to obtain drop size distributions within the GATE area was quite extensive. The primary instruments for this purpose were an MRI foil impactor and a Knollenberg 1-D particle spectrometer (cloud droplet and raindrop probes). Both the NOAA DC-6 and C-130 aircraft carried foil impactors during the three phases of GATE (first phase - June 28 to July 16, 1974; second phase - July 28 to August 17, 1974; third phase - August 30 to September 19, 1974). During the second phase a Knollenberg 1-D particle spectrometer (cloud and rain probes) was carried on the DC-6 aircraft, but the raindrop probe was transferred to the C-130 aircraft for the third phase. A Knollenberg 1-D drop spectrometer (cloud and rain probes) was carried on the NCAR Electra for the three phases and on the NCAR Sabreliner (cloud probe only) during the second and third phases.

During the GATE experiment, the DC-6 aircraft operated mainly at an altitude near cloud base, the NCAR Electra operated at altitudes between cloud base and 10,000 ft, the C-130 aircraft flew typically at the freezing level (15,000 ft) or colder, and the Sabreliner flew at very high altitudes (>30,000 ft). The aircraft sections of this paper are concerned only with data obtained from the foil impactor operated on the DC-6 aircraft near the cloud-base level.

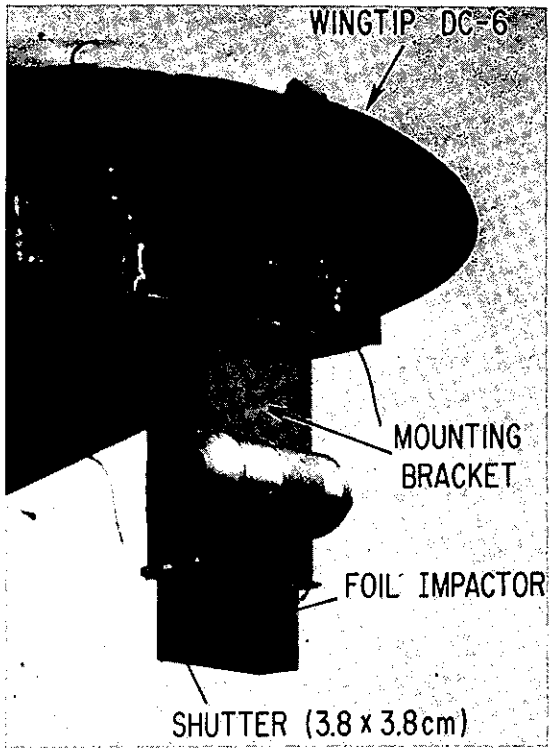

Figure 2. Foil impactor of MRI design mounted on the wingtip of the NOAA DC-6 aircraft. The football-shaped cylinder directly above the impactor is an optical ice particle counter.

The foil impactor, located on one wingtip of the DC-6 (fig. 2), is operated manually whenever the aircraft traverses a precipitation shaft. When the impactor is activated, a motor mechanism moves a strip of aluminum foil[2] (approximately 8 cm wide) over a grooved (.25 mm) drum. A striated pattern remains at the point where the drop impacts on the grooved drum. A metal shutter (3.8 x 3.8 cm) operates synchronously with the transport mechanism to expose the foil to precipitation. As configured for GATE, the shutter is open and the foil exposed for approximately .2 seconds. During the next .8 seconds, the shutter is closed and the foil is advanced. The shutter then opens again and the sampling is repeated in this mode until the aircraft passes completely through the precipitation core. The cross-sectional area of the shutter opening is 14.5 cm^2; thus, for an exposure of .2 seconds on an aircraft moving at 100 m sec^{-1}, the sampling volume is approximately 30 liters. It has been found from experience with heavy tropical rain that sampling volumes much in excess of 30 liters per frame of foil result in a serious overlapping of drops. The foil impactor mounted on the DC-6 aircraft was, therefore, able to sample about 1 m^3 of air during a traverse through an isolated medium-sized convective element (approximately 3 km in diameter). When fully loaded, the impactor can carry about 9000 cm of foil, enough to obtain measurements from about 10 to 20 rain shafts of the sizes typically encountered within the area covered by the GATE B-scale array.

3.3 Surface Program

The U. S. program to measure drop size distributions at the surface was carried out on GATE ships at fixed locations within the B-scale array (fig. 1). Distrometers of the type developed by Joss and Waldvogel (1967) were used exclusively by the U. S. participants. During the three GATE phases, the NHEML distrometer was on the NOAA ship *Researcher,* and a second distrometer operated by the Department of Meteorology, Massachusetts Institute of Technology, was on the *R/V Gilliss*. A third distrometer, operated by the Department of Physics, University of Toronto, was on the Coast Guard ship *Dallas* during the first phase and on the *R/V Fay* during the third phase of GATE. The surface

[2]Foil used during GATE on the NOAA DC-6 had a thickness of .001 inch and was purchased from Clecon Metals, Cleveland, Ohio, with their alloy specification 1145-0, pack roll finish, on 1-5/16 inch I.D. flush fiber core.

program sections of this report are confined to a discussion of results obtained by the distrometer operated on board the NOAA ship *Researcher*.

The distrometer was located on the flying bridge of the *Researcher,* a site chosen for its good exposure to rain, reduced background noise, and proximity to the center of gravity for minimal ship vertical motion. The distrometer was activated manually whenever showers passed over the ship. The transducer and processor system (fig. 3) provides an electronic signal (0 to 10 v pulse of 500 ms duration) proportional to the momentum transfer of raindrops impacting upon the distrometer head. The signal is pulse-height analyzed, digitized, formatted into standard two-track NRZI serial data, and recorded on a Uher Model 4200 tape recorder. The conical sampling head has a cross-sectional exposure area of 50 cm^2. The sampling volume per unit time is proportional to the terminal velocity of the raindrops. For a 120-second interval, the sampling volume of the distrometer for raindrops 1 mm in diameter is about 2 m^3, while, for raindrops 5 mm in diameter, the sampling volume is nearly 5.5 m^3.

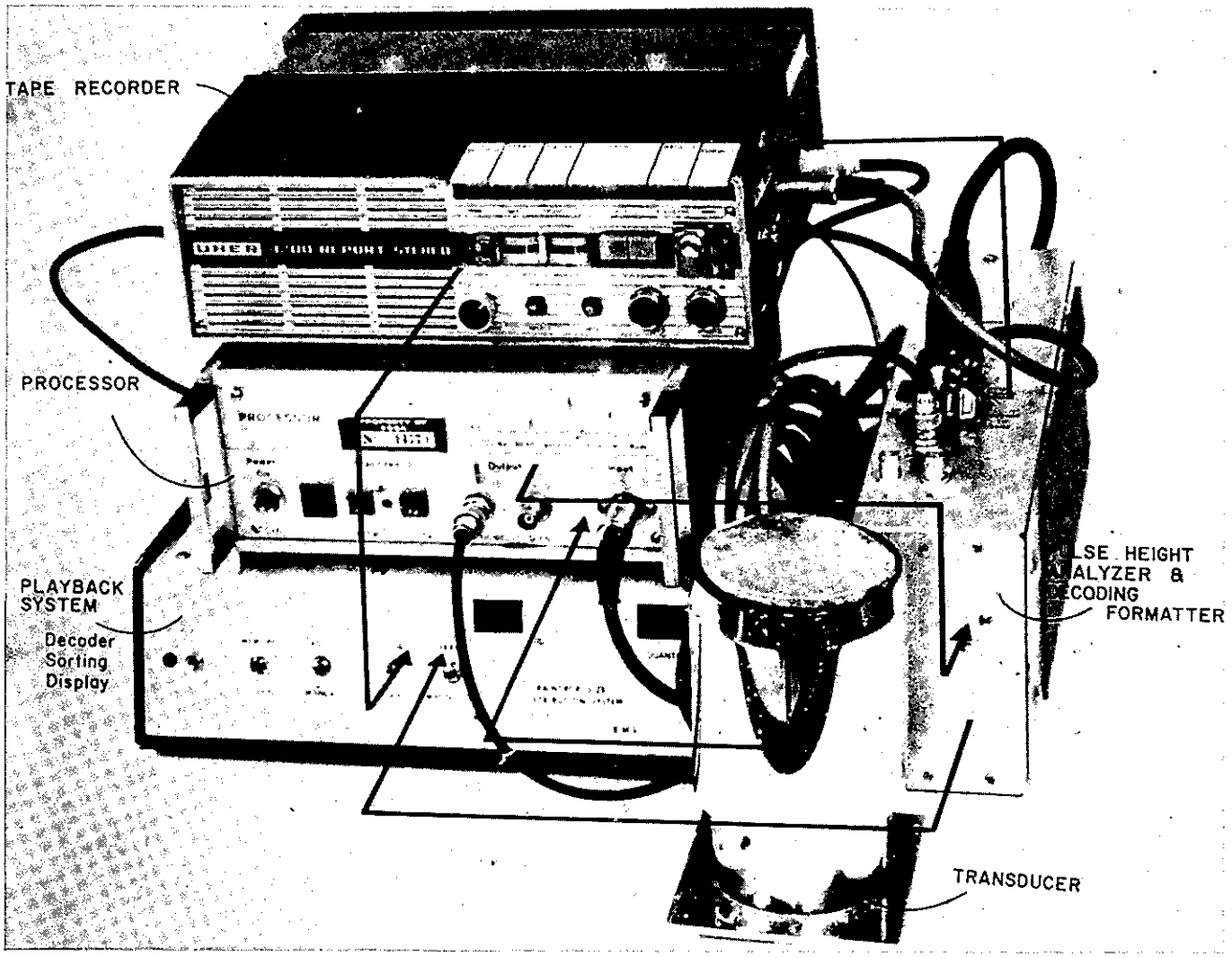

Figure 3. NHEML raindrop distrometer package. Shown are the Joss transducer and processor, pulse height analyzer, tape recorder, and NOAA-designed playback system.

4. DATA ANALYSIS TECHNIQUES

4.1 Aircraft Data

Upon completion of each flight day, the foil from the impactor device was dried to prevent corrosion. The data were checked to determine whether the impactor was operating properly and were cataloged for delivery to the U. S. At the conclusion of GATE, all foil data were inch-marked for time and length continuity and subsequently analyzed on a frame-by-frame basis with a Bausch and Lomb Quantitative Metallurgical System (QMS). The QMS is an electro-optical system that employs a vidicon camera and associated logic circuitry to allow for fast, automated measurements of a spectrum of particle sizes.

The analyzed foil data were sorted into 10 .50-mm size categories, the first being $0 < D \leq .50$ mm and the tenth being $4.5 \text{ mm} < D \leq 5.0$ mm. A correction, similar to that used by Schecter and Russ (1970), was applied to the drop imprint diameters to account for spreading of the liquid upon impact with the foil.[3] The terminal velocity expression used in the calculation of the rainfall rate (2) for the aircraft data was derived by Foote and Dutoit (1969) to fit the empirical data of Gunn and Kinzer (1949) and has the form

$$V_o = \sum_{j=0}^{N} a_j d^j \tag{3}$$

where the subscript zero refers to conditions at 20° C and 1013 mb, d is drop diameter, and a_j is determined from a least-squares curve fitting technique. A ninth-degree polynomial (N = 9) was used in the calculation of a_j. An altitude correction for V(d) as discussed by Foote and Dutoit (1969) was also applied, but in the case of the DC-6 foil data collected at or below about 3,000 ft, such a correction was negligible.

A single drop size distribution is derived for each aircraft penetration through a precipitation core region. For statistical validity (see Appendix C) each drop-size distribution typically has an integrated sample size of at least several hundred drops. Finally, from the number concentration of drops in each of the 10 size categories, a value of radar reflectivity (1), rainfall rate (2), and other related variables, such as liquid water content and slope of the best fit curve to the drop size spectra, are calculated for each aircraft traverse through a precipitation core region. A discussion of statistical criteria for the representativeness of drop size distributions sampled with a device such as a foil impactor and techniques for using a transformation function to calculate the drop size distribution is provided in Appendix C.

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[3]The expression used in this work has the form:

$$D_{ACT} = 0.865 D_{IMG}$$

It was derived and has been applied by Francis J. Merceret (personal communication) as a simplistic linear best fit to the Schecter and Russ size calibration data.

4.2 Surface Data

Upon completion of the operational phases of GATE, each tape from the distrometer recording system was played back through a processing and display unit. Each tape could contain up to about 48 minutes of rainfall data. It was usual procedure to record each new shower on a fresh tape, so many tapes were only partially filled with data. To achieve the maximum number of individual drop spectra (and hence Z-R data points) per shower while, at the same time, maintaining a sample volume judged adequate for the accumulation of a representative concentration of drops in each bin size, we decided to calculate each drop size distribution on the basis of uniform 120-second time intervals. This allowed a maximum of 24 distributions (Z-R data points) per data tape. In almost all cases selected for detailed study, the integrated number of drops in each 120-second interval was at least 100. Two-minute segments of distrometer data containing much fewer than 100 drops (integrated through all bin sizes) were not considered for further analysis.

The data processing package allowed each pulse-height analyzed drop to be placed into one of 64 discrete size intervals with the maximum drop diameter in mm for each drop size category given by the expression

$$D = 0.30711M^{0.65789} \tag{4}$$

where M is the category number (1-64). The range of sizes associated with each bin is variable, but generally is between .06 and .09 mm. The terminal velocity in cm sec^{-1} corresponding to the drop size at the midpoint of each category was calculated according to a formulation expressed by Best (1950),

$$V_T = K \left\{1-\exp \left[-(d/a)^n\right]\right\} \tag{5}$$

where d is the drop diameter in millimeters and K, a, and n are constants with values of 943, 1.77, and 1.147, respectively. Table 3 provides a complete summary of the minimum, midpoint, and maximum drop diameters, vertical velocity, and sampling volume (for a sampling period of 120 seconds) associated with each bin size. Several successive bins can be combined through the range of bin sizes to obtain a uniform bin spacing of .25 mm. This is done in an effort to smooth irregularities in the drop spectrum resulting from processing of bin sizes too small to allow the accumulation of a representative sample of drops in each bin. The .25-mm uniform bin size selected for the distrometer analysis is about half that (.43 mm) used in the processing of the foil data. Table 4 summarizes the combined bin size information, with the midpoint diameter, terminal velocity, and sampling volume corresponding to a 120-second sampling period given for each bin size.

5. RESULTS - AIRBORNE PROGRAM

Measurements of drop size spectra were obtained during each phase of GATE with the majority of data collected during the second phase. Table 5 gives the dates, duration, altitudes, and aircraft mission type from which data were collected. As can be seen from table 5, a large amount of data, totaling in excess of 76,000 cm of foil, was collected on 21 days during GATE. The days selected for analysis were those on which more than 2000 cm of foil were

Table 3. *Relevant Drop Size Information for Distrometer Bins*

Size category	Minimum diameter (mm)	Midpoint diameter (mm)	Maximum diameter (mm)	Terminal velocity (cm sec^{-1})	Sampling volume for Δt = 120 sec (m^3)
1	0	0.15	0.30	55	0.33
2	0.30	0.39	0.48	152	0.91
3	0.48	0.55	0.63	213	1.28
4	0.63	0.69	0.76	271	1.63
5	0.76	0.82	0.89	319	1.91
6	0.89	0.95	1.00	365	2.19
7	1.00	1.05	1.10	399	2.39
8	1.10	1.15	1.21	430	2.58
9	1.21	1.25	1.30	461	2.77
10	1.30	1.35	1.40	490	2.94
11	1.40	1.45	1.49	517	3.10
12	1.49	1.53	1.57	538	3.23
13	1.57	1.62	1.66	561	3.37
14	1.66	1.70	1.74	580	3.48
15	1.74	1.78	1.82	598	3.59
16	1.82	1.86	1.90	616	3.70
17	1.90	1.94	1.98	632	3.79
18	1.98	2.02	2.06	648	3.89
19	2.06	2.09	2.13	662	3.97
20	2.13	2.16	2.20	675	4.05
21	2.20	2.24	2.28	689	4.13
22	2.28	2.31	2.35	700	4.20
23	2.35	2.38	2.42	711	4.27
24	2.42	2.45	2.48	722	4.33
25	2.48	2.51	2.55	731	4.39
26	2.55	2.58	2.62	741	4.45
27	2.62	2.66	2.69	752	4.51
28	2.69	2.72	2.75	760	4.56
29	2.75	2.78	2.81	767	4.60
30	2.81	2.84	2.88	774	4.64
31	2.88	2.91	2.94	782	4.69
32	2.94	2.97	3.00	789	4.73
33	3.00	3.03	3.06	795	4.77
34	3.06	3.09	3.12	801	4.81
35	3.12	3.15	3.19	807	4.84
36	3.19	3.22	3.24	814	4.88
37	3.24	3.27	3.30	818	4.91
38	3.30	3.33	3.36	823	4.94
39	3.36	3.39	3.42	828	4.97
40	3.42	3.45	3.48	833	5.00
41	3.48	3.50	3.53	837	5.02
42	3.53	3.56	3.59	841	5.05
43	3.59	3.62	3.65	846	5.07
44	3.65	3.67	3.70	849	5.10
45	3.70	3.73	3.76	853	5.12
46	3.76	3.79	3.81	857	5.14
47	3.81	3.84	3.87	860	5.16
48	3.87	3.89	3.92	863	5.18
49	3.92	3.94	3.97	866	5.20
50	3.97	4.00	4.03	869	5.22
51	4.03	4.05	4.08	872	5.23
52	4.08	4.11	4.13	875	5.25
53	4.13	4.16	4.18	877	5.26
54	4.18	4.21	4.24	880	5.28
55	4.24	4.26	4.28	882	5.29
56	4.28	4.31	4.33	884	5.31
57	4.33	4.36	4.39	886	5.32
58	4.39	4.41	4.44	888	5.33
59	4.44	4.46	4.49	890	5.34
60	4.49	4.51	4.54	892	5.35
61	4.54	4.56	4.59	894	5.37
62	4.59	4.61	4.63	896	5.38
63	4.63	4.66	4.68	898	5.39
64	4.68	4.70	4.73	901	5.41

$D = 0.30711M^{0.65789}$ where D is drop diameter in millimeters and M is the size bin category.

$V_T = A \left\{ 1 - \exp \left[- \left(d/a \right)^n \right] \right\}$ where V_T is terminal velocity in cm sec^{-1}, d is drop diameter in mm, and A, a, and n are constants with respective values of 943, 1.77, and 1.147.

Table 4. Combined Distrometer Bins for 0.25-mm Spacing

Size category	Distrometer bins	Actual spacing	Representative spacing	Midpoint diameter	Terminal velocity cm sec^{-1}	Sampling volume for Δt=120 sec (m^3)
1	1	0.00 - 0.30	0.00 - 0.25	0.125	44	.26
2	2	0.30 - 0.48	0.25 - 0.50	0.375	146	.88
3	3, 4	0.48 - 0.76	0.80 - 0.75	0.625	247	1.48
4	5, 6	0.76 - 1.00	0.75 - 1.00	0.875	339	2.03
5	7, 8	1.00 - 1.21	1.00 - 1.25	1.125	422	2.53
6	9, 10, 11	1.21 - 1.49	1.25 - 1.50	1.375	496	2.98
7	12, 13, 14	1.49 - 1.74	1.50 - 1.75	1.625	562	3.37
8	15, 16, 17	1.74 - 1.98	1.75 - 2.00	1.875	619	3.71
9	18, 19, 20, 21	1.98 - 2.28	2.00 - 2.25	2.125	668	4.01
10	22, 23, 24	2.28 - 2.48	2.25 - 2.50	2.375	710	4.26
11	25, 26, 27, 28	2.48 - 2.75	2.50 - 2.75	2.625	747	4.48
12	29, 30, 31, 32	2.75 - 3.00	2.75 - 3.00	2.875	778	4.67
13	33, 34, 35, 36	3.00 - 3.24	3.00 - 3.25	3.125	805	4.83
14	37, 38, 39, 40	3.24 - 3.48	3.25 - 3.50	3.375	827	4.96
15	41, 42, 43, 44, 45,	3.48 - 3.76	3.50 - 3.75	3.625	846	5.08
16	46, 47, 48, 49	3.76 - 3.97	3.75 - 4.00	3.875	862	5.17
17	50, 51, 52, 53, 54	3.97 - 4.24	4.00 - 4.25	4.125	875	5.25
18	55, 56, 57, 58, 59	4.24 - 4.49	4.25 - 4.50	4.375	887	5.32
19	60, 61, 62, 63, 64	4.49 - 4.73	4.50 - 4.75	4.625	896	5.38

Table 5. Cloud-Base Drop Spectra Measurements Made During GATE

Date (1974)	Amount of foil analyzed (cm)	Number of rainshaft penetrations	GATE mission type	DC-6 flight altitude (ft)	Date (1974)	Amount of foil analyzed (cm)	Number of rainshaft penetrations	GATE mission type	DC-6 flight altitude (ft)
3 July	586	4	2 (ITCZ crossing)	500	17 August*	4572	3	2B (box)	500
12 July*	7112	7	5A4 (railroad)	1300	30 August*	3048	5	5A1 (box)	300
16 July	1500	7	5A/8A1 (aborted)		2 September	1543	5	1C2 (line)	850-2000
29 July*	5080	9	1A (butterfly)	500	3 September	615	4	5B2 (line)	500
3 August*	7620	15	1C2 (line)	5000	6 September*	5080	10	5B2 (line)	300-800
5 August*	8890	19	1C2 (line)	300-2000	7 September	421	2	5B1/6A (L's)	1200
8 August	1800	8	1A (butterfly)	4000	9 September	1100	4	1C2 Box (aborted)	300
10 August*	7620	12	1A (butterfly)	500	14 September*	5080	7	1C2 (line)	1000
11 August*	5588	5	2A-mod (line)	500	17 September	402	2	7A2 (line)	3000
13 August*	8890	12	1A (butterfly)	500	18 September	1570	4	1 (box, line)	3500
14 August*	2286	3	5B2 (line)	3000-5000					

* Dates analyzed with more than 2000 cm of foil.

collected. For the 12 days that met the 2000-cm criterion, more than 70,000 cm of foil were analyzed from 107 rainshaft penetrations. The flight altitudes of the DC-6 generally varied between 300 and 1500 ft, although several penetrations were carried out at an altitude higher than 3000 ft. A complete listing of the drop size distributions from each rainshaft penetration is given in Appendix A.

Figures 4a through 4f show composited drop distributions for various rainfall rates. The dotted line indicates the mean distribution and the shaded area indicates two standard deviations away from the mean. None of the composited distributions showed any marked differences as a function of altitude within the range of observations and, for ease of classification, will be categorized together as cloud-base distributions. Figure 5 shows drop size distributions for five rainfall rates on August 10, 1974. The distributions indicate that, for light to moderate rainfall rates, the spectrum decays exponentially for drop diameters larger than about 1 mm. For the heavier rain rates, the exponential decay commences near a diameter of 1.5 mm. The best-fit curve to the drop size distributions given in figure 5 assumes the form:

$$N(D) = N_o \, e^{-\lambda D} \tag{6}$$

where N_o is the intercept and λ is the slope of the best-fit line.

Through the use of (1) and (2), Z-R data points can be computed from each drop size distribution to derive a Z-R relationship. Table 6 summarizes the Z-R relationships on a day-to-day basis for the 12 days analyzed for GATE. The best-fit curves for eight days during which drop size distributions were obtained from seven or more rainshaft penetrations are shown in figure 6. It is not possible to discern any significant day-to-day variation as a function of either flight altitude or mission type. Table 7 gives the rainfall rates (mm hr^{-1}) as a function of Z(dB) for the eight days shown in figure 6. It can be seen that, for radar reflectivity values between 35 and 50 dB, the daily variability of the computed rainfall is quite small. A divergence of the calculated daily rainfall rates is noted for Z(dB) values < 35 dB and > 50 dB. Only in the latter case, that of extremely heavy rain rates, is the daily variability likely to be of any practical consequence to the determination of radar-derived rainfall.

Since, at reasonable rain rates, there is no indication of high variability on a day-to-day basis or from mission type to mission type, the total data set for the 107 Z-R points can be combined to derive an averaged Z-R relationship. Figure 7 shows all of the individual Z-R points and the best-fit line to the points derived from a regression of Z, the dependent variable, on R, the independent variable. The Z-R relationship

$$Z = 170R^{1.52} \tag{7}$$

has a correlation coefficient of .986, and this relationship is put forward as the cloud base Z-R relationship for the GATE area.

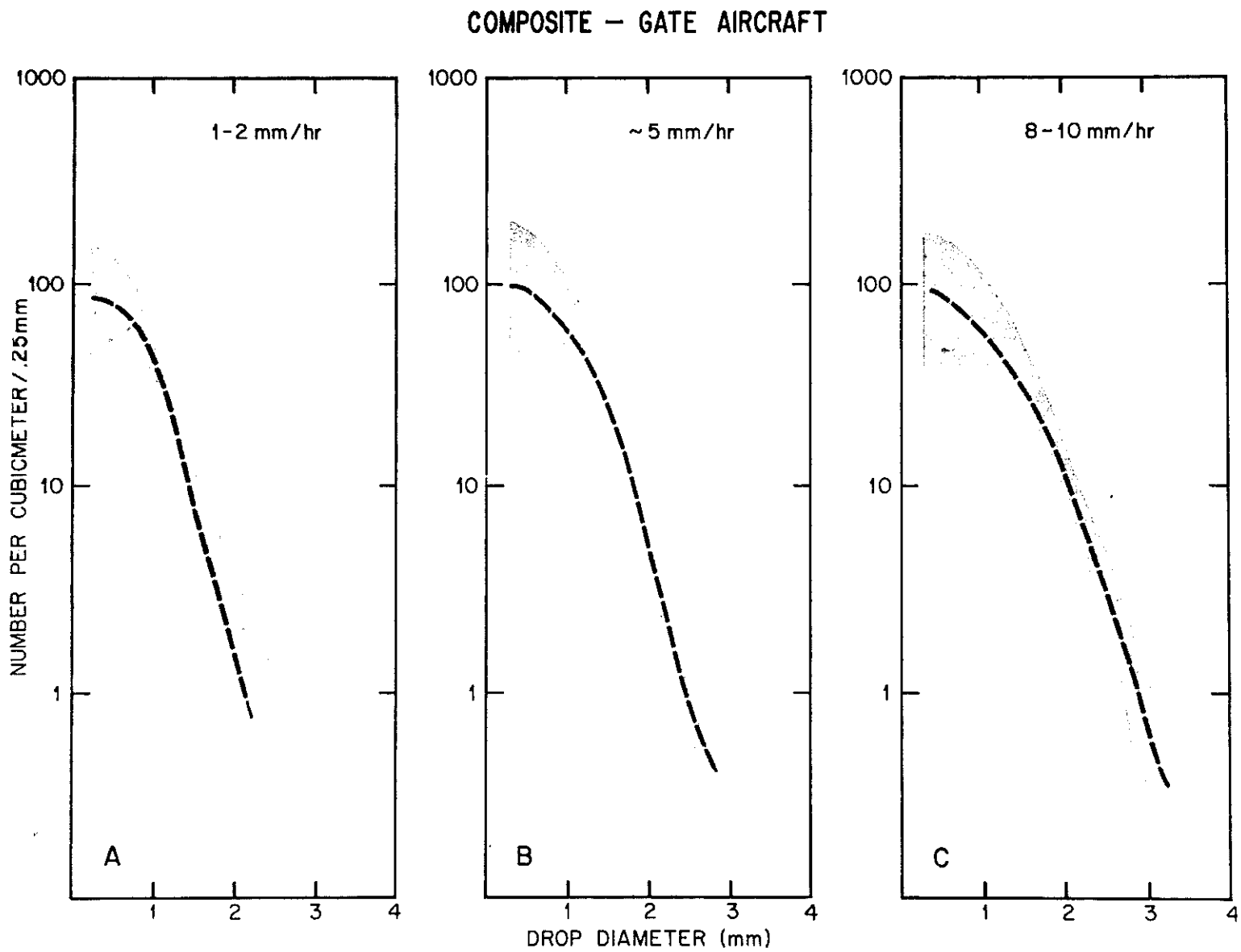

Figure 4. Composites of drop size distributions for various rainfall rates obtained from DC-6 foil data during GATE.

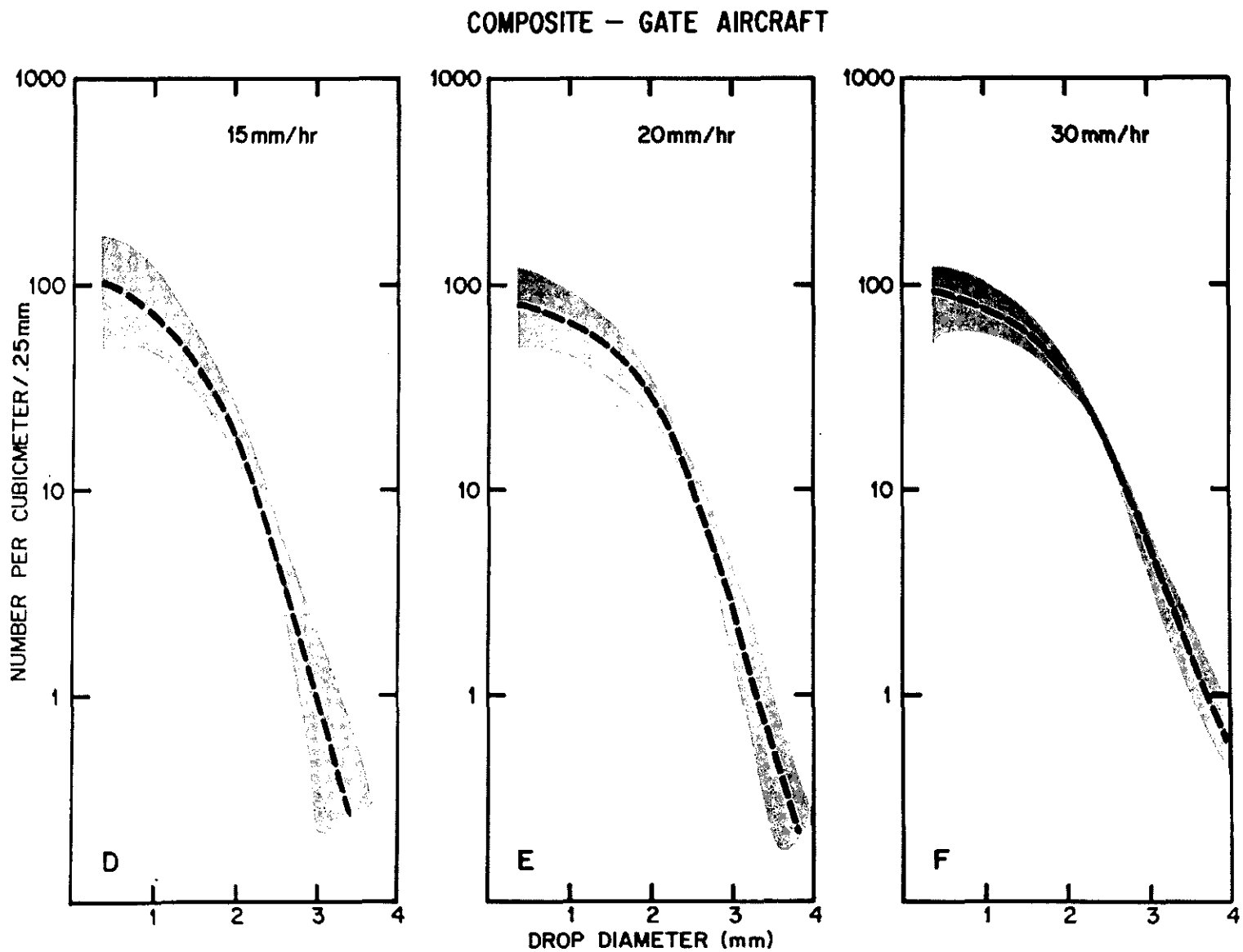

Figure 4. Composites of drop size distributions for various rainfall rates obtained from DC-6 foil data during GATE.

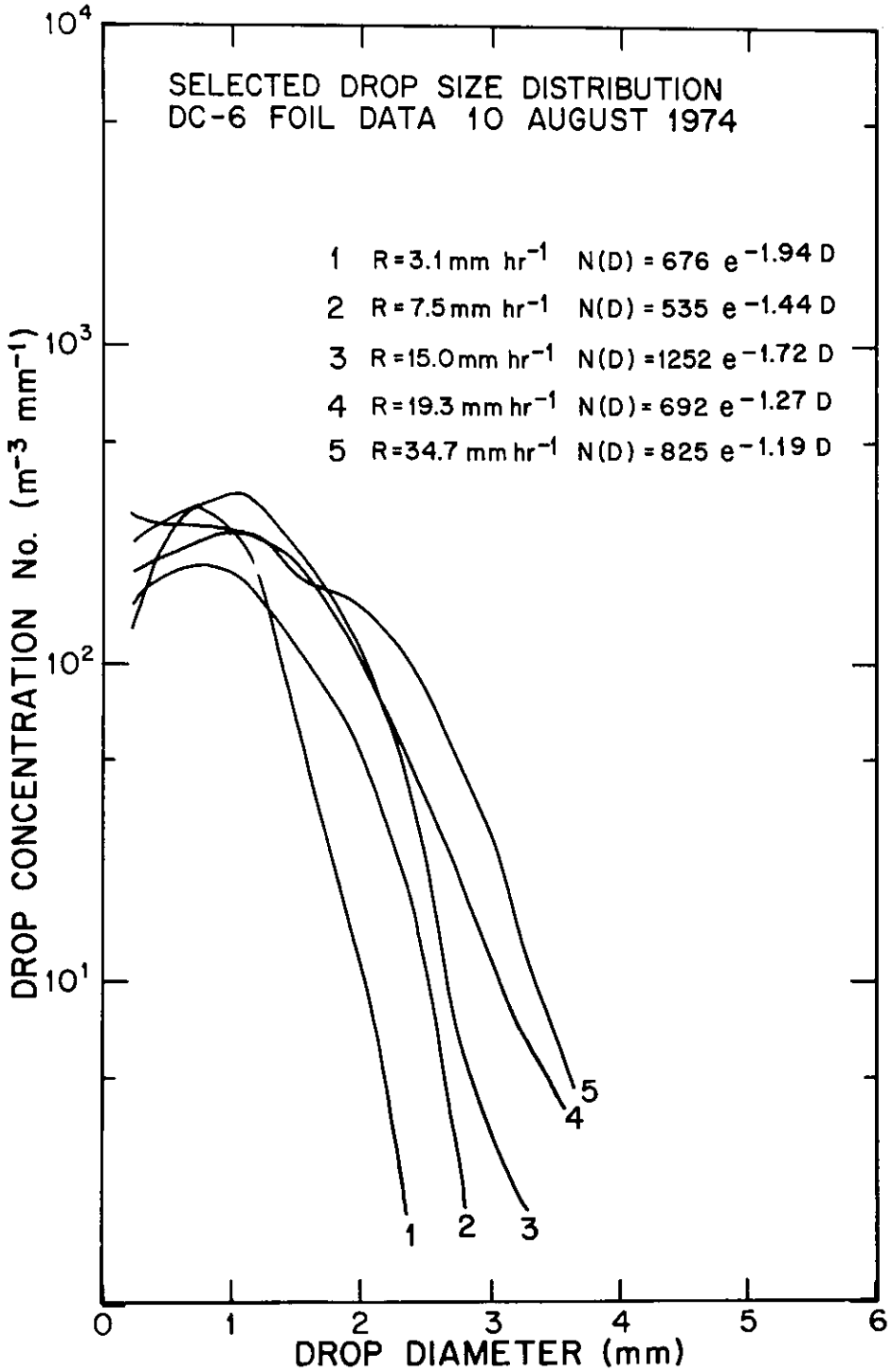

Figure 5. Five selected drop size distributions obtained from an analysis of DC-6 foil data collected on August 10, 1974.

Table 6. Daily Cloud-Base Z-R Relationships

Date (1974)	Number of rainshaft penetrations	Calculated Z-R relationship	Correlation coefficient
12 July	7	$Z = 164\ R^{1.54}$	0.99
29 July	9	$Z = 146\ R^{1.55}$	0.99
3 August	15	$Z = 261\ R^{1.34}$	0.97
5 August	19	$Z = 176\ R^{1.45}$	0.99
10 August	12	$Z = 211\ R^{1.47}$	0.98
11 August	5	$Z = 163\ R^{1.58}$	0.97
13 August	12	$Z = 291\ R^{1.38}$	0.98
14 August	3	$Z = 150\ R^{1.44}$	0.99
17 August	3	$Z = 116\ R^{1.63}$	0.99
30 August	5	$Z = 179\ R^{1.38}$	0.99
6 September	10	$Z = 163\ R^{1.54}$	0.99
14 September	7	$Z = 118\ R^{1.66}$	0.99

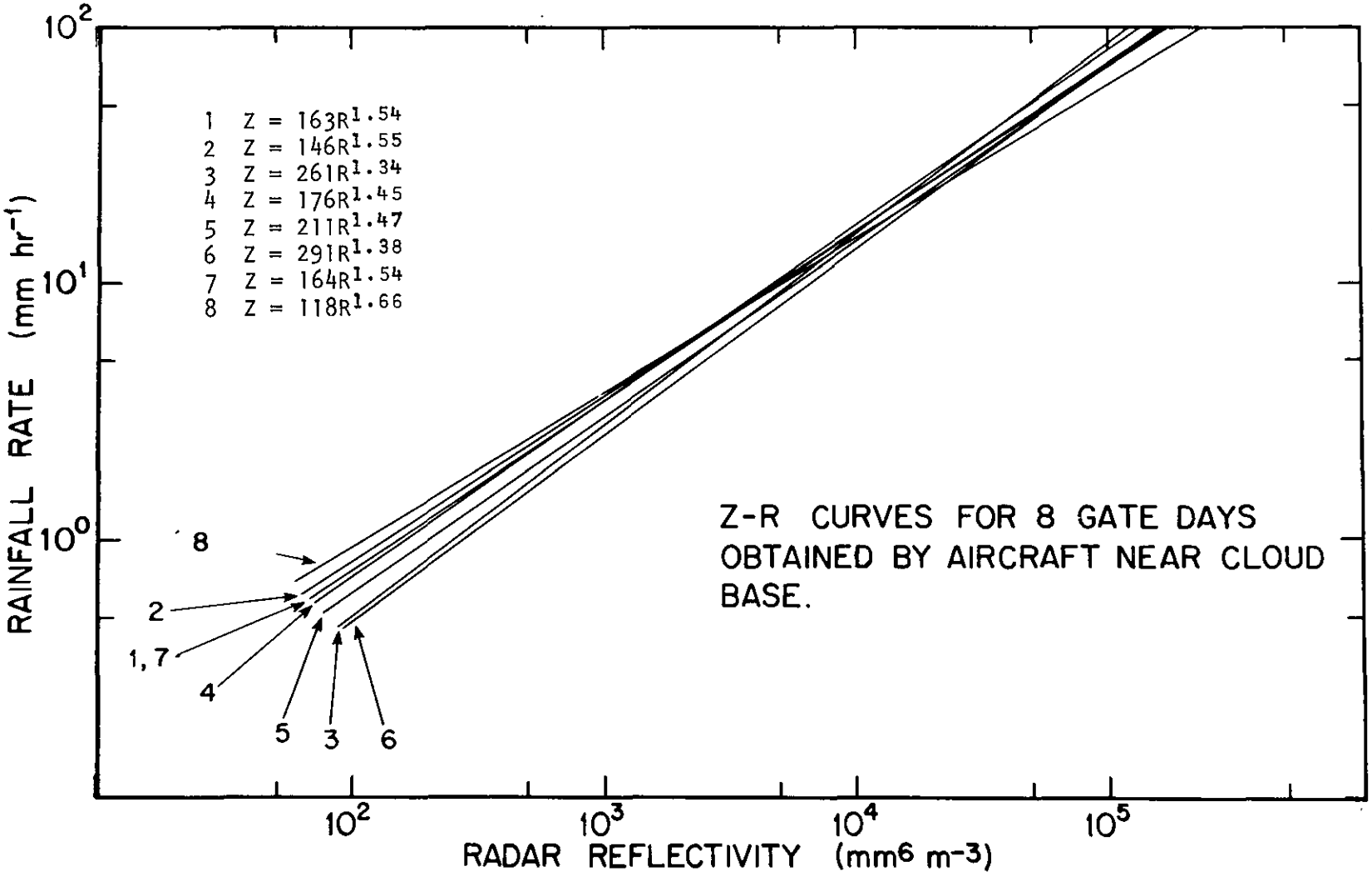

Figure 6. Daily best-fit Z-R relationship curves obtained from an analysis of DC-6 foil data collected near cloud base on eight days during GATE.

Table 7. Rainfall Rates (mm hr^{-1}) as a Function of Z (db) for Eight Daily Z-R Relationships Obtained at Cloud Base During GATE

	1	2	3	4	5	6	7	8
Z (db)	$164\ R^{1.54}$	$146\ R^{1.55}$	$261\ R^{1.34}$	$176\ R^{1.45}$	$211\ R^{1.47}$	$291\ R^{1.38}$	$163\ R^{1.54}$	$118\ R^{1.66}$
60	287	298	472	388	317	365	288	232
55	136	142	200	175	145	158	136	116
50	64	68	85	79	66	69	65	58
45	30	32	36	36	30	30	31	29
40	14	15	15	16	14	13	14	15
35	7	7	6	7	6	6	7	7
30	3	3	3	3	3	2	3	4
25	2	2	1	1	1	1	2	2
20	1	1	< 1	1	1	< 1	1	1

$Z\ (db) = 10 \log Z_o\ (mm^6 m^{-3})$; $Z = aR^b$

$R\ (mm\ hr^{-1}) = \left(\frac{Z_o}{a}\right)^k$ where $k = \frac{1}{b}$

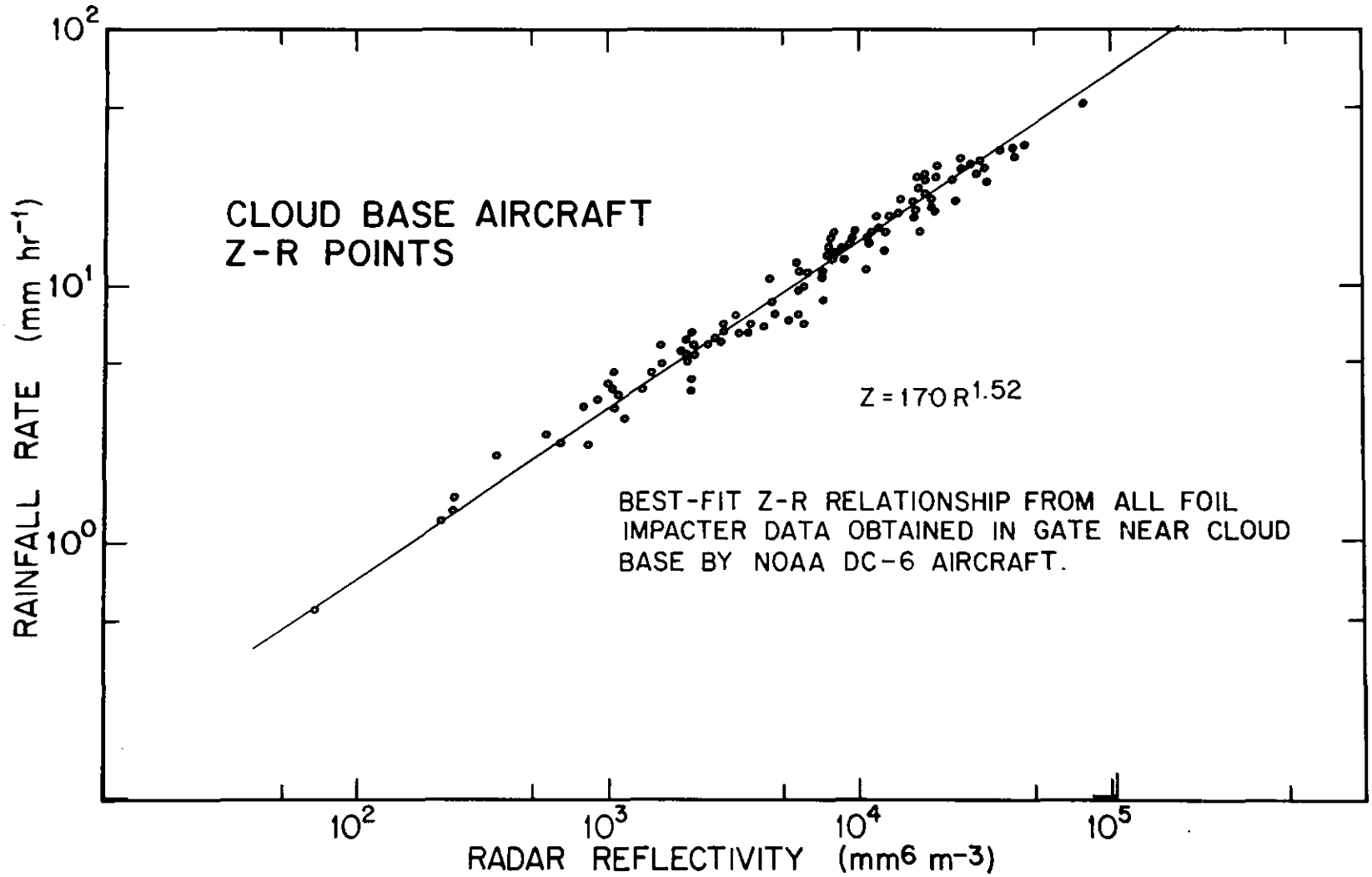

Figure 7. Best-fit Z-R relationship drawn to all data points obtained through an analysis of DC-6 foil data collected near cloud base within the GATE B-scale array.

Table 8 provides an additional stratification of the total set of Z-R points as a function of rainfall rate. Here, all the Z-R points greater than the R values indicated in the first column are used to calculate a Z-R relationship. It can be seen that the rainfall rates computed for 50, 45, 40, and 35 dB are, for all practical purposes, completely unaffected by the stratification by rainfall rate. This is displayed graphically in figure 8 where the best-fit Z-R relationship is plotted to data points (not shown) stratified as a function of rainfall rate. The best-fit lines to three values of rainfall rate ($R > 0$, $R > 7.5$ mm hr^{-1}, and $R > 12.5$ mm hr^{-1}) are shown. Lines drawn to intermediate rainfall values would fall superimposed on the three shown. This indicates that the best-fit Z-R relationship is not unduly weighted by a predominance of data points at any given rainfall intensity.

6. RESULTS - SHIPBORNE PROGRAM

Measurements of raindrop size distributions were taken on board the NOAA ship *Researcher* during the three phases of GATE. Table 9 presents the dates, number of showers, number of showers analyzed, and the GATE convective code for that day.[4] The table indicates that only nine showers, accounting for 137 individual distributions, were analyzed from a possible total of 42. This was partly the result of a signal-to-noise problem that is inherent in the distrometer and partly a consequence of many showers being too light (sampling on the periphery instead of the core) to insure an adequate number of drops recorded in an acceptable number of bins to derive a representative distribution.

Figure 9 shows five drop size distributions from the distrometer for various rainfall rates recorded on June 30, 1974. Unlike most drop spectra which are characterized by an exponential decay, the distrometer distributions do not exhibit such a shape for drop diameters < 2 mm. This feature in the drop spectrum is most likely the result of a detection problem of the distrometer that occurs when it is placed in a high background noise environment. The distrometer transducer is basically similar to a microphone that cannot only detect raindrops, but which is also sensitive to background noise. The processor unit of the distrometer has a noise-suppression circuit which acts to level shift the mean detectable signal to filter out the background noise. However, this circuit also eliminates the detection of all raindrops that have a signal intensity less than the level-shifted mean detectable signal.

In the shipboard environment, the background sound level was very high with the presence of continuous generator and motor noise. The result of this high background noise for the distrometer measurements is that all drop sizes < 1 mm were completely eliminated, and the number of drops recorded in the 1- to 2-mm range was greatly reduced. An attempt has been made to account for this problem in the analysis by extrapolating a best-fit curve to the distribution of drop sizes not affected by the noise problem back to small drop diameters in a consistent manner. Figure 10 illustrates how the drop size distributions for the five rainfall cases on June 30 (shown in figure 9) can

[4]A detailed description of this convective code adopted by the GATE ships is found in GATE Information Bulletin #8, September 1, 1975.

Table 8. Cloud-Base Best-fit Z-R Relationships as a Function of Rainfall Rate

Stratification	No. data points	Z-R relationship	Correlation coefficient	R at 50 db mm hr^{-1}	R at 45 db mm hr^{-1}	R at 40 db mm hr^{-1}	R at 35 db mm hr^{-1}
All data	107	$Z = 170\ R^{1.52}$	0.986	66	31	15	7
R > 2.5 mm hr^{-1}	100	$Z = 173\ R^{1.51}$	0.980	67	31	15	7
R > 5.0 mm hr^{-1}	86	$Z = 186\ R^{1.49}$	0.974	68	31	15	7
R > 7.5 mm hr^{-1}	63	$Z = 192\ R^{1.48}$	0.949	68	31	14	7
R > 10.0 mm hr^{-1}	56	$Z = 138\ R^{1.58}$	0.941	65	31	15	7
R > 12.5 mm hr^{-1}	49	$Z = 140\ R^{1.58}$	0.937	64	31	15	7

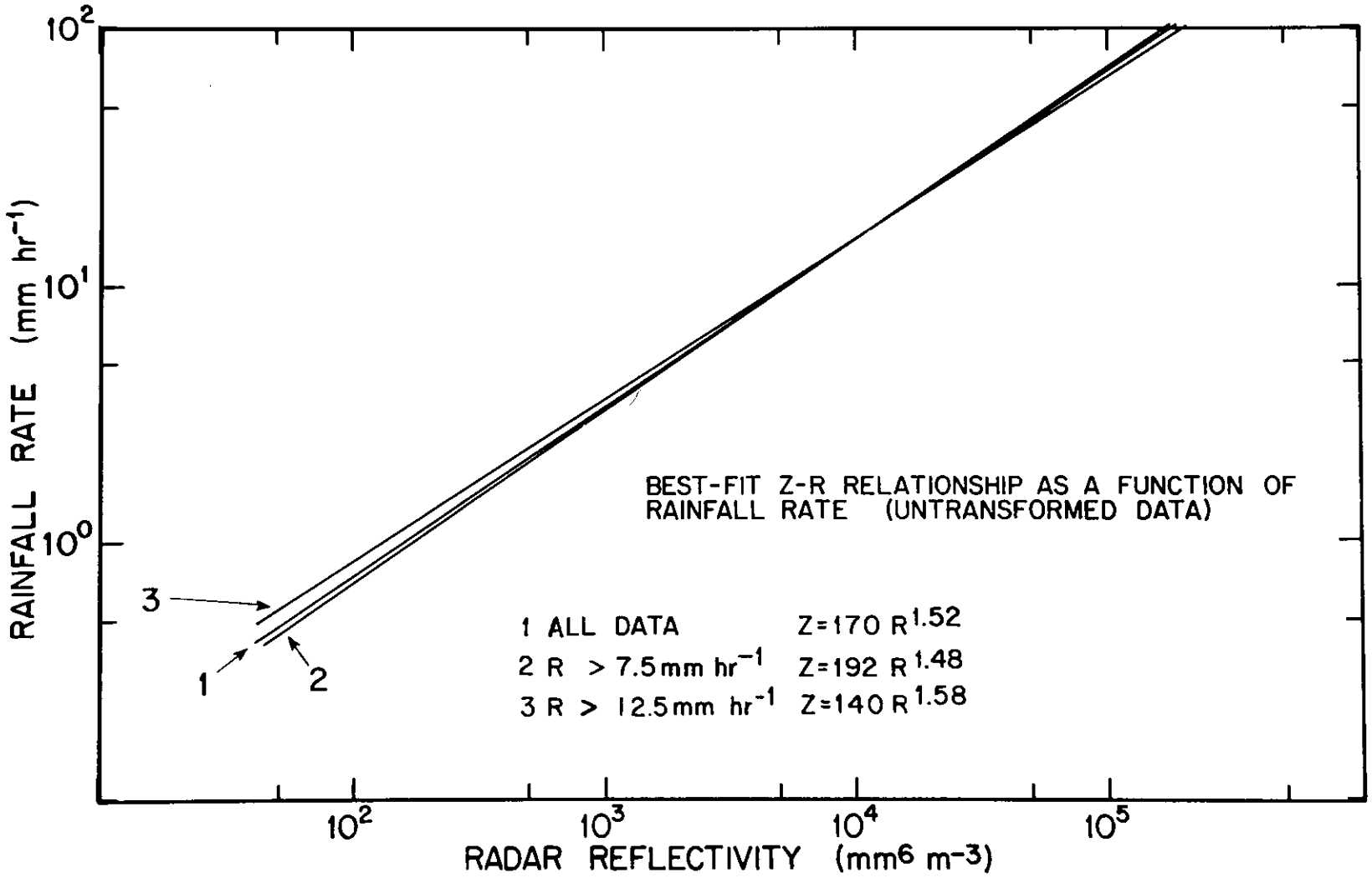

Figure 8. Best-fit Z-R relationship curves as a function of rainfall rate obtained from an analysis of DC-6 foil data collected during GATE.

Table 9. Catalog of GATE Distrometer Data from the NOAA Ship "Researcher"

DATE	No. of showers	No. of showers analyzed	Convective code[1]
6/28	3	0	2-3
6/29	1	1	1-2
6/30	4	1	1-3
7/2	1	0	2-3
7/3	1	0	1
7/4	1	0	1
7/7	1	0	1-4
7/8	2	1	1-3
7/14	1	0	1-4
7/28	3	1	3-4
8/2	2	1	3-4
8/3	2	0	4
8/12	2	0	3-5
8/18	2	1	intercomparison
9/2	1	0	3-4
9/4	2	1	3-4
9/5	2	0	2-3
9/12	2	0	3-4
9/16	5	2	2-4
9/17	1	0	2-3
9/19	1	0	2-4
9/21	2	0	intercomparison

[1] Code 1: extremely depressed convection; Code 2: moderately-slightly depressed convection; Code 3: weakly enhanced convection; Code 4: moderately enhanced convection; Code 5: strongly enhanced convection.

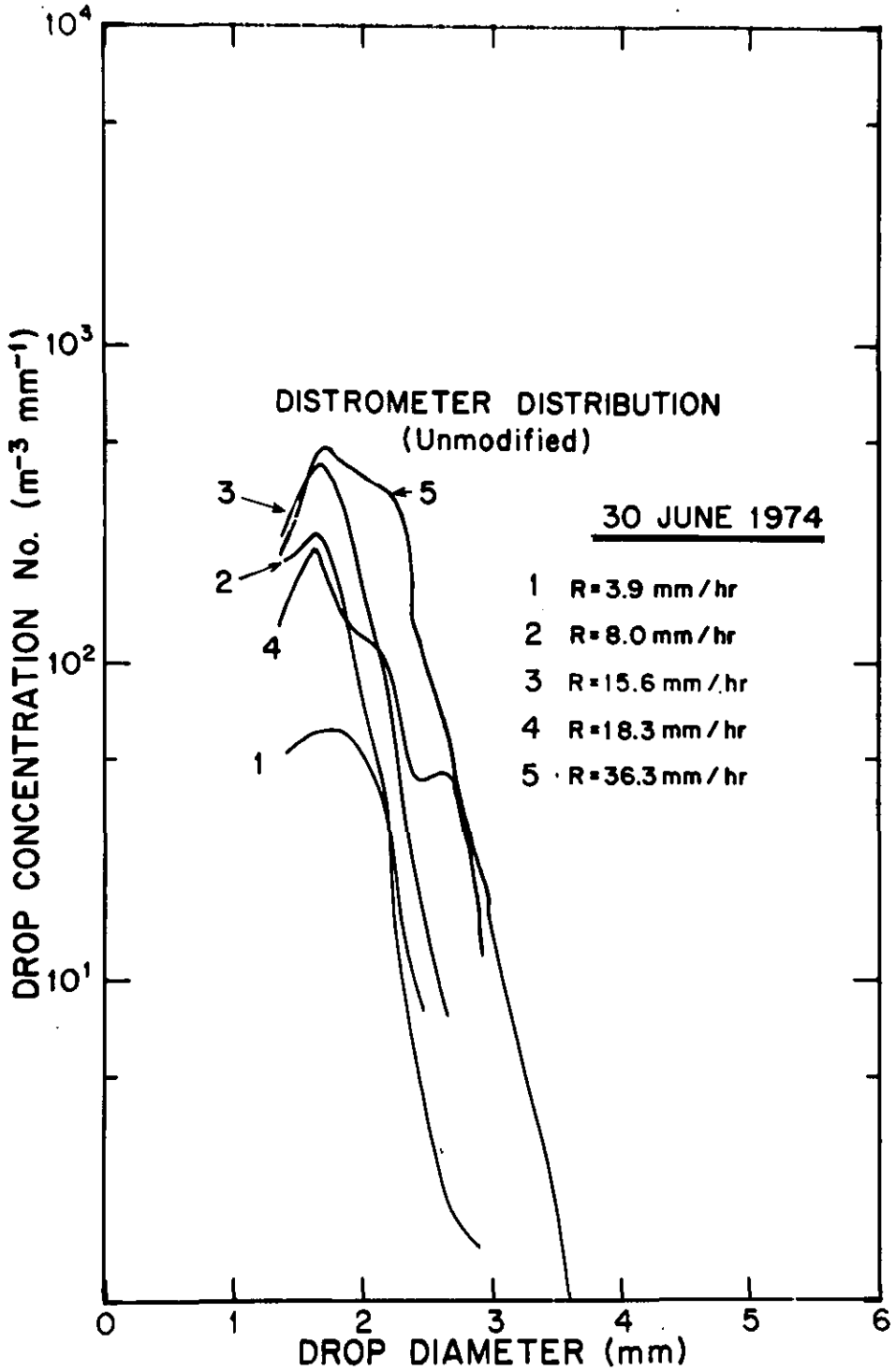

Figure 9. Unmodified selected drop size distributions obtained from an analysis of "Researcher" distrometer data collected on June 30, 1974.

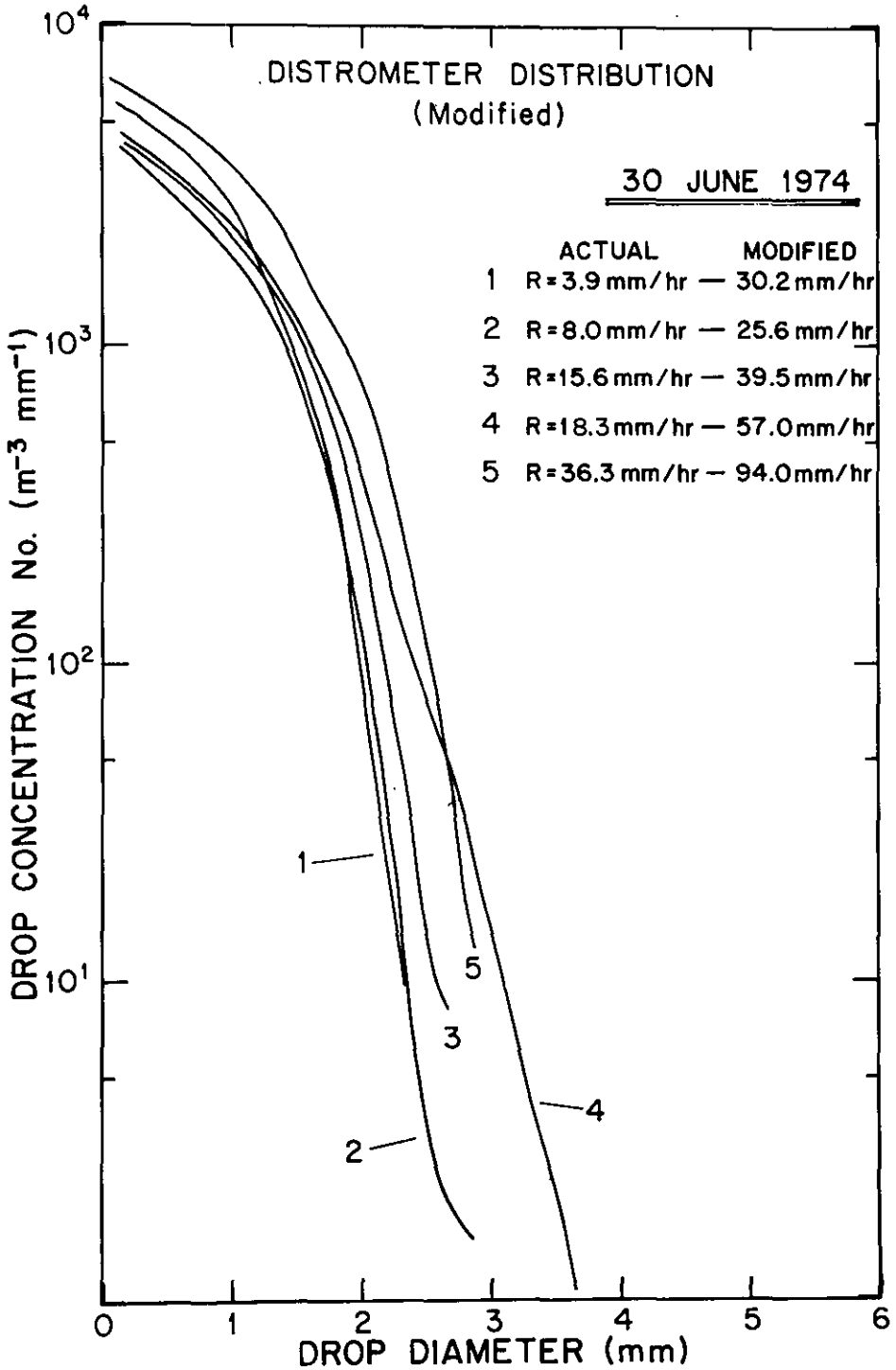

Figure 10. As in figure 9, except drop size distributions modified at the small end.

be modified by extrapolating backwards from the large end of the spectrum. The most logical way to test the validity of this technique from available data was to compare the derived precipitation amounts from the integrated modified distrometer distributions to those from the siphon gages (located on the mast and boom) or from the wedge gages (located elsewhere on the ship).

Table 10 shows the 6-minute averaged precipitation amounts for the siphon gage, the indicated distrometer, and the corrected (modified) distrometer data for a shower which passed over the *Researcher* on July 8, 1974. The corrected distrometer amounts are slightly less than those for the siphon gage, but provide a much better comparison with the gage than do the uncorrected distrometer amounts. The siphon gage data were available for September 4 and 16, 1974, and a similar correction procedure was carried out for those days. Siphon gage data were not available coincident with usable distrometer data on any other day. The available wedge gage data were unsuitable as a basis for intercomparison with the distrometer because the gages were read too infrequently (once every 6 hours). It was decided, therefore, that for these cases, the best way to correct the distrometer was to extrapolate the drop size distributions back to small drop diameters in the same manner as that which had been applied to the three days with siphon gage data.

Figure 11 shows composited drop distributions (from the uncorrected data) for eight rainfall rates. The solid line indicates the mean distribution and the shaded area is a measure of two standard deviations away from the mean. These composites appear to exhibit the same general trends as a function of rain rate as those from the aircraft, although the drop concentrations at small diameters ($D < 2$ mm) generally are reduced compared with those from the aircraft (sampling problem just discussed), and these distributions are somewhat narrower (fewer large drops) than are those from the aircraft. A complete listing of the drop size distributions for each 120-second interval of each shower is given in Appendix B, both for the raw (uncorrected) and modified distrometer data.

Again, through the use of (1) and (2), Z-R points can be derived from each drop size distribution. Table 11 presents the Z-R relationship for the actual and modified distribution for each of the nine showers sampled. Figures 12 and 13 show the shower-to-shower variability for the Z-R relationship derived from the modified and unmodified drop distribution data, respectively. It can be seen that the daily variability of the Z-R relationship derived from the distrometer data is considerably greater than that derived from the foil impactor data shown in section 5. This is particularly true in the case of the modified data set. Table 12 gives the rainfall rates (mm hr^{-1}) as a function of Z(dB) for the eight modified case days shown in figure 10. The rainfall rate variability from case to case within the Z(dB) range of 35 to 50 is considerably greater than that derived from the foil data shown in table 7.

Since all the distrometer data is taken from approximately the same fixed location, and since there are not enough shower cases to determine the Z-R variability as a function of different types of synoptic conditions, the total data set was combined to derive an averaged Z-R relationship. Figure 14 shows all of the modified Z-R points along with the best fit line to the points.

Table 10. Comparison of Distrometer-Derived Rainfall with that from Siphon Gage on Board "Researcher"

6-minute averaged, July 8, 1974 - *Researcher*

Time	Siphon Gage (mm)	Distrometer Uncorrected	Distrometer Corrected
1745-1751	6.2	3.5	4.6
1751-1757	10.9	6.7	12.0
1757-1803	9.3	5.1	7.8
1803-1809	7.6	3.0	6.3
1809-1815	6.7	1.7	2.4
1815-1821	3.9	1.0	1.4
1821-1827	7.3	2.6	4.5
1827-1833	6.4	2.1	3.3
Total	53.8	24.7	42.3

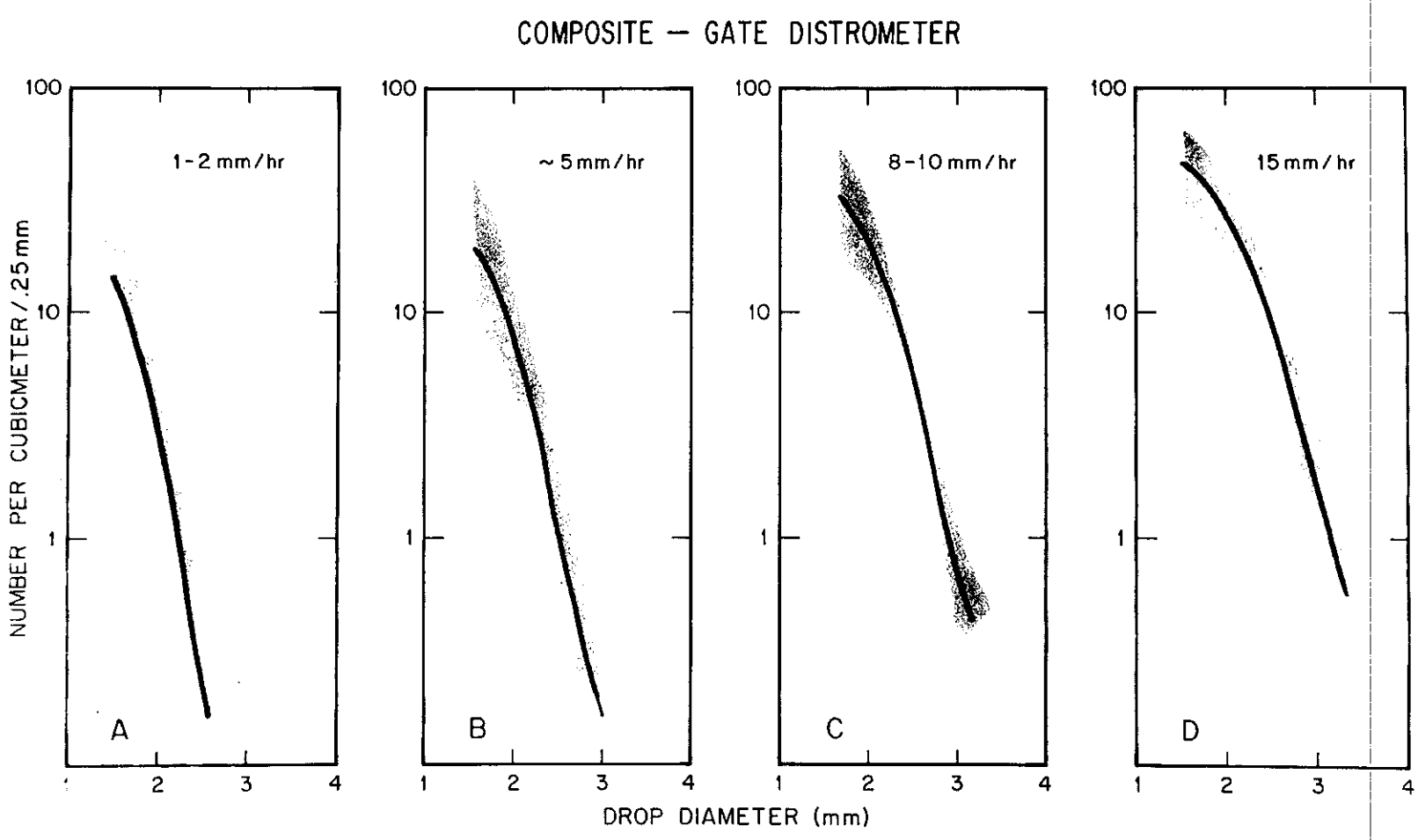

Figure 11. Composites of drop size distributions for various rainfall rates obtained from "Researcher" distrometer data during GATE.

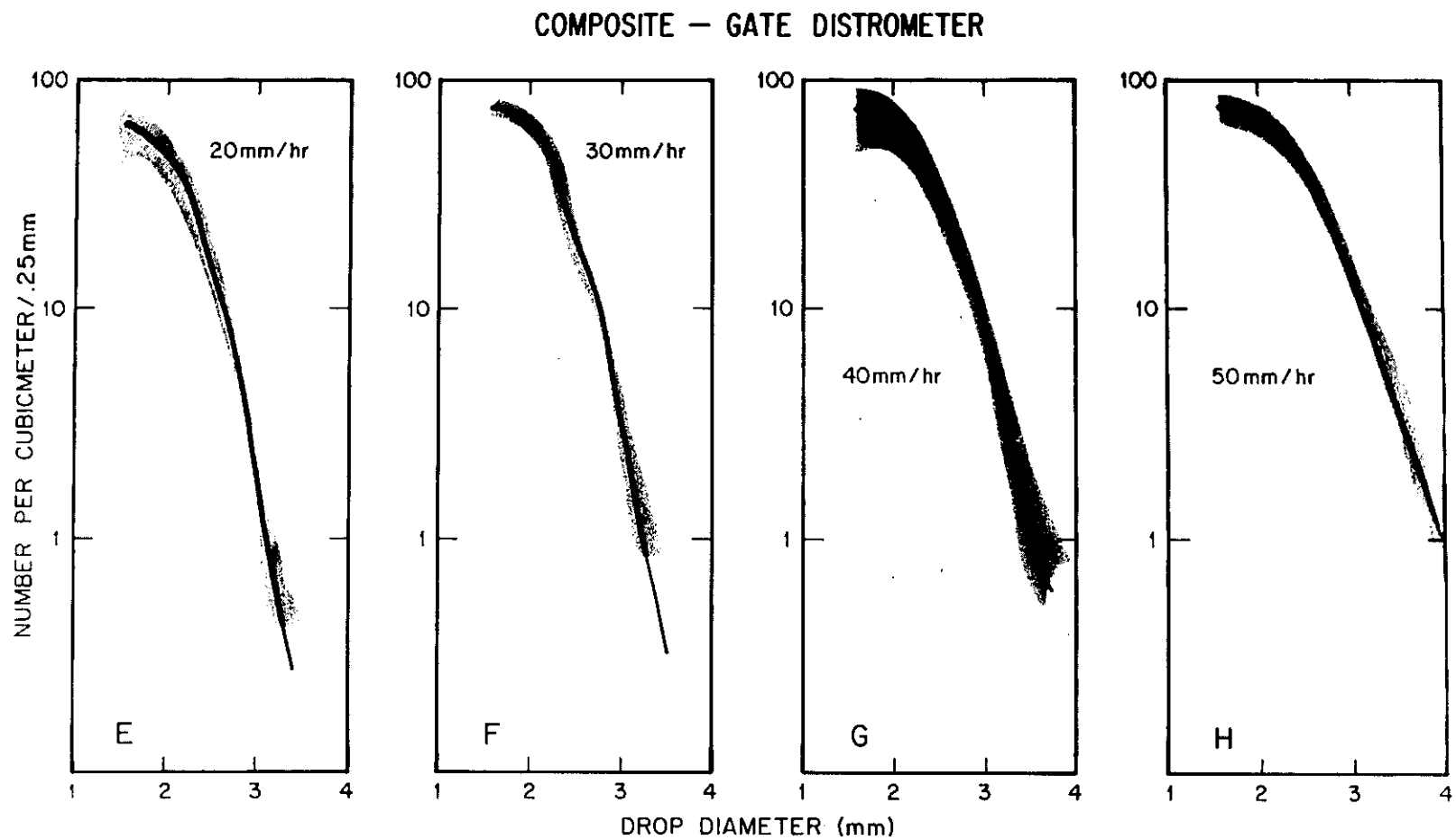

Figure 11. Composites of drop size distributions for various rainfall rates obtained from "Researcher" distrometer data during GATE.

Table 11. Daily Z-R Relationships from Ship "Researcher"

Date (1974)	Tape ID	Distrometer start time (GMT)	No. data points	Best-fit Z-R relationship (modified data)	Correlation coefficient	Best-fit Z-R relationship (actual data)	Correlation coefficient
29 June	1P04	NA	8	$Z = 142R^{1.19}$	0.98	$Z = 375R^{1.19}$	0.99
30 June	1P05	NA	24	$Z = 94R^{1.41}$	0.99	$Z = 495R^{1.18}$	0.96
8 July	1P14	1745	24	$Z = 296R^{1.23}$	0.97	$Z = 294R^{1.36}$	0.98
28 July	2P01	NA	19	$Z = 159R^{1.30}$	0.95	$Z = 699R^{1.09}$	0.93
2 August	2P05	2126	17	$Z = 197R^{1.09}$	0.99	$Z = 432R^{1.07}$	0.99
18 August	2P11	0750	19	$Z = 61R^{1.53}$	0.98	$Z = 402R^{1.25}$	0.99
4 September	3P03	1845	8	$Z = 363R^{1.03}$	0.99	$Z = 582R^{1.03}$	0.96
16 September (a)	3P08	1020	10	$Z = 297R^{1.12}$	0.98	$Z = 487R^{1.24}$	0.99
16 September (b)	3P09	1112	8	$Z = 296R^{1.12}$	0.99	$Z = 395R^{1.13}$	0.99
ALL DATA	--	--	137	$Z = 170R^{1.29}$	0.97	$Z = 484R^{1.19}$	0.98

Note: Sample time 120 sec per data point. Drop distribution modified in small size range. See Appendix B.

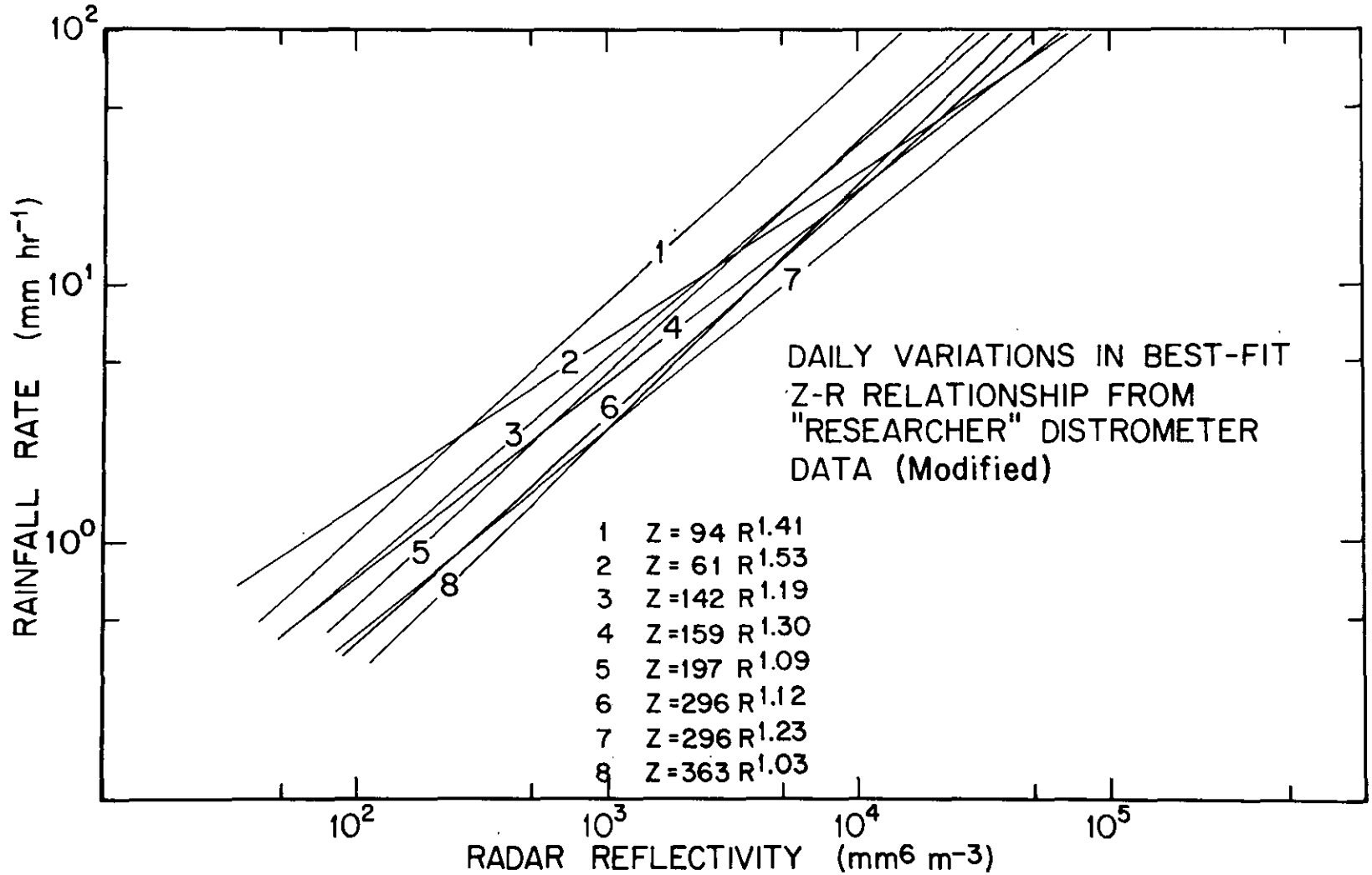

Figure 12. Daily best-fit Z-R relationship curves obtained from an analysis of modified "Researcher" distrometer data collected on eight days during GATE.

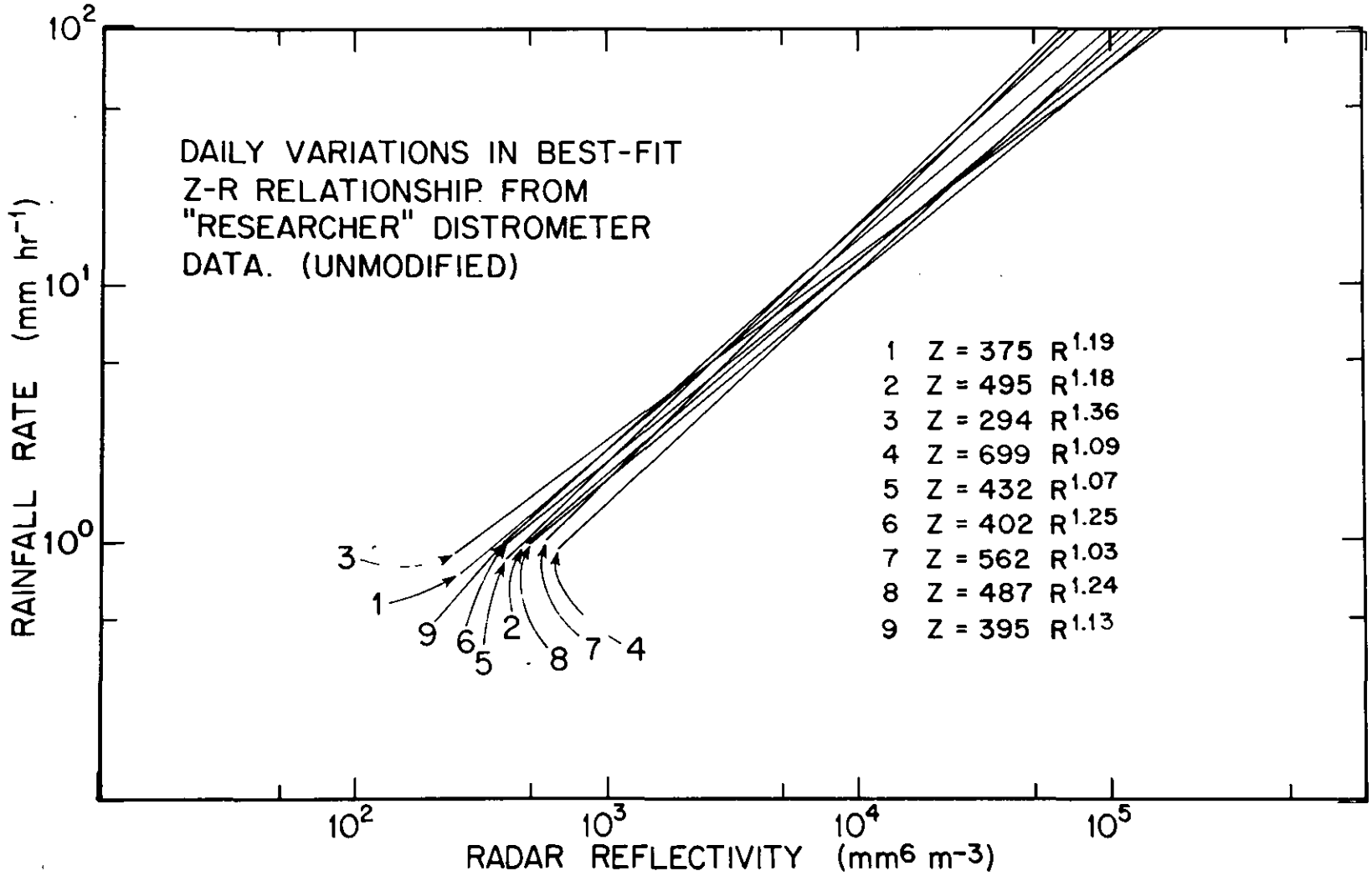

Figure 13. As in figure 12, except curves derived using unmodified (raw) distrometer data.

Table 12. Rainfall Rates (mm hr^{-1}) as a Function of Z(db) for Eight Daily Z-R Relationships Obtained at the Surface (Shipborne) During GATE

Z(db)	$94R^{1.41}$	$61R^{1.53}$	$141R^{1.19}$	$159R^{1.30}$	$197R^{1.09}$	$296R^{1.12}$	$296R^{1.23}$	$363R^{1.03}$
55	317	271	654	345	873	506	291	715
50	140	128	248	142	303	181	114	234
45	62	60	95	49	106	65	45	76
40	27	28	36	24	37	23	18	25
35	12	13	14	10	13	8	7	8
30	5	6	5	4	4	3	3	3
25	2	3	2	2	2	1	1	1
20	1	1	1	1	1	< 1	< 1	< 1

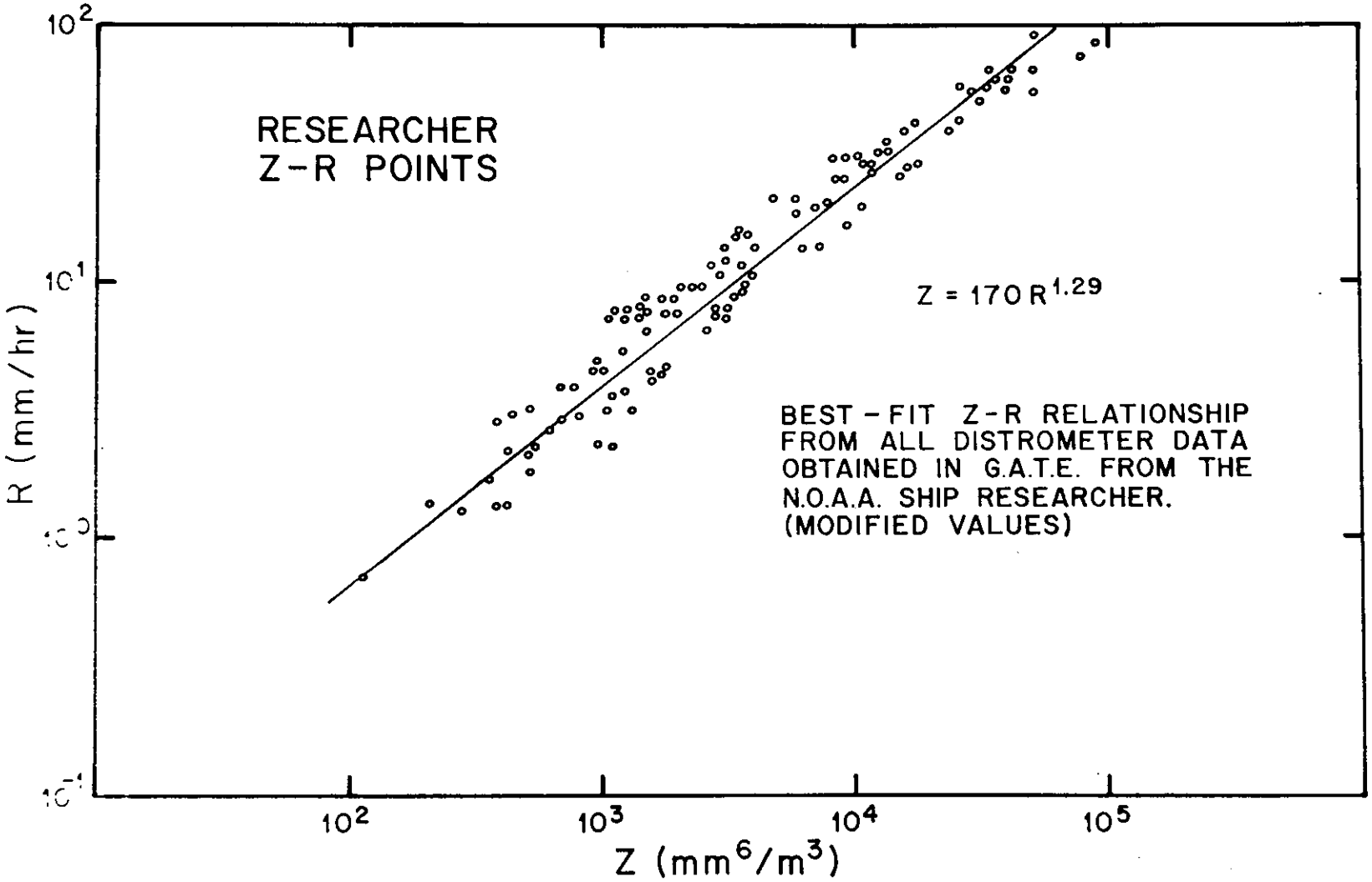

Figure 14. Best-fit Z-R relationship drawn to all data points obtained through an analysis of modified distrometer data on board NOAA ship "Researcher" during GATE.

The Z-R relationship

$$Z = 170R^{1.29} \tag{8}$$

obtained by regressing the dependent variable Z on the independent variable R has a correlation coefficient of .97, and it is this relationship around which discussions of the distrometer-derived surface Z-R relationship for the GATE area[5] in section 7 are based.

Table 13 provides an additional stratification of the distrometer-derived best-fit Z-R relationship as a function of rainfall rate. It can be seen that the elimination of the 33 data points associated with light rainfall rates (< 5.0 mm hr^{-1}) results in a Z-R relationship with a greater slope and tends to decrease R at a high value of Z (50 dB). The change in R for moderate values of Z (35 dB to 45 dB) is not strongly noticeable, however. Figure 15 provides the best-fit Z-R relationship curves drawn to data points (not shown) stratified as a function of three rainfall rates ($R > 0$, $R > 7.5$ mm hr^{-1}, and $R > 12.5$ mm hr^{-1}). The best-fit lines for the other rainfall rates given in table 13 would fall between those shown in figure 15.

7. DISCUSSION OF RESULTS

The drop spectra measurements obtained during GATE with the foil impactor on the NOAA DC-6 aircraft provide a consistent set of derived Z-R relationships that have only minor, day-to-day variability (fig. 6). The practical consequence of this is shown in table 7, where it can be seen that, within the range of the highest[6] reflectivity values (30 to 50 dB) that are most likely to occur, similar rainfall rates are computed from each of the daily Z-R relationships. Stratification of the foil-derived set of Z-R data points on the basis of rainfall rate (table 8) makes no practical difference to the calculated rainfall rates for values of radar reflectivity ≤ 50 dB. The foil data provide drop distributions that are, in most cases, monomodal and feature an expected exponential decay in concentration for drop sizes $\gtrsim 1$ mm in diameter (e.g., fig. 5). The mass integration of the drop size spectrum obtained through the foil analysis usually gives shower-averaged rainfall contents of order 1 gm m^{-3}, a value which appears to be quite reasonable.

The raw (unmodified) drop-spectrum measurements obtained with a raindrop distrometer on the NOAA ship *Researcher* exhibited strong peculiarities at drop sizes $\lesssim 2$ mm. This was most likely caused by insensitivity of the instrument to small drop sizes due to a high level of continuous shipboard noise. As is evident from curve #4 in figure 9, the distrometer-derived drop distributions, on occasion, showed a suspicious-looking multimodal tendency. A comparison of

[5]Note that the relationship $Z = 170R^{1.29}$ was derived only from the distrometer data collected on the NOAA ship *Researcher*. Results from distrometers on other GATE ships are not discussed in this report.

[6]Geotus (personal communication) has calculated a mean radar reflectivity value of 26 dB with an 8-dB standard deviation for observations taken on board the *Gilliss* during Phase 3 of GATE. This would indicate, if we assume a normal distribution of reflectivity values, that Z would be expected to exceed 44 dB on only about 5 percent of all occasions.

Table 13. Best-fit Z-R Relationships as a Function of Rainfall Rate (From "Researcher" Distrometer Data)

Stratification	No. data points	Z-R relationship	Correlation coefficient	R at 50 db mm hr^{-1}	R at 45 db mm hr^{-1}	R at 40 db mm hr^{-1}	R at 35 db mm hr^{-1}
All data	137	$Z = 170\ R^{1.29}$	0.970	140	57	24	10
R > 2.5 mm hr^{-1}	122	$Z = 131\ R^{1.37}$	0.967	127	55	24	10
R > 5.0 mm hr^{-1}	104	$Z = 100\ R^{1.45}$	0.963	117	53	24	11
R > 7.5 mm hr^{-1}	91	$Z = 99\ R^{1.45}$	0.960	118	53	24	11
R > 10.0 mm hr^{-1}	72	$Z = 92\ R^{1.47}$	0.950	116	53	24	11
R > 12.5 mm hr^{-1}	61	$Z = 90\ R^{1.48}$	0.947	114	52	24	11

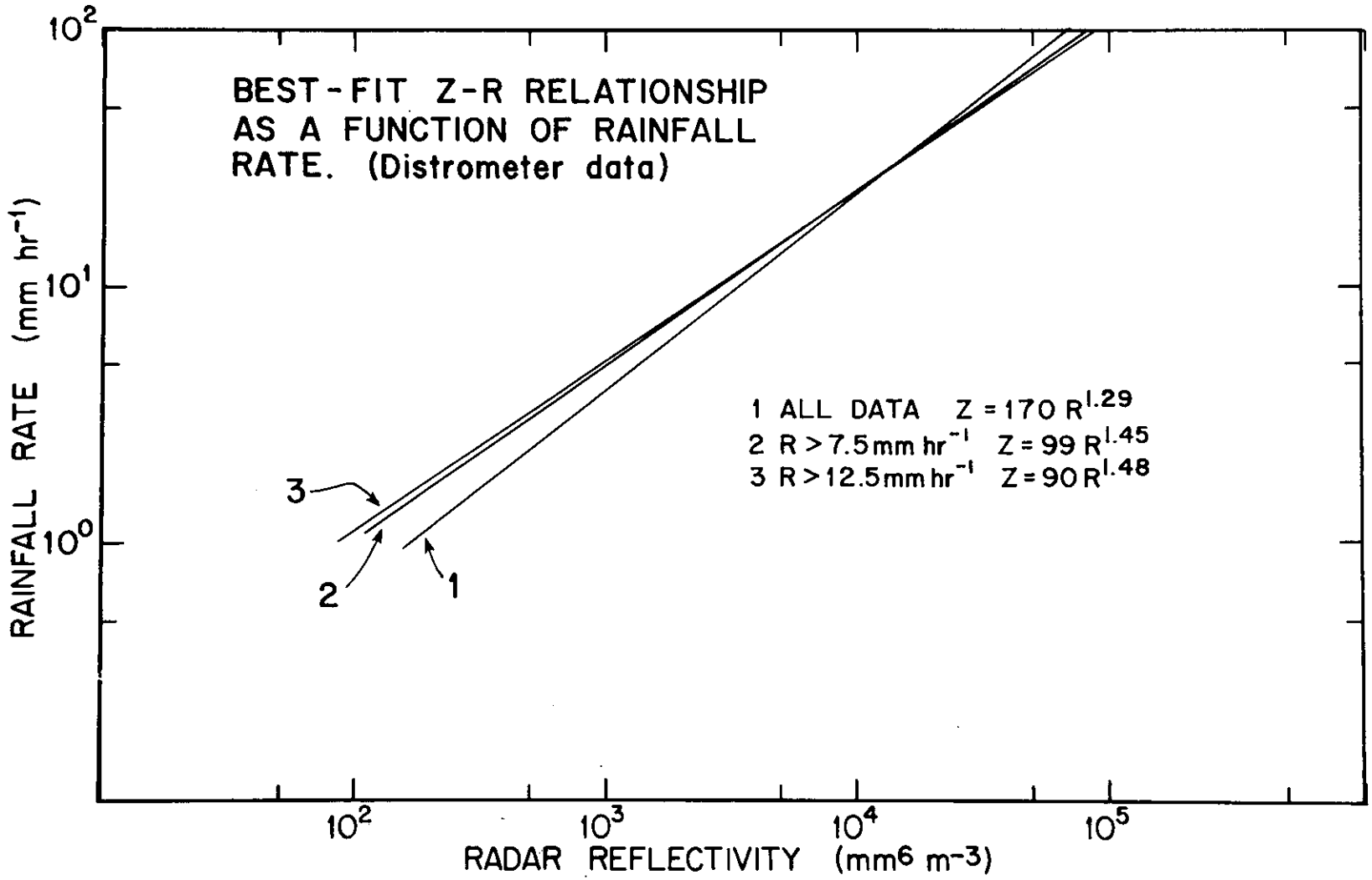

Figure 15. Best-fit Z-R relationship curves as a function of rainfall rate obtained from an analysis of modified "Researcher" distrometer data.

figure 9 with figure 10 demonstrates the type of modification necessary to produce drop spectra, the integration of which provide mass (rainfall depth) measurements more consistent with those obtained by shipboard gages.

The degree to which the best-fit Z-R relationship derived from the raw (unmodified) distrometer data differs from that derived from the corrected (modified) distrometer data can be seen by comparing curves #3 and #4 in figure 16. The Z-R relationship derived from the raw data set has a slightly steeper slope (1.19) than that derived from the modified data set (1.29), but the Z-axis intercept (at R = 1) of the latter (170) is much less than that of the former (484). The crossover point for the two curves occurs near a Z value of 70 dB (rainfall rate approximately 4500 mm hr^{-1}) with increasing divergence between the curves at values of Z < 70 dB. As can be seen from the distrometer section of table 14, this results in a rather large percentage difference in computed rainfall rates between the two curves for all reflectivity values < 60 dB. Since the range of radar reflectivities of greatest frequency of occurrence within the GATE B-scale array probably lies between 20 and 50 dB, a shift in the best-fit Z-R relationship from the raw to the modified distrometer data set will make a significant difference to the calculated total rain depth as determined from radar.

A comparison of curves #1 and #4 in figure 16 reveals that the best-fit Z-R relationships derived from the aircraft untransformed (raw) foil data and the shipboard-modified distrometer data also diverge from each other. In this case, the crossover point is near 23 dB, but, by 50 dB, the difference in rain rates derived from the two curves exceeds a factor of 2 (see table 14). It is clear, therefore, that the best-fit Z-R relationships for the aircraft (DC-6) foil and shipboard (*Researcher*) distrometer data are not in close agreement. No attempt has been made to derive a best-fit curve from the combined distrometer/foil data set in this study.

A comparison of figure 9 with figure 10 shows that the corrections which had to be applied to the distrometer drop-distribution data at the small end of the spectrum were appreciable. The small end of the drop spectrum was molded by correction factors which, though intuitively consistent with what might reasonably be expected, were applied somewhat arbitrarily. The differences in rainfall rate resulting from such corrections are dramatically apparent in figure 10 where the actual and modified rainfall rates for each of the five curves are shown. The rainfall rates derived from the modified data set were about a factor of 3 greater than those derived from the actual data set for curves #2 through #5. The very light rainfall case, curve #1, was modified by nearly an order of magnitude in rain rate. Although it is clear from the unmodified distrometer data shown in figure 8 that some correction at the small end of the spectrum is necessary, we are not comfortable with the significant changes that such corrections can make to the rainfall rates. The resultant best-fit Z-R relationship to the modified distrometer data has been shaped as much, or more so, by the corrections as by actual recorded data. Therefore, we are forced to question the advisability of relying upon the *Researcher* distrometer as a source of data for the derivation of a valid Z-R relationship for the GATE B-scale array.

Figure 16 and table 14 also give results for the DC-6 foil data transformed through use of a cumulative distribution function. A discussion of the

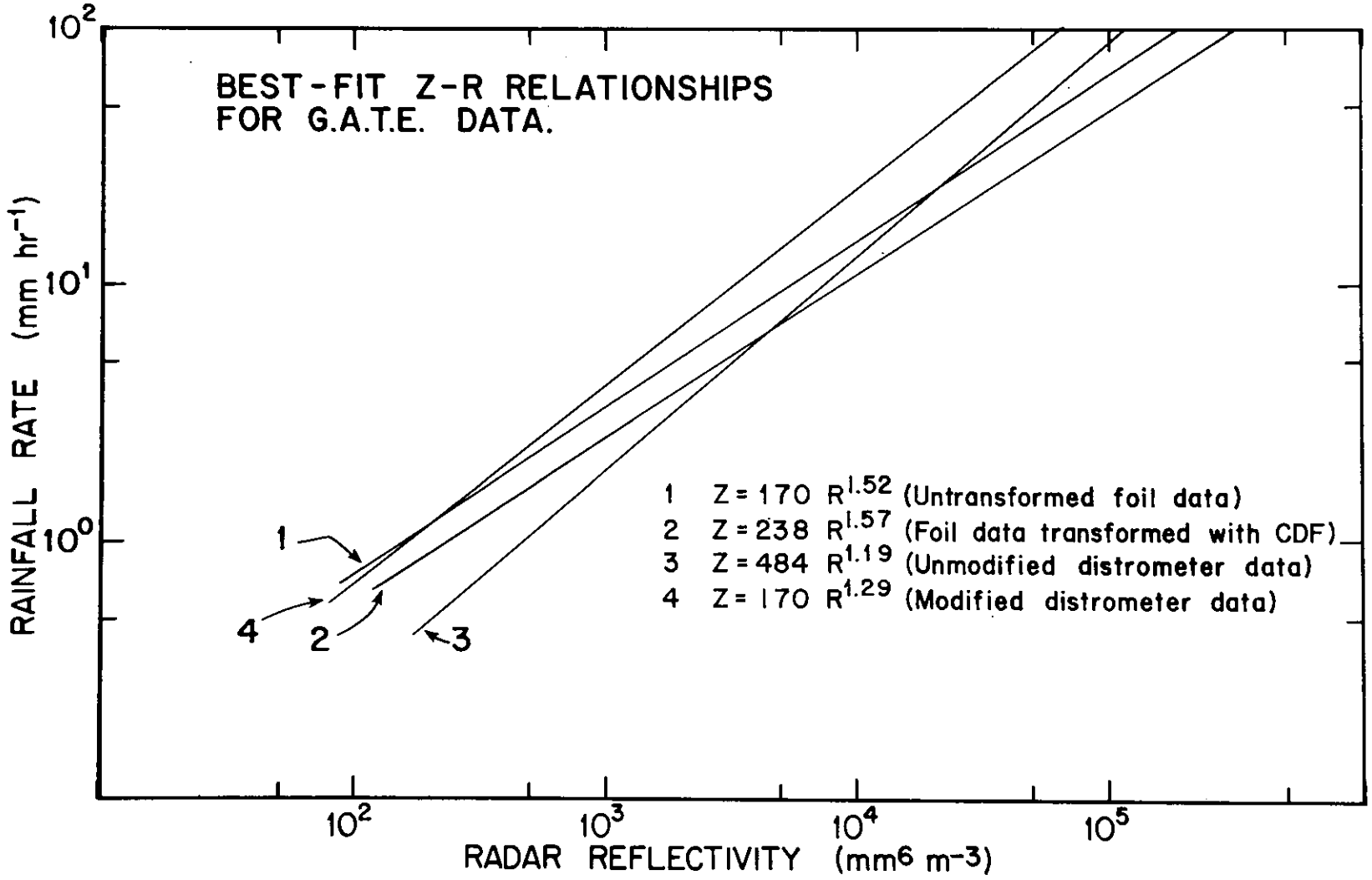

Figure 16. Best-fit Z-R relationship curves for the GATE B-scale array obtained through an analysis of all (1) untransformed DC-6 foil data, (2) CDF-transformed DC-6 foil data, (3) unmodified "Researcher" distrometer data, and (4) modified "Researcher" distrometer data.

Table 14. Rainfall (mm hr^{-1}) as a Function of Radar Reflectivity (db) for Various GATE Z-R Relationships

	Cloud base foil impactor data		Surface distrometer data	
	(untransformed)	(transformed with CDF)[1]	(unmodified)	(modified)
Z(db)	$Z = 170\ R^{1.52}$	$Z = 238\ R^{1.57}$	$Z = 484\ R^{1.19}$	$Z = 170\ R^{1.29}$
60	302	203	611	836
55	142	98	232	342
50	66	47	88	140
45	31	23	34	57
40	15	11	13	24
35	7	5	5	10
30	3	2	2	4
25	2	1	<1	2

[1] Transformation of foil data through use of a cumulative distribution function (CDF) is discussed in detail in Appendix C.

rationale and procedure for using such a transformation is presented in Appendix C. Results from the analysis of the untransformed foil data have been presented in the main text because this type of approach is consistent with the many Z-R observations recorded in the literature (e.g., table 1). Although a discussion of the procedure for transforming drop size data through use of a cumulative distribution function has been relegated to an appendix, mainly because of the unconventional nature of that type of analysis, the authors have confidence in the technique and feel that it deserves attention. It can be seen from figure 16 that the slope of the best-fit curve for the untransformed foil data differs little from that for the transformed data. Table 14 shows that the rainfall rates computed from the two best-fit curves differ consistently by about a factor of 1.5 over the whole range of reflectivity values, the rainfall for the transformed data being lower.

For the sake of consistency with other published data, the authors suggest that the best-fit curve to the untransformed foil data

$$Z = 170R^{1.52} \tag{9}$$

best represents the Z-R relationship for the area of the GATE B-scale array. The rain rates as a function of Z derived from (9) give R values of 66, 31, 15, 7, and 3 mm hr^{-1} for Z values of 50, 45, 40, 35, and 30 dB, respectively. This can be compared to R values of 49, 24, 12, 6, and 3 mm hr^{-1} for the corresponding Z values (50, 45, 40, 35, and 30 dB) derived from the "classical" Marshall-Palmer (1948) relationship

$$Z = 200R^{1.6} \ . \tag{10}$$

It can be seen that differences in rain rates derived from the two expressions diverge and begin to become appreciable for $Z \lesssim 40$ dB.

8. SUMMARY AND CONCLUSIONS

Drop spectra data were obtained during GATE with a foil impactor mounted on the wingtip of a NOAA DC-6 aircraft and a distrometer exposed on the flying bridge of the NOAA ship *Researcher*. Foil data were collected at or near cloud base and were analyzed on a per-rainshaft-penetration basis by an optical scanning device for 12 GATE days, most of which occurred during the second phase. The distrometer data were analyzed in 2-minute intervals for the duration of nine showers that occurred during 8 GATE days. Values of radar reflectivity (Z) and rainfall rate (R) were calculated as a function of the drop size distribution for each analyzed unit. A total of 107 Z-R data points are available from the foil analysis, and 137 Z-R data points are available from the distrometer analysis.

The drop spectra derived from an analysis of the foil data appear reasonable in terms of an exponential decay of the form

$$N(D) = N_o e^{-\lambda D} \tag{11}$$

for $D \gtrsim 1$ mm. The drop spectra derived from an analysis of the distrometer data, however, are not found, for the most part, to decay exponentially for

$D \lesssim 2$ mm. It is suspected that a continuous level of shipboard noise resulted in a loss of instrument sensitivity for drops $\lesssim 2$ mm in diameter. A modification of the small end of the drop spectra obtained from the distrometer analysis was attempted with siphon gage data as a means of ground truth comparison. The modification to the spectra resulted in substantial changes in distrometer-derived rainfall rates and calculated radar reflectivities.

The best-fit Z-R relationship to the modified distrometer data set has the form

$$Z = 170R^{1.29}$$

The best-fit Z-R relationship to the foil data (without any transformation) has the form

$$Z = 170R^{1.52}$$

Although the Z-axis intercept (at R = 1) is identical in the two expressions, the slopes are sufficiently different to induce rather large differences in R as a function of Z over the important range Z = 30 dB to Z = 50 dB. We have chosen not to attempt to derive a best-fit expression to a combination of the two sets of data, since each set appears to be mutually exclusive. Because of the arbitrary nature of the rather significant modifications which had to be made to the drop spectra derived from the distrometer, we feel that most weight should be placed on the cloud-base Z-R relationship (9) obtained through the analysis of the foil data.

A method of transforming the foil drop spectra data through a cumulative distribution function is described in Appendix C. This technique allows for the derivation of a best-fit equation to a histogram of drop sizes while maintaining internal consistency between the total drop concentration and the integrated mass of rain water. The main advantage of applying the technique is the alleviation of sampling volume problems which can occur at the large end of the spectrum. This technique is unconventional and inconsistent with the manner in which previously published Z-R relationships have been obtained, but it is felt that such an approach has considerable merit and may be utilized more in the future.

9. ACKNOWLEDGMENTS

Jack Thomas of NHEML's Cumulus Group was responsible for a large portion of the foil impactor data processing, and the authors are most grateful for the care and dedicated effort he displayed in carrying out this very tedious task. Processing of the distrometer data was carried out primarily by Matt Bamberg, now at Florida State University. The authors express gratitude to Dr. William Woodley for his interest and support throughout this study, and to Drs. William Cotton (now at Colorado State University) and Anthony Olson (now at Batelle Northwest) for the mathematical treatment of the cumulative distribution function. The project was funded by the NOAA GATE Project Office.

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Appendix A

Drop Size Distributions from the DC-6 Foil Impactor

This appendix presents the complete list of 107 drop size distributions collected near cloud base for the 12 days analyzed for GATE. The heading section for each drop size distribution contains the date, beginning time, sampling duration, and sampling volume for that distribution. It also gives the computed Z and R values from the actual and cumulative distribution function, CDF (see Appendix C) data. Column 1 gives each of the 10 drop size categories. Columns 2 and 3, respectively, give the midpoint diameter for that category and the actual number of drops measured in that category. Columns 4 and 5, respectively, show the normalized distributions for a ΔD spacing of .432 mm and the normalized distributions for a ΔD spacing of 1.0 mm for the actual data set. Columns 6, 7, and 8 present the data derived from the cumulative distribution function. Column 6 gives the number of drops in each drop size category and columns 7 and 8 present the normalized distributions for a ΔD spacing of .432 mm and a ΔD spacing of 1.0 mm, respectively. The minimum and maximum drop diameters for each size category are given at the end of table A-1, page 70.

Table A-1. Drop Distribution Data Obtained Near Cloud Base from DC-6 Foil Impactor

12 July 74 — Pass duration: 253 sec
Begin time: 142514 GMT — Sample volume: 7.6
Z(ACT) = 1091; R(ACT) = 3.5; Z(CDF) = 1499; R(CDF) = 3.3

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	2556	338	782	3328	440	1018
2	0.65	1704	225	521	1260	166	384
3	1.08	770	102	236	477	63	146
4	1.51	274	36	83	180	24	55
5	1.94	44	6	14	68	9	21
6	2.38	7	1	2	26	3	7
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

12 July 74 — Pass duration: 43 sec
Begin time: 144014 GMT — Sample volume: 1.3
Z(ACT) = 2870; R(ACT) = 6.5; Z(CDF) = 3666; R(CDF) = 5.6

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	374	289	669	464	359	831
2	0.65	222	171	396	206	159	368
3	1.08	137	106	245	91	70	162
4	1.51	68	53	123	40	31	72
5	1.94	27	21	49	18	14	32
6	2.38	4	3	7	8	6	14
7	2.81	1	1	2	4	3	7
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

12 July 74 — Pass duration: 143 sec
Begin time: 153521 GMT — Sample volume: 4.3
Z(ACT) = 2221; R(ACT) = 5.7; Z(CDF) = 2299; R(CDF) = 4.8

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	1432	334	773	1939	453	1049
2	0.65	1042	243	562	809	189	437
3	1.08	567	132	305	337	79	183
4	1.51	199	46	106	141	33	76
5	1.94	74	17	39	59	14	32
6	2.38	12	3	7	24	6	14
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

12 July 74 — Pass duration: 33 sec
Begin time: 161037 GMT — Sample volume: 1.0
Z(ACT) = 69; R(ACT) = 0.5; Z(CDF) = 94; R(CDF) = 0.5

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	366	368	852	410	412	954
2	0.65	138	139	322	92	92	213
3	1.08	22	22	51	20	22	51
4	1.51	2	2	5	5	5	12
5	1.94	-	-	-	-	-	-
6	2.38	-	-	-	-	-	-
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

12 July 74 — Pass duration: 53 sec
Begin time: 163327 GMT — Sample volume: 1.6
Z(ACT) = 1617; R(ACT) = 4.8; Z(CDF) = 1979; R(CDF) = 4.2

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	521	327	757	685	430	995
2	0.65	329	207	479	279	175	405
3	1.08	212	133	308	114	71	164
4	1.51	77	48	111	46	29	67
5	1.94	14	9	21	19	12	28
6	2.38	3	2	5	8	5	12
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

12 July 74 — Pass duration: 60 sec
Begin time: 165749 GMT — Sample volume: 1.8
Z(ACT) = 19274; R(ACT) = 20.0; Z(CDF) = 20468; R(CDF) = 15.6

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	449	250	579	448	249	576
2	0.65	162	90	208	253	141	586
3	1.08	137	76	176	143	80	185
4	1.51	108	60	139	81	45	104
5	1.94	89	50	116	46	26	60
6	2.38	62	35	81	25	14	32
7	2.81	18	10	23	15	8	19
8	3.24	5	3	7	8	5	12
9	3.67	1	1	2	5	3	7
10	4.05	-	-	-	-	-	-

Table A-1. Drop Distribution Data Obtained Near Cloud Base from DC-6 Foil Impactor (continued)

12 July 74 — Pass duration: 73 sec
Begin time: 165937 GMT — Sample volume: 2.2
Z(ACT) = 36046; R(ACT) = 32.1; Z(CDF) = 32367; R(CDF) = 23.4

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	376	171	396	654	298	690
2	0.65	360	164	380	386	176	407
3	1.08	293	134	310	228	104	241
4	1.51	261	119	275	135	61	141
5	1.94	176	80	185	79	36	83
6	2.38	76	35	81	47	21	49
7	2.81	31	14	32	28	13	30
8	3.24	15	7	16	16	7	16
9	3.67	8	4	9	10	4	9
10	4.05	-	-	-	-	-	-

29 July 74 — Pass duration: 53 sec
Begin time: 115300 GMT — Sample volume: 1.6
Z(ACT) = 240; R(ACT) = 1.3; Z(CDF) = 161; R(CDF) = 0.7

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	139	87	201	263	164	380
2	0.65	155	97	225	102	64	148
3	1.08	121	76	176	40	25	58
4	1.51	15	9	21	15	10	23
5	1.94	-	-	-	-	-	-
6	2.38	-	-	-	-	-	-
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

29 July 74 — Pass duration: 33 sec
Begin time: 115301 GMT — Sample volume: 1.0
Z(ACT) = 792; R(ACT) = 3.3; Z(CDF) = 826; R(CDF) = 2.3

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	111	111	257	262	263	609
2	0.65	154	155	359	113	113	262
3	1.08	162	163	377	49	49	113
4	1.51	30	30	69	21	21	49
5	1.94	3	3	7	9	9	21
6	2.38	-	-	-	-	-	-
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

29 July 74 — Pass duration: 80 sec
Begin time: 122400 GMT — Sample volume: 2.4
Z(ACT) = 2209; R(ACT) = 5.3; Z(CDF) = 3229; R(CDF) = 4.3

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	95	40	93	383	160	370
2	0.65	209	87	201	194	81	187
3	1.08	312	131	303	99	41	95
4	1.51	123	51	118	50	21	49
5	1.94	32	13	30	26	11	25
6	2.38	6	3	7	13	5	12
7	2.81	1	.5	1	7	3	7
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

29 July 74 — Pass duration: 107 sec
Begin time: 123244 GMT — Sample volume: 3.2
Z(ACT) = 5672; R(ACT) = 9.8; Z(CDF) = 5625; R(CDF) = 7.9

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	1095	344	796	1293	406	940
2	0.65	608	191	442	609	191	442
3	1.08	398	125	289	287	90	208
4	1.51	188	59	136	135	42	97
5	1.94	110	35	81	64	20	46
6	2.38	43	13	30	30	9	21
7	2.81	3	1	2	14	4	9
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

29 July 74 — Pass duration: 27 sec
Begin time: 130500 GMT — Sample volume: 0.8
Z(ACT) = 2537; R(ACT) = 5.7; Z(CDF) = 3589; R(CDF) = 4.9

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	56	70	162	170	213	493
2	0.65	99	124	287	83	104	241
3	1.08	122	153	354	41	51	118
4	1.51	45	56	130	20	25	58
5	1.94	8	10	23	10	12	28
6	2.38	2	3	7	5	6	14
7	2.81	1	1	2	2	3	7
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

Table A-1. Drop Distribution Data Obtained Near Cloud Base from DC-6 Foil Impactor (continued)

29 July 74 — Pass duration: 23 sec
Begin time: 130501 GMT — Sample volume: 0.7
Z(ACT) = 1035; R(ACT) = 4.0; Z(CDF) = 1061; R(CDF) = 3.1

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	239	343	794	356	511	1183
2	0.65	200	287	664	136	195	451
3	1.08	106	152	352	52	75	174
4	1.51	27	39	90	20	29	67
5	1.94	4	6	14	8	11	25
6	2.38	-	-	-	-	-	-
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

29 July 74 — Pass duration: 130 sec
Begin time: 144950 GMT — Sample volume: 3.9
Z(ACT) = 7553; R(ACT) = 13.9; Z(CDF) = 11877; R(CDF) = 11.5

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	254	65	150	1030	265	613
2	0.65	507	131	303	560	144	333
3	1.08	838	216	500	305	78	181
4	1.51	418	108	250	166	42	97
5	1.94	181	47	109	90	23	53
6	2.38	56	14	32	49	13	30
7	2.81	4	1	2	27	7	16
8	3.24	1	5	1	15	4	9
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

29 July 74 — Pass duration: 30 sec
Begin time: 153345 GMT — Sample volume: 0.9
Z(ACT) = 13635; R(ACT) = 18.6; Z(CDF) = 13775; R(CDF) = 12.3

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	49	55	127	173	194	449
2	0.65	86	96	222	102	114	264
3	1.08	93	104	241	60	67	155
4	1.51	106	118	273	35	40	93
5	1.94	65	72	167	21	23	53
6	2.38	15	17	39	12	14	32
7	2.81	7	8	19	7	8	18
8	3.24	1	1	2	4	5	12
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

29 July 74 — Pass duration: 160 sec
Begin time: 161535 GMT — Sample volume: 4.8
Z(ACT) = 587; R(ACT) = 2.5; Z(CDF) = 624; R(CDF) = 1.7

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	274	57	132	917	192	444
2	0.65	623	130	301	399	84	194
3	1.08	625	131	303	174	36	83
4	1.51	89	19	44	76	16	37
5	1.94	13	3	7	33	7	16
6	2.38	-	-	-	-	-	-
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

3 August 74 — Pass duration: 20 sec
Begin time: 120930 GMT — Sample volume: 0.6
Z(ACT) = 1042; R(ACT) = 4.4; Z(CDF) = 1178; R(CDF) = 3.4

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	98	164	380	280	469	1086
2	0.65	227	380	880	113	189	437
3	1.08	125	209	483	46	76	176
4	1.51	16	27	62	18	31	72
5	1.94	4	7	16	7	12	28
6	2.38	-	-	-	-	-	-
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

3 August 74 — Pass duration: 30 sec
Begin time: 121134 GMT — Sample volume: 0.9
Z(ACT) = 802; R(ACT) = 2.2; Z(CDF) = 941; R(CDF) = 1.9

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	78	87	201	157	175	405
2	0.65	119	133	308	66	74	171
3	1.08	51	57	132	28	31	72
4	1.51	17	19	44	12	13	30
5	1.94	5	6	14	5	5	12
6	2.38	1	1	2	2	3	7
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

Table A-1 Drop Distribution Data Obtained Near Cloud Base from DC-6 Foil Impactor (continued)

3 August 74 — Pass duration: 163 sec
Begin time: 121315 GMT — Sample volume: 4.9
Z(ACT) = 6143; R(ACT) = 6.9; Z(CDF) = 4669; R(CDF) = 6.3

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	2441	508	1171	2430	498	1153
2	0.65	1084	222	514	997	204	472
3	1.08	361	74	171	409	84	194
4	1.51	99	20	46	168	34	79
5	1.94	71	15	35	69	14	32
6	2.38	41	8	19	28	6	14
7	2.81	18	4	9	12	2	5
8	3.24	7	1	2	5	1	2
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

3 August 74 — Pass duration: 120 sec
Begin time: 122445 GMT — Sample volume: 3.6
Z(ACT) = 3670; R(ACT) = 6.8; Z(CDF) = 5359; R(CDF) = 7.1

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	1335	373	863	1922	536	1241
2	0.65	1210	338	782	799	223	516
3	1.08	523	146	338	332	93	215
4	1.51	136	38	88	138	39	90
5	1.94	50	14	32	57	16	37
6	2.38	32	9	21	24	7	16
7	2.81	2	.5	1	10	3	7
8	3.24	1	.3	.7	4	1	2
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

3 August 74 — Pass duration: 280 sec
Begin time: 124922 GMT — Sample volume: 8.4
Z(ACT) = 1340; R(ACT) = 3.9; Z(CDF) = 1618; R(CDF) = 3.7

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	3886	465	1076	4769	570	1319
2	0.65	2345	280	648	1725	206	477
3	1.08	898	107	248	624	75	174
4	1.51	248	30	69	226	27	62
5	1.94	83	10	23	82	10	23
6	2.38	12	1	2	30	4	9
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

3 August 74 — Pass duration: 20 sec
Begin time: 125622 GMT — Sample volume: 0.6
Z(ACT) = 7892; R(ACT) = 13.0; Z(CDF) = 7465; R(CDF) = 11.3

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	386	646	1495	454	760	1759
2	0.65	214	358	829	200	334	773
3	1.08	134	224	519	88	147	340
4	1.51	46	77	178	38	64	148
5	1.94	19	32	74	17	28	65
6	2.38	8	13	30	7	12	28
7	2.81	3	5	12	3	6	14
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

3 August 74 — Pass duration: 23 sec
Begin time: 130320 GMT — Sample volume: 0.7
Z(ACT) = 2447; R(ACT) = 5.7; Z(CDF) = 2300; R(CDF) = 4.8

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	261	374	866	346	497	1150
2	0.65	201	288	667	141	203	470
3	1.08	76	109	252	58	83	192
4	1.51	32	46	106	23	34	79
5	1.94	12	17	39	10	14	32
6	2.38	3	4	9	4	6	14
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

3 August 74 — Pass duration: 163 sec
Begin time: 130644 GMT — Sample volume: 4.9
Z(ACT) = 2097; R(ACT) = 5.0; Z(CDF) = 3109; R(CDF) = 5.0

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	1325	276	639	2036	417	965
2	0.65	1269	260	602	844	173	400
3	1.08	608	125	289	350	72	167
4	1.51	209	43	100	145	30	69
5	1.94	54	11	25	60	12	28
6	2.38	10	2	5	25	5	12
7	2.81	4	1	2	10	2	5
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

Table A-1. Drop Distribution Data Obtained Near Cloud Base from DC-6 Foil Impactor (continued)

3 August 74 — Pass duration: 80 sec
Begin time: 131122 GMT — Sample volume: 2.4
Z(ACT) = 18112; R(ACT) = 26.2; Z(CDF) = 20265; R(CDF) = 19.3

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	454	190	440	922	385	891
2	0.65	513	215	498	515	216	500
3	1.08	459	192	444	288	121	280
4	1.51	329	138	319	161	67	155
5	1.94	229	96	222	90	38	88
6	2.38	91	38	88	50	21	49
7	2.81	13	5	12	28	12	28
8	3.24	3	1	2	16	7	16
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

3 August 74 — Pass duration: 143 sec
Begin time: 132723 GMT — Sample volume: 4.3
Z(ACT) = 16883; R(ACT) = 20.4; Z(CDF) = 28667; R(CDF) = 20.4

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	1385	324	750	2074	485	1123
2	0.65	1109	259	600	1074	251	581
3	1.08	942	220	509	556	130	301
4	1.51	501	117	271	288	67	155
5	1.94	237	55	127	149	35	81
6	2.38	85	20	46	77	18	42
7	2.81	29	7	16	40	9	21
8	3.24	11	3	7	21	5	12
9	3.67	2	.5	1	11	2	5
10	4.05	1	.2	.5	6	1	2

3 August 74 — Pass duration: 147 sec
Begin time: 134939 GMT — Sample volume: 4.4.
Z(ACT) = 24583; R(ACT) = 28.5; Z(CDF) = 30998; R(CDF) = 23.9

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	967	221	512	1847	422	977
2	0.65	1166	266	616	1028	235	544
3	1.08	896	205	475	512	130	301
4	1.51	523	119	275	318	73	169
5	1.94	381	87	201	177	40	93
6	2.38	165	38	88	98	22	51
7	2.81	48	11	25	55	13	30
8	3.24	12	3	7	30	7	16
9	3.67	5	1	2	17	4	9
10	4.05	-	-	-	-	-	-

3 August 74 — Pass duration: 90 sec
Begin time: 141115 GMT — Sample volume: 2.7
Z(ACT) = 24827; R(ACT) = 32.4; Z(CDF) = 24621; R(CDF) = 23.2

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	596	222	514	1188	442	1023
2	0.65	594	221	512	671	250	579
3	1.08	604	225	521	379	141	326
4	1.51	531	198	458	214	79	183
5	1.94	261	97	225	121	45	104
6	2.38	103	38	88	68	25	58
7	2.81	31	12	28	39	14	32
8	3.24	10	4	9	22	8	19
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

3 August 74 — Pass duration: 77 sec
Begin time: 141530 GMT — Sample volume: 2.3
Z(ACT) = 2173; R(ACT) = 3.6; Z(CDF) = 1795; R(CDF) = 3.4

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	1153	504	1167	1156	505	1169
2	0.65	464	203	470	409	179	414
3	1.08	91	40	93	145	63	146
4	1.51	42	18	42	51	22	51
5	1.94	29	13	30	18	8	19
6	2.38	7	3	7	6	3	7
7	2.81	3	1	2	2	1	2
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

3 August 74 — Pass duration: 30 sec
Begin time: 141749 GMT — Sample volume: 0.9
Z(ACT) = 5993; R(ACT) = 11.8; Z(CDF) = 4165; R(CDF) = 7.8

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	229	256	593	293	439	1016
2	0.65	240	268	620	190	212	491
3	1.08	170	190	440	92	103	238
4	1.51	79	88	204	45	50	116
5	1.94	30	33	76	22	24	56
6	2.38	14	16	37	10	12	28
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

Table A-1. Drop Distribution Data Obtained Near Cloud Base from DC-6 Foil Impactor (continued)

3 August 74 — Pass duration: 107 sec
Begin time: 142924 GMT — Sample volume: 3.2
Z(ACT) = 18293; R(ACT) = 22.4; Z(CDF) = 16548; R(CDF) = 15.6

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	504	158	366	929	291	674
2	0.65	538	169	391	526	165	382
3	1.08	445	140	324	298	94	218
4	1.51	306	96	222	169	53	123
5	1.94	198	62	143	96	30	69
6	2.38	116	36	83	54	17	39
7	2.81	29	9	21	31	10	23
8	3.24	7	2	5	17	5	12
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

5 August 74 — Pass duration: 127 sec
Begin time: 111630 GMT — Sample volume: 3.8
Z(ACT) = 17291; R(ACT) = 24.2; Z(CDF) = 11036; R(CDF) = 13.4

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	390	103	238	1096	290	671
2	0.65	596	158	366	631	167	387
3	1.08	649	172	398	364	96	222
4	1.51	482	127	294	209	55	127
5	1.94	302	80	185	121	32	74
6	2.38	126	33	76	69	18	42
7	2.81	40	11	25	40	11	25
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

5 August 74 — Pass duration: 73 sec
Begin time: 112135 GMT — Sample volume: 2.2
Z(ACT) = 7923; R(ACT) = 12.9; Z(CDF) = 6598; R(CDF) = 8.3

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	213	97	225	494	226	523
2	0.65	265	121	280	270	123	285
3	1.08	288	131	303	148	67	155
4	1.51	189	86	199	81	37	86
5	1.94	93	43	100	44	20	46
6	2.38	37	17	39	24	11	25
7	2.81	6	3	7	13	6	14
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

5 August 74 — Pass duration: 33 sec
Begin time: 114716 GMT — Sample volume: 1.0
Z(ACT) = 4061; R(ACT) = 6.9; Z(CDF) = 3910; R(CDF) = 5.2

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	101	101	234	190	191	442
2	0.65	121	121	280	97	97	225
3	1.08	85	85	197	49	49	113
4	1.51	47	47	109	25	25	58
5	1.94	27	27	62	13	13	30
6	2.38	5	5	12	7	7	16
7	2.81	2	2	5	3	3	7
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

5 August 74 — Pass duration: 33 sec
Begin time: 124826 GMT — Sample volume: 1.0
Z(ACT) = 16216; R(ACT) = 21.6; Z(CDF) = 10238; R(CDF) = 12.4

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	159	159	368	292	293	678
2	0.65	123	124	287	166	166	384
3	1.08	168	169	391	94	94	218
4	1.51	120	120	278	53	53	123
5	1.94	66	66	153	30	30	69
6	2.38	25	25	58	17	17	39
7	2.81	13	13	30	10	10	23
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

5 August 74 — Pass duration: 113 sec
Begin time: 125345 GMT — Sample volume: 3.4
Z(ACT) = 3276; R(ACT) = 6.6; Z(CDF) = 2343; R(CDF) = 4.3

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	423	125	289	780	230	532
2	0.65	447	132	306	283	113	262
3	1.08	400	118	273	189	56	130
4	1.51	166	49	113	93	27	62
5	1.94	73	22	51	46	13	30
6	2.38	25	7	16	22	7	16
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

Table A-1. Drop Distribution Data Obtained Near Cloud Base from DC-6 Foil Impactor (continued)

5 August 74 — Pass duration: 50 sec
Begin time: 130000 GMT — Sample volume: 1.5
Z(ACT) = 3293; R(ACT) = 7.5; Z(CDF) = 2994; R(CDF) = 5.8

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	429	287	664	704	471	1090
2	0.65	472	316	731	310	207	479
3	1.08	215	144	333	136	91	211
4	1.51	103	69	160	60	40	93
5	1.94	28	19	44	26	18	42
6	2.38	10	7	16	12	8	19
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

5 August 74 — Pass duration: 83 sec
Begin time: 131530 GMT — Sample volume: 2.5
Z(ACT) = 1061; R(ACT) = 3.8; Z(CDF) = 1018; R(CDF) = 3.1

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	1088	437	1012	1407	565	1308
2	0.65	689	276	639	515	207	479
3	1.08	338	136	315	189	76	176
4	1.51	86	35	81	69	28	65
5	1.94	19	8	19	25	10	23
6	2.38	-	-	-	-	-	-
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

5 August 74 — Pass duration: 60 sec
Begin time: 131915 GMT — Sample volume: 1.8
Z(ACT) = 248; R(ACT) = 1.4; Z(CDF) = 222; R(CDF) = 1.1

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	478	267	618	682	380	880
2	0.65	381	213	493	219	122	282
3	1.08	127	71	164	70	39	90
4	1.51	18	10	23	23	13	30
5	1.94	-	-	-	-	-	-
6	2.38	-	-	-	-	-	-
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

5 August 74 — Pass duration: 67 sec
Begin time: 132320 GMT — Sample volume: 2.0
Z(ACT) = 1492; R(ACT) = 4.5; Z(CDF) = 938; R(CDF) = 2.5

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	188	94	218	460	231	535
2	0.65	277	139	322	213	107	248
3	1.08	289	145	336	99	49	113
4	1.51	73	37	86	46	23	53
5	1.94	30	15	35	21	11	25
6	2.38	-	-	-	-	-	-
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

5 August 74 — Pass duration: 83 sec
Begin time: 133048 GMT — Sample volume: 2.5
Z(ACT) = 10703; R(ACT) = 15.1; Z(CDF) = 8225; R(CDF) = 11.4

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	1280	514	1190	1346	541	1252
2	0.65	631	253	586	646	260	602
3	1.08	306	123	285	310	125	289
4	1.51	180	72	167	149	60	139
5	1.94	120	48	111	72	29	67
6	2.38	59	24	56	34	14	32
7	2.81	14	6	14	17	7	16
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

5 August 74 — Pass duration: 87 sec
Begin time: 135453 GMT — Sample volume: 2.6
Z(ACT) = 7463; R(ACT) = 13.7; Z(CDF) = 7714; R(CDF) = 10.1

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	511	197	456	917	354	819
2	0.65	421	163	377	473	183	424
3	1.08	528	204	472	244	94	218
4	1.51	281	109	253	126	49	113
5	1.94	116	45	104	65	25	58
6	2.38	30	12	28	34	13	30
7	2.81	7	3	7	17	7	16
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

Table A-1. Drop Distribution Data Obtained Near Cloud Base from DC-6 Foil Impactor (continued)

5 August 74 — Pass duration: 87 sec
Begin time: 135930 GMT — Sample volume: 2.6
Z(ACT) = 2088; R(ACT) = 5.3; Z(CDF) = 2109; R(CDF) = 4.2

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	734	283	655	925	357	826
2	0.65	439	170	394	400	154	356
3	1.08	267	103	238	173	67	155
4	1.51	140	54	125	75	29	67
5	1.94	44	17	39	32	12	28
6	2.38	5	2	5	14	5	12
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

5 August 74 — Pass duration: 167 sec
Begin time: 140848 GMT — Sample volume: 5.0
Z(ACT) = 1600; R(ACT) = 5.8; Z(CDF) = 1380; R(CDF) = 3.9

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	1035	208	481	2229	448	1037
2	0.65	1492	300	694	955	192	444
3	1.08	1028	207	479	409	82	190
4	1.51	295	59	137	175	35	81
5	1.94	50	10	23	75	15	35
6	2.38	-	-	-	-	-	-
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

5 August 74 — Pass duration: 230 sec
Begin time: 144140 GMT — Sample volume: 6.9
Z(ACT) = 7673; R(ACT) = 15.8; Z(CDF) = 9063; R(CDF) = 11.8

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	1046	152	352	2778	404	935
2	0.65	1671	243	562	1442	210	486
3	1.08	1612	235	544	748	109	252
4	1.51	970	141	326	388	57	132
5	1.94	397	58	134	202	29	67
6	2.38	70	10	23	105	15	35
7	2.81	9	1	2	54	8	19
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

5 August 74 — Pass duration: 110 sec
Begin time: 151648 GMT — Sample volume: 3.3
Z(ACT) = 9429; R(ACT) = 16.6; Z(CDF) = 8921; R(CDF) = 11.8

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	714	217	502	1276	388	898
2	0.65	664	202	468	666	203	470
3	1.08	675	205	475	347	106	245
4	1.51	356	108	250	181	55	127
5	1.94	185	56	130	94	29	67
6	2.38	65	20	46	49	15	35
7	2.81	8	2	5	26	8	19
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

5 August 74 — Pass duration: 37 sec
Begin time: 152215 GMT — Sample volume: 1.1
Z(ACT) = 8416; R(ACT) = 14.1; Z(CDF) = 7375; R(CDF) = 9.6

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	135	123	285	312	285	660
2	0.65	195	178	412	167	152	352
3	1.08	163	149	345	89	81	187
4	1.51	104	95	220	48	43	100
5	1.94	53	48	111	25	23	53
6	2.38	16	15	35	14	12	28
7	2.81	4	4	9	7	7	16
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

5 August 74 — Pass duration: 140 sec
Begin time: 154345 GMT — Sample volume: 4.2
Z(ACT) = 2201; R(ACT) = 5.0; Z(CDF) = 1971; R(CDF) = 4.1

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	1060	254	588	1560	373	863
2	0.65	971	232	537	657	157	363
3	1.08	448	107	248	277	66	153
4	1.51	137	33	76	116	28	65
5	1.94	59	14	32	49	12	28
6	2.38	20	5	12	21	5	12
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

Table A-1. Drop Distribution Data Obtained Near Cloud Base from DC-6 Foil Impactor (continued)

5 August 74 — Pass duration: 150 sec
Begin time: 155013 GMT — Sample volume: 4.5
Z(ACT) = 3447; R(ACT) = 6.5; Z(CDF) = 3771; R(CDF) = 5.5

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	831	185	428	1266	283	655
2	0.65	716	160	370	592	132	306
3	1.08	515	115	266	277	62	144
4	1.51	211	47	109	130	29	67
5	1.94	73	16	37	61	14	32
6	2.38	26	6	14	28	6	14
7	2.81	7	2	5	13	3	7
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

5 August 74 — Pass duration: 133 sec
Begin time: 162225 GMT — Sample volume: 4.0
Z(ACT) = 20603; R(ACT) = 29.7; Z(CDF) = 17058; R(CDF) 21.0

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	993	249	576	1621	407	942
2	0.65	965	242	560	915	229	530
3	1.08	784	197	456	517	129	299
4	1.51	498	125	289	456	114	264
5	1.94	330	83	192	error	error	error
6	2.38	124	31	72	93	23	53
7	2.81	28	7	16	52	13	30
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

10 August 74 — Pass duration: 27 sec
Begin time: 102738 GMT — Sample volume: 0.8
Z(ACT) = 2626; R(ACT) = 6.1; Z(CDF) = 2076; R(CDF) = 3.7

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	65	81	187	139	175	405
2	0.65	83	104	241	71	89	206
3	1.08	61	77	178	36	45	104
4	1.51	55	69	160	18	23	53
5	1.94	18	23	53	9	12	28
6	2.38	2	3	7	5	6	14
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

10 August 74 — Pass duration: 30 sec
Begin time: 114832 GMT — Sample volume: 0.9
Z(ACT) = 1176; R(ACT) = 3.0; Z(CDF) = 1130; R(CDF) = 2.1

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	28	31	72	102	114	264
2	0.65	64	71	164	50	56	130
3	1.08	76	85	197	24	27	62
4	1.51	25	28	65	12	13	30
5	1.94	5	6	14	6	6	14
6	2.38	2	2	5	3	3	7
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

10 August 74 — Pass duration: 47 sec
Begin time: 115705 GMT — Sample volume: 1.4
Z(ACT) = 1067; R(ACT) = 3.1; Z(CDF) = 1316; R(CDF) = 2.5

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	79	57	132	254	182	421
2	0.65	188	135	312	115	83	192
3	1.08	151	108	250	52	37	86
4	1.51	37	26	60	24	17	39
5	1.94	8	6	14	11	8	19
6	2.38	2	1	2	5	4	9
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

10 August 74 — Pass duration: 90 sec
Begin time: 122000 GMT — Sample volume: 2.7
Z(ACT) = 41851; R(ACT) = 31.9; Z(CDF) = 29019; R(CDF) = 19.3

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	224	83	192	463	172	398
2	0.65	261	97	225	292	109	252
3	1.08	241	89	206	184	68	157
4	1.51	169	63	146	116	43	100
5	1.94	161	60	139	73	27	62
6	2.38	103	38	88	46	17	39
7	2.81	60	22	51	29	11	25
8	3.24	25	9	21	18	7	16
9	3.67	10	4	9	12	4	9
10	4.05	-	-	-	-	-	-

Table A-1 Drop Distribution Data Obtained Near Cloud Base from DC-6 Foil Impactor (continued)

10 August 74 — Pass duration: 123 sec
Begin time: 122458 GMT — Sample volume: 3.7
Z(ACT) = 4542; R(ACT) = 7.5; Z(CDF) = 4001; R(CDF) = 5.1

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	255	69	160	560	152	352
2	0.65	329	89	206	300	82	190
3	1.08	306	83	192	161	44	102
4	1.51	178	48	111	86	23	53
5	1.94	99	27	62	46	12	28
6	2.38	35	9	21	25	7	16
7	2.81	5	1	2	13	4	9
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

10 August 74 — Pass duration: 217 sec
Begin time: 123540 GMT — Sample volume: 6.5
Z(ACT) = 45362; R(ACT) = 34.7; Z(CDF) = 44489; R(CDF) = 25.3

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	811	125	289	1444	223	516
2	0.65	762	118	273	892	138	319
3	1.08	742	115	266	552	85	197
4	1.51	487	75	174	341	53	123
5	1.94	453	70	162	211	33	76
6	2.38	319	49	113	130	20	46
7	2.81	141	22	51	81	12	28
8	3.24	40	6	14	50	8	19
9	3.67	13	2	5	31	5	12
10	4.05	13	2	5	17	3	7

10 August 74 — Pass duration: 57 sec
Begin time: 140900 GMT — Sample volume: 1.7
Z(ACT) = 19627; R(ACT) = 19.3; Z(CDF) = 20425; R(CDF) = 14.7

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	146	86	199	336	198	458
2	0.65	175	103	238	197	116	269
3	1.08	194	115	266	115	68	157
4	1.51	150	89	206	68	40	93
5	1.94	89	53	123	40	23	53
6	2.38	35	21	49	23	14	32
7	2.81	14	8	19	14	8	19
8	3.24	5	3	7	8	5	12
9	3.67	3	2	5	5	3	7
10	4.05	-	-	-	-	-	-

10 August 74 — Pass duration: 293 sec
Begin time: 141315 GMT — Sample volume: 8.8
Z(ACT) = 9480; R(ACT) = 14.9; Z(CDF) = 12117; R(CDF) = 11.7

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	936	107	248	2236	255	590
2	0.65	1153	132	306	1229	140	324
3	1.08	1369	156	361	675	77	178
4	1.51	862	98	227	371	42	97
5	1.94	460	53	123	204	23	53
6	2.38	158	18	42	112	13	30
7	2.81	21	2	5	62	7	16
8	3.24	6	1	2	34	4	9
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

10 August 74 — Pass duration: 210 sec
Begin time: 142450 GMT — Sample volume: 6.3
Z(ACT) = 11612; R(ACT) = 18.4; Z(CDF) = 8945; R(CDF) = 10.9

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	709	113	262	1630	259	600
2	0.65	756	120	278	920	147	340
3	1.08	964	154	356	520	83	192
4	1.51	687	109	252	294	47	109
5	1.94	441	70	162	166	26	60
6	2.38	169	27	62	94	15	35
7	2.81	18	3	7	53	8	19
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

10 August 74 — Pass duration: 163 sec
Begin time: 143245 GMT — Sample volume: 4.9
Z(ACT) = 8600; R(ACT) = 12.2; Z(CDF) = 5892; R(CDF) = 7.3

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	461	94	218	887	182	421
2	0.65	508	104	240	495	101	234
3	1.08	429	88	204	276	57	132
4	1.51	290	59	137	154	32	74
5	1.94	209	43	100	86	18	42
6	2.38	90	18	42	48	10	23
7	2.81	21	4	9	27	6	14
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

Table A-1. Drop Distribution Data Obtained Near Cloud Base from DC-6 Foil Impactor (continued)

10 August 74 — Pass duration: 127 sec
Begin time: 154912 GMT — Sample volume: 3.8
Z(ACT) = 17343; R(ACT) = 16.3; Z(CDF) = 17013; R(CDF) = 13.9

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	1087	287	664	1261	333	771
2	0.65	676	179	414	663	175	405
3	1.08	396	105	243	348	92	213
4	1.51	237	63	146	183	48	111
5	1.94	149	39	90	96	25	58
6	2.38	66	17	39	51	13	30
7	2.81	28	7	16	27	7	16
8	3.24	14	4	9	14	4	9
9	3.67	5	1	2	7	2	5
10	4.05	-	-	-	-	-	-

10 August 74 — Pass duration: 33 sec
Begin time: 160020 GMT — Sample volume: 1.0
Z(ACT) = 17571; R(ACT) = 27.12; Z(CDF) = 12738; R(CDF) = 15.3

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	111	111	257	332	334	773
2	0.65	157	158	366	191	192	444
3	1.08	191	192	444	110	111	257
4	1.51	180	181	419	64	64	148
5	1.94	110	110	255	37	37	86
6	2.38	26	26	60	21	21	49
7	2.81	9	9	21	12	12	28
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

11 August 74 — Pass duration: 170 sec
Begin time: 124038 GMT — Sample volume: 5.1
Z(ACT) = 10987; R(ACT) = 11.4; Z(CDF) = 11972; R(CDF) = 9.9

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	1236	243	562	1269	250	579
2	0.65	536	106	245	661	130	301
3	1.08	367	72	167	344	68	157
4	1.51	249	49	113	179	35	81
5	1.94	144	28	65	93	18	42
6	2.38	79	15	35	48	9	21
7	2.81	23	4	9	25	5	12
8	3.24	10	2	5	13	3	7
9	3.67	3	.6	1	7	1	2
10	4.05	-	-	-	-	-	-

11 August 74 — Pass duration: 187 sec
Begin time: 125111 GMT — Sample volume: 5.6
Z(ACT) = 11080; R(ACT) = 16.1; Z(CDF) = 12648; R(CDF) = 11.9

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	532	95	220	1267	227	525
2	0.65	541	97	225	714	128	296
3	1.08	815	146	338	404	72	167
4	1.51	582	104	241	228	41	95
5	1.94	311	56	130	129	23	53
6	2.38	100	18	42	73	13	30
7	2.81	24	4	9	41	7	16
8	3.24	6	1	2	23	4	9
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

11 August 74 — Pass duration: 30 sec
Begin time: 140020 GMT — Sample volume: 0.9
Z(ACT) = 2237; R(ACT) = 5.6; Z(CDF) = 2105; R(CDF) = 3.8

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	75	84	194	184	205	475
2	0.65	88	98	227	90	101	234
3	1.08	134	149	345	45	50	116
4	1.51	50	56	130	22	25	58
5	1.94	12	13	30	11	12	28
6	2.38	3	3	7	5	6	14
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

11 August 74 — Pass duration: 50 sec
Begin time: 151740 GMT — Sample volume: 1.5
Z(ACT) = 4491; R(ACT) = 8.4; Z(CDF) = 4891; R(CDF) = 6.6

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	221	148	343	396	265	613
2	0.65	208	139	322	197	132	306
3	1.08	214	143	331	99	66	153
4	1.51	99	66	153	49	33	76
5	1.94	30	20	46	25	16	37
6	2.38	17	11	25	12	8	19
7	2.81	1	.7	2	6	4	9
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

Table A-1. Drop Distribution Data Obtained Near Cloud Base from DC-6 Foil Impactor (continued)

11 August 74 — Pass duration: 113 sec
Begin time: 152015 GMT — Sample volume: 3.4
Z(ACT) = 19976; R(ACT) = 21.7; Z(CDF) = 30220; R(CDF) = 19.8

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	574	170	394	1133	335	775
2	0.65	750	222	514	627	185	428
3	1.08	592	175	405	347	102	236
4	1.51	280	83	192	192	57	132
5	1.94	184	54	125	106	31	72
6	2.38	115	34	79	59	17	39
7	2.81	29	9	21	32	10	23
8	3.24	10	3	7	18	5	12
9	3.67	1	.3	.7	10	3	7
10	4.05	1	.3	.7	5	1	2

13 August 74 — Pass duration: 80 sec
Begin time: 064013 GMT — Sample volume: 2.4
Z(ACT) = 6073; R(ACT) = 11.3; Z(CDF) = 9236; R(CDF) = 9.0

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	135	56	130	453	190	440
2	0.65	195	82	190	250	105	243
3	1.08	331	139	322	138	58	134
4	1.51	233	98	227	76	32	74
5	1.94	91	38	88	42	18	42
6	2.38	23	10	23	23	10	23
7	2.81	2	.8	2	13	5	12
8	3.24	1	.4	1	7	3	7
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

13 August 74 — Pass duration: 60 sec
Begin time: 064551 GMT — Sample volume: 1.8
Z(ACT) = 77936; R(ACT) = 50.8; Z(CDF) = 62153; R(CDF) = 35.6

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	282	157	363	519	289	669
2	0.65	262	146	338	324	181	419
3	1.08	284	158	366	202	113	262
4	1.51	235	131	303	126	70	162
5	1.94	141	79	183	79	44	102
6	2.38	87	49	113	49	27	62
7	2.81	44	25	58	31	17	39
8	3.24	27	15	35	19	11	25
9	3.67	12	7	16	12	7	16
10	4.05	7	4	9	7	4	9

13 August 74 — Pass duration: 73 sec
Begin time: 080610 GMT — Sample volume: 2.2
Z(ACT) = 20676; R(ACT) = 26.0; Z(CDF) = 19020; R(CDF) = 17.1

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	204	93	215	596	272	630
2	0.65	289	132	306	350	160	370
3	1.08	371	169	391	206	94	218
4	1.51	293	134	310	121	55	127
5	1.94	181	83	192	71	32	74
6	2.38	77	35	81	42	19	44
7	2.81	24	11	25	24	11	25
8	3.24	5	2	5	14	7	16
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

13 August 74 — Pass duration: 293 sec
Begin time: 082850 GMT — Sample volume: 8.8
Z(ACT) = 5675; R(ACT) = 7.8; Z(CDF) = 6114; R(CDF) = 5.8

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	601	69	160	1088	124	287
2	0.65	520	59	137	602	69	160
3	1.08	613	70	162	333	38	88
4	1.51	358	41	95	184	21	49
5	1.94	226	26	60	102	12	28
6	2.38	88	10	23	56	6	14
7	2.81	24	3	7	31	4	9
8	3.24	4	.5	1	17	2	5
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

13 August 74 — Pass duration: 177 sec
Begin time: 085910 GMT — Sample volume: 5.3
Z(ACT) = 5215; R(ACT) = 7.4; Z(CDF) = 6036; R(CDF) = 5.9

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	373	71	164	775	147	340
2	0.65	444	84	194	415	79	183
3	1.08	437	83	192	223	42	97
4	1.51	228	43	100	119	23	53
5	1.94	136	26	60	64	12	28
6	2.38	39	7	16	34	6	14
7	2.81	8	2	5	18	3	7
8	3.24	5	1	2	10	2	5
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

Table A-1. Drop Distribution Data Obtained Near Cloud Base from DC-6 Foil Impactor (continued)

13 August 74 — Pass duration: 180 sec
Begin time: 092804 GMT — Sample volume: 5.4
Z(ACT) = 5853; R(ACT) = 9.9; Z(CDF) = 5135; R(CDF) = 6.4

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	318	59	137	893	166	384
2	0.65	400	74	171	494	92	213
3	1.08	637	118	273	273	51	118
4	1.51	378	70	162	151	28	65
5	1.94	201	37	86	83	15	35
6	2.38	51	9	21	46	9	21
7	2.81	12	2	5	26	5	12
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

13 August 74 — Pass duration: 103 sec
Begin time: 100250 GMT — Sample volume: 3.1
Z(ACT) = 7093; R(ACT) = 9.7; Z(CDF) = 6450; R(CDF) = 5.9

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	154	50	116	321	104	241
2	0.65	156	51	118	184	60	139
3	1.08	185	60	139	106	34	79
4	1.51	132	43	100	61	20	46
5	1.94	74	24	56	35	11	25
6	2.38	38	12	28	20	7	16
7	2.81	14	5	12	12	4	9
8	3.24	2	1	2	7	2	5
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

13 August 74 — Pass duration: 50 sec
Begin time: 110420 GMT — Sample volume: 1.5
Z(ACT) = 6735; R(ACT) = 11.3; Z(CDF) = 9339; R(CDF) = 10.8

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	596	399	924	775	519	1201
2	0.65	387	259	600	359	240	556
3	1.08	279	187	433	166	111	257
4	1.51	114	76	176	77	52	120
5	1.94	47	31	72	36	24	56
6	2.38	17	11	25	17	11	25
7	2.81	3	2	5	8	5	12
8	3.24	1	.7	2	4	2	5
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

13 August 74 — Pass duration: 233 sec
Begin time: 115845 GMT — Sample volume: 7.0
Z(ACT) = 2186; R(ACT) = 4.2; Z(CDF) = 2479; R(CDF) = 3.4

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	741	106	245	1070	153	354
2	0.65	476	68	157	520	75	174
3	1.08	513	74	171	253	36	83
4	1.51	229	33	76	123	18	42
5	1.94	98	14	32	60	9	21
6	2.38	19	3	7	29	4	9
7	2.81	6	.9	2	14	2	5
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

13 August 74 — Pass duration: 170 sec
Begin time: 120808 GMT — Sample volume: 5.1
Z(ACT) = 10741; R(ACT) = 14.0; Z(CDF) = 10880; R(CDF) = 10.3

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	610	120	278	1097	216	500
2	0.65	588	116	269	609	120	278
3	1.08	570	112	259	338	67	155
4	1.51	331	65	150	188	37	86
5	1.94	238	47	109	104	21	49
6	2.38	96	19	44	58	11	25
7	2.81	28	5	12	32	6	14
8	3.24	5	1	2	18	4	9
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

13 August 74 — Pass duration: 57 sec
Begin time: 121455 GMT — Sample volume: 11.7
Z(ACT) = 23579; R(ACT) = 21.4; Z(CDF) = 28983; R(CDF) = 17.0

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	1107	95	220	2108	181	419
2	0.65	1069	92	213	1264	108	250
3	1.08	1160	100	231	758	65	150
4	1.51	741	64	148	455	39	90
5	1.94	649	56	130	273	23	53
6	2.38	349	30	69	164	14	32
7	2.81	134	11	25	98	8	19
8	3.24	38	3	7	59	5	12
9	3.67	14	1	2	35	3	7
10	4.05	5	.4	1	19	2	5

Table A-1. Drop Distribution Data Obtained Near Cloud Base from DC-6 Foil Impactor (continued)

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
13 August 74 Pass duration: 353 sec Begin time: 131700 GMT Sample volume: 10.6 Z(ACT) = 16086; R(ACT) = 18.2; Z(CDF) = 25738; R(CDF) = 16.0							
1	0.22	1241	118	273	2273	215	498
2	0.65	1083	103	238	1308	124	287
3	1.08	1201	114	264	753	71	164
4	1.51	877	83	192	434	41	95
5	1.94	534	55	127	250	24	56
6	2.38	252	24	56	144	14	32
7	2.81	93	9	21	83	8	19
8	3.24	14	1	2	48	4	9
9	3.67	4	.4	1	27	3	7
10	4.05	2	.2	.5	14	1	2
14 August 74 Pass duration: 37 sec Begin time: 133500 GMT Sample volume: 1.1 Z(ACT) = 5568; R(ACT) = 12.4; Z(CDF) = 6720; R(CDF) = 9.8							
1	0.22	206	188	435	392	358	829
2	0.65	209	191	442	196	179	414
3	1.08	213	195	451	98	90	208
4	1.51	102	93	215	49	45	104
5	1.94	49	45	104	25	23	53
6	2.38	5	5	12	12	11	25
7	2.81	2	2	5	6	6	14
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-
14 August 74 Pass duration: 27 sec Begin time: 144253 GMT Sample volume: 0.8 Z(ACT) = 650; R(ACT) = 2.4; Z(CDF) = 601; R(CDF) = 2.0							
1	0.22	223	280	648	287	360	833
2	0.65	148	186	431	103	129	299
3	1.08	55	69	160	37	46	106
4	1.51	17	21	49	13	17	39
5	1.94	4	5	12	5	6	14
6	2.38	-	-	-	-	-	-
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-
14 August 74 Pass duration: 103 sec Begin time: 145350 GMT Sample volume: 3.1 Z(ACT) = 362; R(ACT) = 2.1; Z(CDF) = 293; R(CDF) = 1.6							
1	0.22	1409	457	1058	1718	557	1289
2	0.65	755	245	567	531	172	398
3	1.08	269	87	201	164	53	123
4	1.51	53	17	39	51	16	37
5	1.94	-	-	-	-	-	-
6	2.38	-	-	-	-	-	-
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-
17 August 74 Pass duration: 100 sec Begin time: 135630 GMT Sample volume: 3.0 Z(ACT) = 12296; R(ACT) = 16.1; Z(CDF) = 16568; R(CDF) = 14.0							
1	0.22	509	170	394	818	274	634
2	0.65	526	176	407	441	148	343
3	1.08	325	109	252	238	80	185
4	1.51	188	63	146	129	43	100
5	1.94	141	47	109	69	23	53
6	2.38	67	22	51	38	13	30
7	2.81	17	6	14	20	7	16
8	3.24	3	1	2	11	4	9
9	3.67	1	.3	.7	6	2	5
10	4.05	-	-	-	-	-	-
17 August 74 Pass duration: 200 sec Begin time: 140400 GMT Sample volume: 6.0 Z(ACT) = 13837; R(ACT) = 20.4; Z(CDF) = 21664; R(CDF) = 17.3							
1	0.22	660	110	255	1568	262	606
2	0.65	778	130	301	888	149	345
3	1.08	908	152	352	503	84	194
4	1.51	702	118	273	285	48	111
5	1.94	387	65	150	161	27	62
6	2.38	140	23	53	91	15	35
7	2.81	35	6	14	52	9	21
8	3.24	4	.7	2	29	5	12
9	3.67	2	.3	.7	17	3	7
10	4.05	-	-	-	-	-	-

Table A-1. Drop Distribution Data Obtained Near Cloud Base from DC-6 Foil Impactor (continued)

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
17 August 74; Begin time: 141000 GMT; Pass duration: 253 sec; Sample volume: 7.6; Z(ACT) = 2019; R(ACT) = 5.9; Z(CDF) = 3323; R(CDF) = 6.2							
1	0.22	4074	538	1245	5348	707	1637
2	0.65	2964	392	907	2011	266	616
3	1.08	1036	137	317	756	99	229
4	1.51	379	50	116	284	38	88
5	1.94	104	14	32	107	14	32
6	2.38	10	1	2	40	5	12
7	2.81	3	.4	1	15	2	5
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-
30 August 74; Begin time: 151750 GMT; Pass duration: 113 sec; Sample volume: 3.4; Z(ACT) = 2736; R(ACT) = 5.8; Z(CDF) = 3496; R(CDF) = 4.8							
1	0.22	416	123	285	704	208	481
2	0.65	366	108	250	345	102	236
3	1.08	334	99	229	169	50	116
4	1.51	187	55	127	83	24	56
5	1.94	65	19	44	41	12	28
6	2.38	11	3	7	20	6	14
7	2.81	2	.6	1	10	3	7
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-
30 August 74; Begin time: 182000 GMT; Pass duration: 57 sec; Sample volume: 1.7; Z(ACT) = 2187; R(ACT) = 6.5; Z(CDF) = 2761; R(CDF) = 5.5							
1	0.22	476	281	650	827	488	1130
2	0.65	515	304	704	349	209	484
3	1.08	316	187	433	151	89	206
4	1.51	111	66	153	65	38	88
5	1.94	24	14	32	28	16	37
6	2.38	3	2	5	12	7	16
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-
30 August 74; Begin time: 182200 GMT; Pass duration: 117 sec; Sample volume: 3.5; Z(ACT) = 909; R(ACT) = 3.5; Z(CDF) = 938; R(CDF) = 2.8							
1	0.22	1252	359	831	1751	503	1164
2	0.65	943	270	625	648	186	431
3	1.08	454	130	301	240	69	160
4	1.51	113	32	74	89	26	60
5	1.94	19	5	12	33	9	21
6	2.38	-	-	-	-	-	-
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-
30 August 74; Begin time: 182605 GMT; Pass duration: 90 sec; Sample volume: 2.7; Z(ACT) = 221; R(ACT) = 1.1; Z(CDF) = 350; R(CDF) = 1.3							
1	0.22	1375	512	1185	1688	628	1454
2	0.65	774	288	667	433	161	373
3	1.08	100	37	86	111	41	95
4	1.51	18	7	16	28	11	25
5	1.94	3	1	2	7	3	7
6	2.38	-	-	-	-	-	-
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-
30 August 74; Begin time: 183433 GMT; Pass duration: 213 sec; Sample volume: 6.4; Z(ACT) = 4216; R(ACT) = 10.8; Z(CDF) = 4254; R(CDF) = 8.0							
1	0.22	2055	323	748	3468	544	1259
2	0.65	1836	288	667	1603	251	581
3	1.08	1656	260	602	741	116	269
4	1.51	675	106	245	343	54	125
5	1.94	197	31	72	158	25	58
6	2.38	30	5	12	73	11	25
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

Table A-1. Drop Distribution Data Obtained Near Cloud Base from DC-6 Foil Impactor (continued)

6 September 74 — Pass duration: 37 sec
Begin time: 125836 GMT — Sample volume: 1.1
Z(ACT) = 10985; R(ACT) = 15.8; Z(CDF) = 7868; R(CDF) = 9.8

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	106	97	225	274	250	579
2	0.65	149	136	315	152	139	322
3	1.08	177	162	375	84	77	178
4	1.51	106	97	225	47	43	100
5	1.94	48	44	102	26	24	56
6	2.38	22	20	46	14	13	30
7	2.81	8	7	16	8	7	16
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

6 September 74 — Pass duration: 23 sec
Begin time: 130055 GMT — Sample volume: 0.7
Z(ACT) = 9246; R(ACT) = 15.5; Z(CDF) = 7589; R(CDF) = 9.4

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	56	80	185	162	232	537
2	0.65	86	123	285	90	130	301
3	1.08	106	152	352	51	73	169
4	1.51	62	89	206	28	41	95
5	1.94	40	57	132	16	23	53
6	2.38	16	23	53	9	13	30
7	2.81	1	1	2	5	7	16
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

6 September 74 — Pass duration: 127 sec
Begin time: 130231 GMT — Sample volume: 3.8
Z(ACT) = 2851; R(ACT) = 6.6; Z(CDF) = 2355; R(CDF) = 4.3

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	428	113	262	834	221	512
2	0.65	429	113	262	415	110	255
3	1.08	460	122	282	206	55	127
4	1.51	244	64	148	103	27	62
5	1.94	85	22	51	51	13	30
6	2.38	14	4	9	25	7	16
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

6 September 74 — Pass duration: 73 sec
Begin time: 131925 GMT — Sample volume: 2.2
Z(ACT) = 2392; R(ACT) = 5.6; Z(CDF) = 3489; R(CDF) = 5.0

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	392	179	414	588	269	623
2	0.65	261	119	275	274	125	289
3	1.08	289	132	306	127	58	134
4	1.51	121	55	127	59	27	62
5	1.94	29	13	30	28	13	30
6	2.38	7	3	7	13	6	14
7	2.81	1	.5	1	6	3	7
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

6 September 74 — Pass duration: 157 sec
Begin time: 132412 GMT — Sample volume: 4.7
Z(ACT) = 13819; R(ACT) = 18.1; Z(CDF) = 13553; R(CDF) 12.6

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	631	135	312	1072	229	530
2	0.65	491	105	243	612	131	303
3	1.08	546	117	271	349	75	174
4	1.51	354	76	176	199	43	100
5	1.94	319	68	157	114	24	56
6	2.38	123	26	60	65	14	32
7	2.81	27	6	14	37	8	19
8	3.24	6	1	2	21	5	12
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

6 September 74 — Pass duration: 133 sec
Begin time: 132839 GMT — Sample volume: 4.0
Z(ACT) = 12006; R(ACT) = 13.0; Z(CDF)=17348; R(CDF)=12.5

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3\Delta D^{-1}$)	Actual no. (m^3mm^{-1})	CDF no.	CDF no. ($m^3\Delta D^{-1}$)	CDF no. (m^3mm^{-1})
1	0.22	905	227	525	1146	288	667
2	0.65	595	149	345	598	150	347
3	1.08	417	104	241	312	78	181
4	1.51	244	61	141	163	41	95
5	1.94	142	36	83	85	21	49
6	2.38	71	18	42	44	11	25
7	2.81	15	4	9	23	6	14
8	3.24	4	1	2	12	3	7
9	3.67	3	.7	2	6	2	5
10	4.05	1	.2	.5	3	.7	2

Table A-1. Drop Distribution Data Obtained Near Cloud Base from DC-6 Foil Impactor (continued)

6 September 74 — Pass duration: 147 sec
Begin time: 135100 GMT — Sample volume: 4.4
Z(ACT) = 29532; R(ACT) = 27.6; Z(CDF) = 28150; R(CDF) = 20.0

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	611	139	322	1089	249	576
2	0.65	551	126	292	647	148	343
3	1.08	565	129	299	385	88	204
4	1.51	410	94	218	229	52	120
5	1.94	299	68	157	136	31	72
6	2.38	143	33	76	81	18	42
7	2.81	77	18	42	48	11	25
8	3.24	21	5	12	29	6	14
9	3.67	8	2	5	17	4	9
10	4.05	-	-	-	-	-	-

6 September 74 — Pass duration: 100 sec
Begin time: 135540 GMT — Sample volume: 3.0
Z(ACT) = 30001; R(ACT) = 28.4; Z(CDF) = 29056; R(CDF) = 20.6

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	436	146	338	768	257	595
2	0.65	374	125	289	457	153	354
3	1.08	388	130	301	271	91	211
4	1.51	306	102	236	161	54	125
5	1.94	217	73	169	96	32	74
6	2.38	107	36	83	57	19	44
7	2.81	41	14	32	34	11	25
8	3.24	19	6	14	20	7	16
9	3.67	5	2	5	12	4	9
10	4.05	-	-	-	-	-	-

6 September 74 — Pass duration: 50 sec
Begin time: 135850 GMT — Sample volume: 1.5
Z(ACT) = 27894; R(ACT) = 29.5; Z(CDF) = 19703; R(CDF) = 17.5

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	167	112	259	362	242	560
2	0.65	204	137	317	218	146	338
3	1.08	168	112	259	131	88	204
4	1.51	147	98	227	79	53	123
5	1.94	127	85	197	48	32	74
6	2.38	67	45	104	29	19	44
7	2.81	21	14	32	17	12	28
8	3.24	9	6	14	10	7	16
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

6 September 74 — Pass duration: 147 sec
Begin time: 142930 GMT — Sample volume: 4.4
Z(ACT) = 9041; R(ACT) = 14.6; Z(CDF) = 11693; R(CDF) = 11.1

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	383	87	201	963	220	509
2	0.65	420	96	222	539	123	285
3	1.08	611	139	322	302	69	160
4	1.51	453	103	238	169	39	90
5	1.94	243	55	127	95	22	51
6	2.38	66	15	35	53	12	28
7	2.81	12	3	7	30	7	16
8	3.24	2	.5	1	17	4	9
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

14 September 74 — Pass duration: 157 sec
Begin time: 121000 GMT — Sample volume: 4.7
Z(ACT) = 9244; R(ACT) = 15.5; Z(CDF) = 12627; R(CDF) = 12.2

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	478	102	236	1206	258	597
2	0.65	518	111	257	666	142	329
3	1.08	824	176	407	368	79	183
4	1.51	513	110	255	203	413	100
5	1.94	288	61	141	112	24	56
6	2.38	56	12	28	62	13	30
7	2.81	16	3	7	34	7	16
8	3.24	2	.4	1	19	4	9
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

14 September 74 — Pass duration: 137 sec
Begin time: 125154 GMT — Sample volume: 4.1
Z(ACT) = 16836; R(ACT) = 20.5; Z(CDF) = 21800; R(CDF) = 15.6

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	357	87	201	798	196	454
2	0.65	327	80	185	473	116	269
3	1.08	449	110	255	281	69	160
4	1.51	380	93	215	166	41	95
5	1.94	296	72	167	99	24	56
6	2.38	117	29	67	58	14	32
7	2.81	25	6	14	35	8	19
8	3.24	8	2	5	21	5	12
9	3.67	2	.5	1	12	3	7
10	4.05	-	-	-	-	-	-

Table A-1. Drop Distribution Data Obtained Near Cloud Base from DC-6 Foil Impactor (continued)

14 September 74 — Pass duration: 30 sec
Begin time: 130130 GMT — Sample volume: 0.9
Z(ACT) = 1917; R(ACT) = 5.2; Z(CDF) = 2062; R(CDF) = 4.0

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	138	154	356	244	272	630
2	0.65	138	154	356	112	125	289
3	1.08	110	123	285	51	57	132
4	1.51	53	59	137	24	26	60
5	1.94	10	11	25	11	12	28
6	2.38	2	2	5	5	6	14
7	2.81	-	-	-	-	-	-
8	3.24	-	-	-	-	-	-
9	3.67	-	-	-	-	-	-
10	4.05	-	-	-	-	-	-

14 September 74 — Pass duration: 213 sec
Begin time: 132515 GMT — Sample volume: 6.4
Z(ACT) = 23007; R(ACT) = 26.3; Z(CDF) = 27537; R(CDF) = 19.5

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	562	88	204	1482	232	537
2	0.65	660	109	241	887	139	322
3	1.08	845	133	308	530	83	192
4	1.51	791	124	287	317	50	116
5	1.94	519	82	190	190	30	69
6	2.38	216	34	79	114	18	42
7	2.81	73	11	25	68	11	25
8	3.24	18	3	7	41	6	14
9	3.67	5	.8	2	24	4	9
10	4.05	-	-	-	-	-	-

14 September 74 — Pass duration: 227 sec
Begin time: 135128 GMT — Sample volume: 6.8
Z(ACT) = 31173; R(ACT) = 29.1; Z(CDF) = 39101; R(CDF)=23.0

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	732	108	250	1581	234	542
2	0.65	841	124	287	954	141	326
3	1.08	801	118	273	576	85	197
4	1.51	694	102	236	347	51	118
5	1.94	510	75	174	210	31	72
6	2.38	256	38	88	126	19	44
7	2.81	111	16	37	76	11	25
8	3.24	27	4	9	46	7	16
9	3.67	10	1	2	28	4	9
10	4.05	4	.6	1	15	2	5

14 September 74 — Pass duration: 47 sec
Begin time: 142100 GMT — Sample volume: 1.4
Z(ACT) = 32064; R(ACT) = 24.8; Z(CDF) = 32682; R(CDF) = 19.4

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	167	120	278	294	211	488
2	0.65	177	127	294	175	126	292
3	1.08	151	108	250	105	75	174
4	1.51	84	60	139	63	45	104
5	1.94	76	55	127	37	27	62
6	2.38	43	31	72	22	16	37
7	2.81	22	16	37	13	10	23
8	3.24	4	3	7	8	6	14
9	3.67	3	2	5	5	3	7
10	4.05	2	1	2	3	2	5

14 September 74 — Pass duration: 103 sec
Begin time: 145043 GMT — Sample volume: 3.1
Z(ACT) = 40938; R(ACT) = 33.9; Z(CDF) = 44112; R(CDF) = 24.9

Drop size category	Midpoint diameter (mm)	Actual no.	Actual no. ($m^3 \Delta D^{-1}$)	Actual no. ($m^3 mm^{-1}$)	CDF no.	CDF no. ($m^3 \Delta D^{-1}$)	CDF no. ($m^3 mm^{-1}$)
1	0.22	278	90	208	651	211	463
2	0.65	326	106	245	405	131	303
3	1.08	346	112	259	252	82	190
4	1.51	281	91	211	157	51	118
5	1.94	266	86	199	98	32	74
6	2.38	149	48	111	61	20	46
7	2.81	40	13	30	38	12	28
8	3.24	27	9	21	23	8	19
9	3.67	7	2	5	15	5	12
10	4.05	3	1	2	8	3	7

Drop size category	Minimum drop diameter	Maximum drop diameter
1	0	0.43
2	0.43	0.86
3	0.86	1.30
4	1.30	1.73
5	1.73	2.16
6	2.16	2.59
7	2.59	3.02
8	3.02	3.46
9	3.46	3.90
10	3.90	4.27

Appendix B

Drop Size Distributions from the *Researcher* Distrometer

This appendix presents the complete list of 137 drop size distributions collected at the surface from the NOAA ship *Researcher* for 9 days analyzed for GATE. The heading section for each drop size distribution contains the date, the beginning time, and the sampling duration, which, for consistency, was kept constant at 120 seconds. It also gives the computed Z and R values for the actual data set and the modified data set. Column 1 gives the 20 drop categories with the midpoint values for each category shown in column 2. The actual number of drops sampled in each category is listed in column 3. Columns 4 and 5, respectively, show the normalized distribution for a ΔD spacing of .25 mm and the normalized distribution for a ΔD spacing of 1.0 mm from the actual data. Columns 6 and 7 present the normalized distributions from the modified data set. Column 6 gives the normalized distribution for a ΔD spacing of .25 mm and column 7 gives the normalized distribution for a ΔD spacing of 1.0 mm.

Table B-1. Drop Distribution Obtained on Board NOAA Ship "Researcher".

29 June 74
Begin time: NA Sample duration: 120 sec
Z(ACT)= 290 ; R(ACT)= 0.8; Z(MOD)= 950 ; R(MOD)= 4.8

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(AD)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(AD)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	640	2560
2	0.375	-	-	-	540	2160
3	0.625	-	-	-	370	1480
4	0.875	-	-	-	250	1000
5	1.125	-	-	-	130	520
6	1.375	41	13.8	55.2	50	200
7	1.625	28	8.3	33.2	8.3	33.2
8	1.875	5	1.4	5.6	1.4	5.6
9	2.125	-	-	-	-	-
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

29 June 74
Begin time: NA Sample duration: 120 sec
Z(ACT)= 330 ; R(ACT)= 1.0 ; Z(MOD)= 940 ; R(MOD)= 4.7

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(AD)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(AD)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	640	2560
2	0.375	-	-	-	540	2160
3	0.625	-	-	-	370	1480
4	0.875	-	-	-	250	1000
5	1.125	-	-	-	130	520
6	1.375	65	21.8	87.2	50	200
7	1.625	29	8.6	34.4	8.6	34.4
8	1.875	4	1.1	4.4	1.1	4.4
9	2.125	-	-	-	-	-
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

29 June 74
Begin time: NA Sample duration: 120 sec
Z(ACT)= 590 ; R(ACT)= 1.3 ; Z(MOD)= 1240; R(MOD)= 5.2

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(AD)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(AD)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	640	2560
2	0.375	-	-	-	540	2160
3	0.625	-	-	-	370	1480
4	0.875	-	-	-	250	1000
5	1.125	-	-	-	130	520
6	1.375	57	19.2	76.8	50	200
7	1.625	45	13.3	53.2	13.3	53.2
8	1.875	8	2.1	8.4	2.1	8.4
9	2.125	3	0.8	3.0	0.8	3.2
10	2.375	2	0.5	2.0	0.5	2.0
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

29 June 74
Begin time: NA Sample duration: 120 sec
Z(ACT)= 2400 ; R(ACT)= 4.8 ; Z(MOD)= 5880 ; R(MOD)= 20.8

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(AD)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(AD)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	999	3996
2	0.375	-	-	-	960	3840
3	0.625	-	-	-	800	3200
4	0.875	-	-	-	650	2600
5	1.125	-	-	-	420	1680
6	1.375	116	39.0	156	250	1000
7	1.625	151	44.8	179.2	90	360
8	1.875	62	16.7	66.8	16.7	66.8
9	2.125	14	3.5	14.0	3.5	14.0
10	2.375	4	0.9	3.6	0.9	3.6
11	2.625	2	0.4	1.6	0.4	1.6
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

29 June 74
Begin time: NA Sample duration: 120 sec
Z(ACT)= 850 ; R(ACT)= 2.1 ; Z(MOD)= 1850 ; R(MOD)= 8.5

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(AD)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(AD)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	950	3800
2	0.375	-	-	-	800	3200
3	0.625	-	-	-	640	2560
4	0.875	-	-	-	450	1800
5	1.125	-	-	-	220	880
6	1.375	94	31.6	126.4	75	300
7	1.625	78	23.1	92.4	23.1	92.4
8	1.875	10	2.7	10.8	2.7	10.8
9	2.125	2	0.5	2.0	0.5	2.0
10	2.375	-	-	-	-	-
11	2.625	1	0.2	0.8	0.2	0.8
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

29 June 74
Begin time: NA Sample duration: 120 sec
Z(ACT)= 400 ; R(ACT)= 1.2 ; Z(MOD)= 1440 ; R(MOD)= 7.7

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(AD)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(AD)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	950	3800
2	0.375	-	-	-	800	3200
3	0.625	-	-	-	640	2560
4	0.875	-	-	-	450	1800
5	1.125	-	-	-	220	880
6	1.375	79	26.5	106.0	75	300
7	1.625	38	11.3	45.2	11.3	45.2
8	1.875	3	0.8	3.2	0.8	3.2
9	2.125	-	-	-	-	-
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

Table B-1. Drop Distribution Obtained on Board NOAA Ship "Researcher" (continued)

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
29 June 74 Begin time: NA Sample duration: 120 sec Z(ACT)= 340 ; R(ACT)= 0.8 ; Z(MOD)= 1280; R(MOD)= 7.3						
1	0.125	-	-	-	950	3800
2	0.375	-	-	-	800	3200
3	0.625	-	-	-	640	2560
4	0.875	-	-	-	450	1800
5	1.125	-	-	-	220	880
6	1.375	77	25.9	103.6	75	300
7	1.625	13	3.6	15.2	3.8	15.2
8	1.875	1	0.3	1.2	0.3	1.2
9	2.125	-	-	-	-	-
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-
29 June 74 Begin time: NA Sample duration: 120 sec Z(ACT)= 480 ; R(ACT)= 1.0 ; Z(MOD)= 1460 ; R(MOD)= 7.7						
1	0.125	-	-	-	950	3800
2	0.375	-	-	-	800	3200
3	0.625	-	-	-	640	2560
4	0.875	-	-	-	450	1800
5	1.125	-	-	-	220	880
6	1.375	44	14.8	59.2	75	300
7	1.625	35	10.4	41.6	10.4	41.6
8	1.875	6	1.6	6.4	1.6	6.4
9	2.125	-	-	-	-	-
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

Table B-1. Drop Distribution Obtained on Board NOAA Ship "Researcher" (continued)

30 June 74
Begin time: N/A — Sample duration: 120 sec
Z(ACT)= 2110 ; R(ACT)= 4.1 ; Z(MOD)= 5920 ; R(MOD)= 17.2

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	700	2800
2	0.375	-	-	-	600	2400
3	0.625	-	-	-	500	2000
4	0.875	-	-	-	370	1480
5	1.125	-	-	-	220	880
6	1.375	105	35.3	141.2	160	640
7	1.625	122	36.2	144.8	90	360
8	1.875	43	11.6	46.4	40	160
9	2.125	25	6.2	24.8	6.2	24.8
10	2.375	3	0.7	2.8	0.7	2.8
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

30 June 74
Begin time: N/A — Sample duration: 120 sec
Z(ACT)= 6290 ; R(ACT)= 7.1 ; Z(MOD)=18100 ; R(MOD)= 40.1

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	999	3996
2	0.375	-	-	-	950	3800
3	0.625	-	-	-	800	3200
4	0.875	-	-	-	640	2560
5	1.125	-	-	-	450	1800
6	1.375	44	14.8	59.2	300	1200
7	1.625	89	26.4	105.6	200	800
8	1.875	71	19.1	76.4	110	440
9	2.125	46	11.5	46.0	30	120
10	2.375	29	6.8	27.2	6.8	27.2
11	2.625	11	2.4	9.6	2.4	9.6
12	2.875	11	2.3	9.2	2.3	9.2
13	3.125	-	-	-	-	-
14	3.375	1	0.2	0.8	0.2	0.8
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

30 June 74
Begin time: N/A — Sample duration: 120 sec
Z(ACT)= 10160; R(ACT)= 12.5 ; Z(MOD)=18880 ; R(MOD)= 39.1

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	999	3996
2	0.375	-	-	-	950	3800
3	0.625	-	-	-	800	3200
4	0.875	-	-	-	640	2560
5	1.125	-	-	-	450	1800
6	1.375	199	66.9	267.6	300	1200
7	1.625	240	71.2	284.8	200	800
8	1.875	160	43.1	172.4	110	440
9	2.125	69	17.2	68.8	30	120
10	2.375	16	3.8	15.2	3.8	15.2
11	2.625	6	1.3	5.2	1.3	5.2
12	2.875	-	-	-	-	-
13	3.125	7	1.4	5.6	1.4	5.6
14	3.375	2	0.4	1.6	0.4	1.6
15	3.625	4	0.8	3.2	0.8	3.2
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

30 June 74
Begin time: N/A — Sample duration: 120 sec
Z(ACT)=17260 ; R(ACT)= 16.4 ; Z(MOD)=53510 ; R(MOD)= 95.1

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1500	6000
2	0.375	-	-	-	1300	5200
3	0.625	-	-	-	999	3996
4	0.875	-	-	-	950	3800
5	1.125	-	-	-	800	3200
6	1.375	43	14.4	57.6	600	2400
7	1.625	112	33.2	132.8	350	1400
8	1.875	97	26.1	104.4	250	1000
9	2.125	122	30.4	121.6	130	520
10	2.375	65	15.2	60.8	50	200
11	2.625	66	14.7	58.8	14.7	58.8
12	2.875	30	6.4	25.6	6.4	25.6
13	3.125	2	0.4	1.6	0.4	1.6
14	3.375	1	0.2	0.8	0.2	0.8
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

30 June 74
Begin time: N/A — Sample duration: 120 sec
Z(ACT)=29380 ; R(ACT)= 36.3 ; Z(MOD)=51370 ; R(MOD)=94.0

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1500	6000
2	0.375	-	-	-	1300	5200
3	0.625	-	-	-	999	3996
4	0.875	-	-	-	950	3800
5	1.125	-	-	-	800	3200
6	1.375	170	57.1	228.4	600	2400
7	1.625	402	119.2	476.8	350	1400
8	1.875	377	101.5	406.0	250	1000
9	2.125	282	95.3	381.2	130	520
10	2.375	130	30.5	122.0	50	200
11	2.625	69	15.4	61.6	15.4	61.6
12	2.875	16	3.4	13.6	3.4	13.6
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

30 June 74
Begin time: N/A — Sample duration: 120 sec
Z(ACT)= 9530 ; R(ACT)= 15.6 ; Z(MOD)=16050 ; R(MOD)= 39.5

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	999	3996
2	0.375	-	-	-	940	3760
3	0.625	-	-	-	800	3200
4	0.875	-	-	-	600	2400
5	1.125	-	-	-	500	2000
6	1.375	179	60.1	240.4	350	1400
7	1.625	375	111.2	444.8	200	800
8	1.875	214	57.6	230.4	100	400
9	2.125	109	27.2	108.8	27.2	108.8
10	2.375	26	6.1	24.4	6.1	24.4
11	2.625	10	2.2	8.8	2.2	8.8
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

Table B-1. Drop Distribution Obtained on Board NOAA Ship "Researcher" (continued)

30 June 74
Begin time: N/A — Sample duration: 120 sec
Z(ACT)= 1540 ; R(ACT)= 2.8 ; Z(MOD)= 4000 ; R(MOD)= 13.4

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(AD)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(AD)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	850	3400
2	0.375	-	-	-	700	2800
3	0.625	-	-	-	530	2120
4	0.875	-	-	-	370	1480
5	1.125	-	-	-	260	1040
6	1.375	58	19.5	78.0	150	600
7	1.625	78	23.1	92.4	70	280
8	1.875	29	7.8	31.2	7.8	31.2
9	2.125	15	3.7	14.8	3.7	14.8
10	2.375	4	1.0	4.0	0.9	3.6
11	2.625	2	0.4	1.6	0.4	1.6
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

30 June 74
Begin time: N/A — Sample duration: 120 sec
Z(ACT)= 4490 ; R(ACT)= 8.7 ; Z(MOD)= 8750 ; R(MOD)= 25.2

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(AD)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(AD)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	999	3996
2	0.375	-	-	-	900	3600
3	0.625	-	-	-	700	2800
4	0.875	-	-	-	550	2200
5	1.125	-	-	-	400	1600
6	1.375	211	70.9	283.6	250	1000
7	1.625	239	70.9	283.6	120	480
8	1.875	114	30.7	122.8	54	216
9	2.125	43	10.7	42.8	10.7	42.8
10	2.375	7	1.6	5.4	1.6	5.4
11	2.625	2	0.4	1.6	0.4	1.6
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

30 June 74
Begin time: N/A — Sample duration: 120 sec
Z(ACT)= 4420 ; R(ACT)= 8.0 ; Z(MOD)= 9170 ; R(MOD)= 25.6

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(AD)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(AD)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	999	3996
2	0.375	-	-	-	900	3600
3	0.625	-	-	-	700	2800
4	0.875	-	-	-	550	2200
5	1.125	-	-	-	400	1600
6	1.375	159	53.4	213.6	250	1000
7	1.625	218	64.6	258.4	120	480
8	1.875	96	25.8	103.2	54	216
9	2.125	50	12.5	50.0	12.5	50.0
10	2.375	7	1.6	5.4	1.6	5.4
11	2.625	2	0.4	1.6	0.4	1.6
12	2.875	2	0.4	1.6	0.4	1.6
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

30 June 74
Begin time: N/A — Sample duration: 120 sec
Z(ACT)= 2000 ; R(ACT)= 4.3 ; Z(MOD)= 3900 ; R(MOD)= 13.2

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(AD)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(AD)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	850	3400
2	0.375	-	-	-	700	2800
3	0.625	-	-	-	530	2120
4	0.875	-	-	-	370	1480
5	1.125	-	-	-	260	1040
6	1.375	196	65.9	263.6	150	600
7	1.625	130	38.5	154.0	70	280
8	1.875	27	7.3	29.2	7.3	29.2
9	2.125	8	2.0	8.0	2.0	8.0
10	2.375	3	0.7	2.8	0.7	2.8
11	2.625	2	0.4	1.8	0.4	1.8
12	2.875	1	0.2	0.8	0.2	0.8
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

30 June 74
Begin time: N/A — Sample duration: 120 sec
Z(ACT)= 1040 ; R(ACT)= 2.4 ; Z(MOD)= 3670 ; R(MOD)= 15.5

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(AD)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(AD)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1500	6000
2	0.375	-	-	-	1200	4800
3	0.625	-	-	-	800	3200
4	0.875	-	-	-	600	2400
5	1.125	-	-	-	360	1440
6	1.375	164	55.1	220.4	220	880
7	1.625	63	18.7	74.8	45	180
8	1.875	8	2.1	8.4	2.1	8.4
9	2.125	3	0.8	3.0	0.7	3.0
10	2.375	1	0.2	0.9	0.2	0.9
11	2.625	-	-	-	-	-
12	2.875	1	0.2	0.8	0.2	0.8
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

30 June 74
Begin time: N/A — Sample duration: 120 sec
Z(ACT)= 620 ; R(ACT)= 1.8 ; Z(MOD)= 3420 ; R(MOD)= 15.2

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(AD)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(AD)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1500	6000
2	0.375	-	-	-	1200	4800
3	0.625	-	-	-	800	3200
4	0.875	-	-	-	600	2400
5	1.125	-	-	-	360	1440
6	1.375	138	46.4	185.6	220	880
7	1.625	49	14.5	58.0	45	180
8	1.875	2	0.5	2.2	0.5	2.2
9	2.125	-	-	-	-	-
10	2.375	1	0.2	0.8	0.2	0.8
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

Table B-1. Drop Distribution Obtained on Board NOAA Ship "Researcher" (continued)

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
30 June 74 Begin time: N/A Sample duration: 120 sec Z(ACT)= 280 ; R(ACT)= 0.5 ; Z(MOD)= 700 ; R(MOD)= 3.7						
1	0.125	-	-	-	600	2400
2	0.375	-	-	-	450	1800
3	0.625	-	-	-	320	1280
4	0.875	-	-	-	210	840
5	1.125	-	-	-	100	400
6	1.375	30	10.0	40.0	45	180
7	1.625	12	3.5	14.0	3.5	14.0
8	1.875	1	0.3	1.2	0.3	1.2
9	2.125	-	-	-	-	-
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-
30 June 74 Begin time: N/A Sample duration: 120 sec Z(ACT)= 500 ; R(ACT)= 1.2 ; Z(MOD)= 3430 ; R(MOD)= 15.2						
1	0.125	-	-	-	1500	6000
2	0.375	-	-	-	1200	4800
3	0.625	-	-	-	800	3200
4	0.875	-	-	-	600	2400
5	1.125	-	-	-	360	1440
6	1.375	66	22.2	88.8	220	880
7	1.625	45	13.3	53.2	45	180
8	1.875	5	1.4	5.6	1.4	5.6
9	2.125	-	-	-	-	-
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-
30 June 74 Begin time: N/A Sample duration: 120 sec Z(ACT)= 880 ; R(ACT)= 2.0 ; Z(MOD)= 3620 ; R(MOD)= 15.5						
1	0.125	-	-	-	1500	6000
2	0.375	-	-	-	1200	4800
3	0.625	-	-	-	800	3200
4	0.875	-	-	-	600	2400
5	1.125	-	-	-	360	1440
6	1.375	98	32.9	131.6	220	880
7	1.625	59	17.5	70.0	45	180
8	1.875	10	2.7	10.8	2.7	10.8
9	2.125	6	1.5	6.0	1.5	6.0
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-
30 June 74 Begin time: N/A Sample duration: 120 sec Z(ACT)= 1410 ; R(ACT)= 3.2 ; Z(MOD)= 2750 ; R(MOD)= 11.8						
1	0.125	-	-	-	900	3600
2	0.375	-	-	-	760	3040
3	0.625	-	-	-	600	2400
4	0.875	-	-	-	480	1920
5	1.125	-	-	-	300	1200
6	1.375	165	55.4	221.6	140	560
7	1.625	103	30.5	122	38	152
8	1.875	14	3.8	15.2	3.8	15.2
9	2.125	3	0.8	3.2	0.8	3.2
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-
30 June 74 Begin time: N/A Sample duration: 120 sec Z(ACT)= 1270 ; R(ACT)= 1.3 ; Z(MOD)=10500 ; R(MOD)= 30.7						
1	0.125	-	-	-	1500	6000
2	0.375	-	-	-	1300	5200
3	0.625	-	-	-	999	3996
4	0.875	-	-	-	800	3200
5	1.125	-	-	-	500	2000
6	1.375	22	7.4	29.6	300	1200
7	1.625	13	3.8	15.2	150	600
8	1.875	2	0.5	2.0	55	220
9	2.125	3	0.8	3.2	0.8	3.2
10	2.375	11	2.6	10.4	2.6	10.4
11	2.625	5	1.1	4.4	1.1	4.4
12	2.875	2	0.4	1.6	0.4	1.6
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-
30 June 74 Begin time: N/A Sample duration: 120 sec Z(ACT)= 3550 ; R(ACT)= 3.2 ; Z(MOD)= 9950 ; R(MOD)= 30.1						
1	0.125	-	-	-	1500	6000
2	0.375	-	-	-	1300	5200
3	0.625	-	-	-	999	3996
4	0.875	-	-	-	800	3200
5	1.125	-	-	-	500	2000
6	1.375	51	17.1	68.4	300	1200
7	1.625	44	13.0	52.0	150	600
8	1.875	19	5.1	20.4	55	220
9	2.125	27	5.7	22.8	5.7	22.8
10	2.375	7	1.6	6.4	1.6	6.4
11	2.625	7	1.6	6.4	1.6	6.4
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875					

Table B-1. Drop Distribution Obtained on Board NOAA Ship "Researcher" (continued)

30 June 74
Begin time: N/A — Sample duration: 120 sec
Z(ACT)= 2520 ; R(ACT)= 3.9 ; Z(MOD)= 9850 ; R(MOD)= 30.2

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(AD)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(AD)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1500	6000
2	0.375	-	-	-	1300	5200
3	0.625	-	-	-	999	3996
4	0.875	-	-	-	800	3200
5	1.125	-	-	-	500	2000
6	1.375	40	13.4	53.6	300	1200
7	1.625	55	16.3	65.2	150	600
8	1.875	55	14.8	59.2	55	220
9	2.125	36	8.9	35.6	8.9	35.6
10	2.375	10	2.3	9.2	2.3	9.2
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

30 June 74
Begin time: N/A — Sample duration: 120 sec
Z(ACT)= 1660 ; R(ACT)= 3.0 ; Z(MOD)= 3090 ; R(MOD)= 12.3

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(AD)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(AD)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	900	3600
2	0.375	-	-	-	760	3040
3	0.625	-	-	-	600	2400
4	0.875	-	-	-	480	1920
5	1.125	-	-	-	300	1200
6	1.375	84	28.2	112.8	140	560
7	1.625	95	28.2	112.8	38	152
8	1.875	22	5.9	23.6	5.9	23.6
9	2.125	13	3.2	12.8	3.2	12.8
10	2.375	1	0.2	0.8	0.2	0.8
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

30 June 74
Begin time: N/A — Sample duration: 120 sec
Z(ACT)= 4920 ; R(ACT)= 4.5 ; Z(MOD)= 8350 ; R(MOD)= 19.4

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(AD)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(AD)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	750	3000
2	0.375	-	-	-	600	2400
3	0.625	-	-	-	470	1880
4	0.875	-	-	-	350	1400
5	1.125	-	-	-	250	1000
6	1.375	40	13.4	53.6	160	640
7	1.625	51	15.1	60.4	90	360
8	1.875	45	12.1	48.4	40	160
9	2.125	24	6.0	24.0	15	60
10	2.375	22	5.2	20.8	5.2	20.8
11	2.625	7	1.6	6.4	1.6	6.4
12	2.875	3	0.6	2.4	0.6	2.4
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

30 June 74
Begin time: N/A — Sample duration: 120 sec
Z(ACT)= 5150 ; R(ACT)= 6.6 ; Z(MOD)= 8140 ; R(MOD)= 19.2

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(AD)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(AD)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	750	3000
2	0.375	-	-	-	600	2400
3	0.625	-	-	-	470	1880
4	0.875	-	-	-	350	1400
5	1.125	-	-	-	250	1000
6	1.375	66	22.2	88.8	160	640
7	1.625	133	39.4	157.6	90	360
8	1.875	75	20.4	81.6	40	160
9	2.125	42	10.5	42.0	15	60
10	2.375	18	4.2	16.8	4.2	16.8
11	2.625	6	1.3	5.2	1.3	5.2
12	2.875	2	0.4	1.6	0.4	1.6
13	3.125	1	0.2	0.8	0.2	0.8
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

30 June 74
Begin time: N/A — Sample duration: 120 sec
Z(ACT)= 17740 ; R(ACT)= 13.7 ; Z(MOD)= 30890 ; R(MOD)= 54.5

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(AD)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(AD)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	999	3996
2	0.375	-	-	-	950	3800
3	0.625	-	-	-	800	3200
4	0.875	-	-	-	650	2600
5	1.125	-	-	-	500	2000
6	1.375	92	30.9	123.6	350	1400
7	1.625	105	31.1	124.4	230	920
8	1.875	83	22.3	89.2	130	520
9	2.125	79	19.7	78.8	60	240
10	2.375	65	15.2	60.8	25	100
11	2.625	38	8.5	34.0	8.5	34.0
12	2.875	12	2.6	10.4	2.6	10.4
13	3.125	7	1.4	5.6	1.4	5.6
14	3.375	2	0.4	1.6	0.4	1.6
15	3.625	1	0.2	0.8	0.2	0.8
16	3.875	1	0.2	0.8	0.2	0.8
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

30 June 74
Begin time: N/A — Sample duration: 120 sec
Z(ACT)=20000 ; R(ACT)=18.3 ; Z(MOD)=34970 ; R(MOD)= 57.0

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(AD)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(AD)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	999	3996
2	0.375	-	-	-	950	3800
3	0.625	-	-	-	800	3200
4	0.875	-	-	-	650	2600
5	1.125	-	-	-	500	2000
6	1.375	95	31.9	127.6	350	1400
7	1.625	203	60.2	240.8	230	920
8	1.875	124	33.4	133.6	130	520
9	2.125	178	29.4	117.6	60	240
10	2.375	47	11.0	44.0	25	100
11	2.625	55	12.3	49.2	12.3	49.2
12	2.875	24	5.1	20.4	5.1	20.4
13	3.125	11	2.3	9.2	2.3	9.2
14	3.375	4	0.8	3.2	0.8	3.2
15	3.625	1	0.2	0.8	0.2	0.8
16	3.875	1	0.2	0.8	0.2	0.8
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

Table B-1. Drop Distribution Obtained on Board NOAA Ship "Researcher" (continued)

8 July 74
Begin time: 1745 GMT; Sample duration: 120 sec
Z(ACT)= 23140; R(ACT)= 17.0; Z(MOD)= 25080; R(MOD)= 23.2

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	300	1200
2	0.375	-	-	-	250	1000
3	0.625	-	-	-	180	720
4	0.875	-	-	-	140	560
5	1.125	-	-	-	100	400
6	1.375	36	12.1	48.4	80	320
7	1.625	86	25.5	102.0	60	240
8	1.875	117	31.5	126.0	45	180
9	2.125	101	25.2	100.8	25	100
10	2.375	38	8.9	35.6	8.9	35.6
11	2.625	47	10.5	42.0	10.5	42.0
12	2.875	24	5.1	20.4	5.1	20.4
13	3.125	13	2.7	10.8	2.7	10.8
14	3.375	8	1.6	6.4	1.6	6.4
15	3.625	6	1.2	4.8	1.2	4.8
16	3.875	5	1.0	4.0	1.0	4.0
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

8 July 74
Begin time: 1747 GMT; Sample duration: 120 sec
Z(ACT)= 53680; R(ACT)= 45.1; Z(MOD)= 55130; R(MOD)= 52.8

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	600	2400
2	0.375	-	-	-	500	2000
3	0.625	-	-	-	350	1400
4	0.875	-	-	-	300	1200
5	1.125	-	-	-	200	800
6	1.375	108	36.3	145.2	150	600
7	1.625	236	70.0	280.0	110	440
8	1.875	282	75.9	303.6	80	320
9	2.125	299	74.6	298.4	60	240
10	2.375	157	36.9	147.6	40	160
11	2.625	149	33.2	132.8	33.2	132.8
12	2.875	65	13.9	55.6	13.9	55.6
13	3.125	24	5.0	20.0	5.0	20.0
14	3.375	16	3.2	12.8	3.2	12.8
15	3.625	5	1.0	4.0	1.0	4.0
16	3.875	3	0.6	2.4	0.6	2.4
17	4.125	3	0.6	2.4	0.6	2.4
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

8 July 74
Begin time: 1749 GMT Sample duration: 120 sec
Z(ACT)= 72940; R(ACT)= 44.2; Z(MOD)= 81070; R(MOD)= 61.5

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	600	2400
2	0.375	-	-	-	500	2000
3	0.625	-	-	-	350	1400
4	0.875	-	-	-	300	1200
5	1.125	-	-	-	200	800
6	1.375	51	17.1	68.4	150	600
7	1.625	155	46.0	184.0	110	440
8	1.875	163	43.9	175.6	80	320
9	2.125	186	46.4	185.6	60	240
10	2.375	107	25.1	100.4	40	160
11	2.625	118	26.3	105.2	26.3	105.2
12	2.875	93	19.9	79.6	19.9	79.6
13	3.125	46	9.5	38.0	9.5	38.0
14	3.375	33	6.4	25.6	6.4	25.6
15	3.625	20	3.9	15.6	3.9	15.6
16	3.875	7	1.4	5.6	1.4	5.6
17	4.125	4	0.8	3.2	0.8	3.2
18	4.375	4	0.8	3.2	0.8	3.2
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

8 July 74
Begin time: 1751 GMT; Sample duration: 120 sec
Z(ACT)=116050; R(ACT)= 76.2; Z(MOD)=140210; R(MOD)=122.7

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	999	3996
2	0.375	-	-	-	900	3600
3	0.625	-	-	-	700	2800
4	0.875	-	-	-	600	2400
5	1.125	-	-	-	450	1800
6	1.375	175	58.8	235.2	300	1200
7	1.625	315	93.4	373.6	250	1000
8	1.875	230	61.9	247.6	200	800
9	2.125	308	76.8	307.2	140	560
10	2.375	184	43.2	172.8	80	320
11	2.625	240	53.5	214.0	53.5	214
12	2.875	173	37.1	148.4	37.1	148.4
13	3.125	83	17.2	68.8	17.2	68.8
14	3.375	50	10.1	40.4	10.1	40.4
15	3.625	35	6.9	27.6	6.9	27.6
16	3.875	10	1.9	7.6	1.9	7.6
17	4.125	5	1.0	4.0	1.0	4.0
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

8 July 74
Begin time: 1753 GMT; Sample duration: 120 sec
Z(ACT)=108420; R(ACT)= 85.3; Z(MOD)=150940; R(MOD)=172.1

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1900	7600
2	0.375	-	-	-	1500	6000
3	0.625	-	-	-	1200	4800
4	0.875	-	-	-	999	3996
5	1.125	-	-	-	800	3200
6	1.375	85	28.6	114.4	600	2400
7	1.625	277	82.1	328.4	500	2000
8	1.875	351	94.5	378.0	340	1360
9	2.125	492	122.8	491.2	200	800
10	2.375	334	78.4	313.6	140	560
11	2.625	331	73.9	295.6	73.9	295.6
12	2.875	180	38.6	154.4	38.6	154.4
13	3.125	60	12.4	49.6	12.4	49.6
14	3.375	26	5.2	20.8	5.2	20.8
15	3.625	14	2.8	11.2	2.8	11.2
16	3.875	4	0.8	3.2	0.8	3.2
17	4.125	3	0.6	2.4	0.6	2.4
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

8 July 74
Begin time: 1755 GMT Sample duration: 120 sec
Z(ACT)= 41960; R(ACT)= 40.0; Z(MOD)= 50990; R(MOD)= 65.8

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1200	4800
2	0.375	-	-	-	850	3400
3	0.625	-	-	-	650	2600
4	0.875	-	-	-	500	2000
5	1.125	-	-	-	370	1480
6	1.375	81	27.2	108.8	270	1080
7	1.625	229	67.9	271.6	200	800
8	1.875	273	73.5	294.0	150	600
9	2.125	354	88.3	353.2	95	380
10	2.375	158	37.1	148.4	37.1	148.4
11	2.625	107	23.9	95.6	23.9	95.6
12	2.875	49	10.5	42.0	10.5	42.0
13	3.125	19	3.9	15.6	3.9	15.6
14	3.375	6	1.2	4.8	1.2	4.8
15	3.625	3	0.6	2.4	0.6	2.4
16	3.875	3	0.6	2.4	0.6	2.4
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

Table B-1. Drop Distribution Obtained on Board NOAA Ship "Researcher" (continued)

8 July 74
Begin time: 1757 GMT; Sample duration: 120 sec
Z(ACT)= 83440 ; R(ACT)= 57.5 ; Z(MOD)= 93900; R(MOD)= 85.1

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	999	3996
2	0.375	-	-	-	850	3400
3	0.625	-	-	-	650	2600
4	0.875	-	-	-	500	2000
5	1.125	-	-	-	370	1480
6	1.375	123	41.3	165.2	270	1080
7	1.625	230	68.2	272.8	200	800
8	1.875	263	70.8	283.2	150	600
9	2.125	288	71.9	287.6	95	380
10	2.375	175	41.1	164.4	41.1	164.4
11	2.625	155	34.6	138.4	34.6	138.4
12	2.875	94	20.1	80.4	20.1	80.4
13	3.125	51	10.6	42.4	10.6	42.4
14	3.375	45	9.1	36.4	9.1	36.4
15	3.625	22	4.3	17.2	4.3	17.2
16	3.875	11	2.1	8.4	2.1	8.4
17	4.125	2	0.4	1.6	0.4	1.6
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

8 July 74
Begin time: 1759 GMT; Sample duration: 120 sec
Z(ACT)= 69190 ; R(ACT)= 55.6; Z(MOD)= 77580; R(MOD)= 79.6

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	999	3996
2	0.375	-	-	-	850	3400
3	0.625	-	-	-	650	2600
4	0.875	-	-	-	500	2000
5	1.125	-	-	-	370	1480
6	1.375	138	46.3	185.2	270	1080
7	1.625	313	92.8	371.2	200	800
8	1.875	305	82.1	328.4	150	600
9	2.125	340	84.8	339.2	95	380
10	2.375	217	50.9	203.6	50.9	203.6
11	2.625	149	33.2	132.8	33.2	132.8
12	2.875	93	19.9	79.6	19.9	79.6
13	3.125	37	7.7	30.8	7.7	30.8
14	3.375	13	2.6	10.4	2.6	10.4
15	3.625	12	2.4	9.6	2.4	9.6
16	3.875	11	2.1	8.4	2.1	8.4
17	4.125	1	0.2	0.8	0.2	0.8
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

8 July 74
Begin time: 1801 GMT Sample duration: 120 sec
Z(ACT)= 34990; R(ACT)= 41.1; Z(MOD)= 42360 ; R(MOD)= 69.1

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1900	7600
2	0.375	-	-	-	1500	6000
3	0.625	-	-	-	1300	5200
4	0.875	-	-	-	950	3800
5	1.125	-	-	-	600	2400
6	1.375	186	62.5	250	400	1600
7	1.625	412	122.2	488.8	250	1000
8	1.875	376	101.2	404.8	125	500
9	2.125	366	91.3	365.2	91.3	365.2
10	2.375	142	33.3	133.2	33.3	133.2
11	2.625	103	23.0	92.0	23.0	92.0
12	2.875	27	5.8	23.2	5.8	23.2
13	3.125	11	2.3	9.2	2.3	9.2
14	3.375	2	0.4	1.6	0.4	1.6
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

8 July 74
Begin time: 1803 GMT; Sample duration: 120 sec
Z(ACT)= 19930; R(ACT)= 22.5; Z(MOD)= 30980; R(MOD)= 58.1

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1900	7600
2	0.375	-	-	-	1500	6000
3	0.625	-	-	-	1300	5200
4	0.875	-	-	-	950	3800
5	1.125	-	-	-	600	2400
6	1.375	121	40.7	162.8	400	1600
7	1.625	199	59.0	236.0	250	1000
8	1.875	173	46.6	186.4	125	500
9	2.125	220	54.9	219.6	54.9	219.6
10	2.375	86	20.2	80.8	20.2	80.8
11	2.625	54	12.0	48.0	12.0	48.0
12	2.875	13	2.8	11.2	2.8	11.2
13	3.125	3	0.6	2.4	0.6	2.4
14	3.375	3	0.6	2.4	0.6	2.4
15	3.625	2	0.4	1.6	0.4	1.6
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

8 July 74
Begin time: 1805 GMT; Sample duration: 120 sec
Z(ACT)= 32720 ; R(ACT)= 34.8; Z(MOD)= 42340; R(MOD)= 67.6

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1900	7600
2	0.375	-	-	-	1500	6000
3	0.625	-	-	-	1300	5200
4	0.875	-	-	-	950	3800
5	1.125	-	-	-	600	2400
6	1.375	151	50.7	202.8	400	1600
7	1.625	244	72.4	289.6	250	1000
8	1.875	269	72.4	289.6	125	500
9	2.125	302	75.3	301.2	75.3	301.2
10	2.375	136	31.9	127.6	31.9	127.6
11	2.625	90	20.1	80.4	20.1	80.4
12	2.875	41	8.8	35.2	8.8	35.2
13	3.125	13	2.7	10.8	2.7	10.8
14	3.375	14	0.8	3.2	0.8	3.2
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875					

8 July 74
Begin time: 1807 GMT Sample duration: 120 sec
Z(ACT)= 27330 ; R(ACT)= 31.7; Z(MOD)= 36600; R(MOD)= 63.8

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1900	7600
2	0.375	-	-	-	1500	6000
3	0.625	-	-	-	1300	5200
4	0.875	-	-	-	950	3800
5	1.125	-	-	-	600	2400
6	1.375	112	37.6	150.4	400	1600
7	1.625	322	95.5	382.0	250	1000
8	1.875	270	72.7	290.8	125	500
9	2.125	291	72.6	290.4	72.6	290.4
10	2.375	116	27.2	110.4	27.2	110.4
11	2.625	82	18.3	73.2	18.3	73.2
12	2.875	21	4.5	18.0	4.5	18.0
13	3.125	9	1.9	7.6	1.9	7.6
14	3.375	1	0.2	0.8	0.2	0.8
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

Table B-1. Drop Distribution Obtained on Board NOAA Ship "Researcher" (continued)

8 July 74
Begin time: 1809 GMT; Sample duration: 120 sec
Z(ACT)= 14130 ; R(ACT)= 18.2 ; Z(MOD)=16390 ; R(MOD)= 27.9

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	900	3600
2	0.375	-	-	-	650	2600
3	0.625	-	-	-	500	2000
4	0.875	-	-	-	350	1400
5	1.125	-	-	-	230	920
6	1.375	96	32.3	129.2	160	640
7	1.625	203	60.2	240.8	100	400
8	1.875	216	58.2	232.8	58.2	232.8
9	2.125	166	41.4	165.6	41.4	165.6
10	2.375	63	14.8	59.2	14.8	59.2
11	2.625	26	5.8	23.2	5.8	23.2
12	2.875	11	2.4	9.6	2.4	9.6
13	3.125	3	0.6	2.4	0.6	2.4
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

8 July 74
Begin time: 1811 GMT; Sample duration: 120 sec
Z(ACT)= 15510; R(ACT)= 19.2 ; Z(MOD)=17660 ; R(MOD)= 28.6

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	900	3600
2	0.375	-	-	-	650	2600
3	0.625	-	-	-	500	2000
4	0.875	-	-	-	350	1400
5	1.125	-	-	-	230	920
6	1.375	104	34.9	139.6	160	640
7	1.625	219	64.9	259.6	100	400
8	1.875	192	51.7	206.8	51.7	206.8
9	2.125	171	42.7	170.8	42.7	170.8
10	2.375	57	13.4	53.6	13.4	53.6
11	2.625	44	9.8	39.2	9.8	39.2
12	2.875	16	3.4	13.6	3.4	13.6
13	3.125	2	0.4	1.6	0.4	1.6
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

8 July 74
Begin time: 1813 GMT Sample duration: 120 sec
Z(ACT)= 8790 ; R(ACT)= 12.4 ; Z(MOD)= 9590 ; R(MOD)= 16.4

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	500	2000
2	0.375	-	-	-	350	1400
3	0.625	-	-	-	250	1000
4	0.875	-	-	-	180	720
5	1.125	-	-	-	120	480
6	1.375	70	23.5	94.0	80	320
7	1.625	189	56.0	224.0	60	240
8	1.875	143	38.5	154.0	38.5	154.0
9	2.125	118	29.4	117.6	29.4	117.6
10	2.375	35	8.2	32.8	8.2	32.8
11	2.625	17	3.8	15.2	3.8	15.2
12	2.875	4	0.9	3.6	0.9	3.6
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

8 July 74
Begin time: 1815 GMT; Sample duration: 120 sec
Z(ACT)= 4590 ; R(ACT)= 7.5 ; Z(MOD)= 5000 ; R(MOD)= 9.9

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	300	1200
2	0.375	-	-	-	250	1000
3	0.625	-	-	-	180	720
4	0.875	-	-	-	120	480
5	1.125	-	-	-	80	320
6	1.375	60	20.2	80.8	60	240
7	1.625	151	44.8	179.2	40	160
8	1.875	111	29.9	119.6	29.9	119.6
9	2.125	56	14.0	56.0	14.0	56.0
10	2.375	16	3.8	15.2	3.8	15.2
11	2.625	5	1.1	4.4	1.1	4.4
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

8 July 74
Begin time: 1817 GMT; Sample duration: 120 sec
Z(ACT)= 5160 ; R(ACT)= 8.6 ; Z(MOD)= 6030 ; R(MOD)= 12.9

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	400	1600
2	0.375	-	-	-	300	1200
3	0.625	-	-	-	230	920
4	0.875	-	-	-	180	720
5	1.125	-	-	-	130	520
6	1.375	82	27.6	110.4	90	360
7	1.625	186	55.2	220.8	55	220
8	1.875	122	32.8	131.2	35.0	140
9	2.125	65	16.2	64.8	16.2	64.8
10	2.375	16	3.8	15.2	3.8	15.2
11	2.625	5	1.1	4.4	1.1	4.4
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

8 July 74
Begin time: 1819 GMT Sample duration: 120 sec
Z(ACT)= 9510 ; R(ACT)=13.1 ; Z(MOD)= 11220; R(MOD)= 20.1

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	650	2600
2	0.375	-	-	-	500	2000
3	0.625	-	-	-	350	1400
4	0.875	-	-	-	250	1000
5	1.125	-	-	-	170	680
6	1.375	91	30.6	122.4	120	480
7	1.625	208	61.7	246.8	80	320
8	1.875	142	38.2	152.8	45	180
9	2.125	114	28.4	113.6	28.4	113.6
10	2.375	38	8.9	35.6	8.9	35.6
11	2.625	19	4.2	16.8	4.2	16.8
12	2.875	6	1.3	5.2	1.3	5.2
13	3.125	1	0.2	0.8	0.2	0.8
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

Table B-1. Drop Distribution Obtained on Board NOAA Ship "Researcher" (continued)

8 July 74
Begin time: 1821 GMT; Sample duration: 120 sec
Z(ACT)= 19940; R(ACT)= 23.1; Z(MOD)= 24680; R(MOD)= 40.9

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1500	6000
2	0.375	-	-	-	1200	4800
3	0.625	-	-	-	800	3200
4	0.875	-	-	-	600	2400
5	1.125	-	-	-	400	1600
6	1.375	107	36.0	144	250	1000
7	1.625	271	80.4	321.6	130	520
8	1.875	209	56.3	225.2	85	340
9	2.125	194	48.4	193.6	48.4	193.6
10	2.375	75	17.6	70.4	17.6	70.4
11	2.625	53	11.8	47.2	11.8	47.2
12	2.875	18	3.9	15.6	3.9	15.6
13	3.125	6	1.2	4.8	1.2	4.8
14	3.375	1	0.2	0.8	0.2	0.8
15	3.625	-	-	-	-	-
16	3.875	1	0.2	0.8	0.2	0.8
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

8 July 74
Begin time: 1823 GMT; Sample duration: 120 sec
Z(ACT)= 21970; R(ACT)= 25.8; Z(MOD)= 26150; R(MOD)= 42.4

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1500	6000
2	0.375	-	-	-	1200	4800
3	0.625	-	-	-	800	3200
4	0.875	-	-	-	600	2400
5	1.125	-	-	-	400	1600
6	1.375	125	42.0	168	250	1000
7	1.625	316	93.7	374.8	130	520
8	1.875	233	62.7	250.8	85	340
9	2.125	217	54.1	216.4	54.1	216.4
10	2.375	87	20.4	81.6	20.4	81.6
11	2.625	58	12.9	51.6	12.9	51.6
12	2.875	19	4.1	16.4	4.1	16.4
13	3.125	5	1.0	4.0	1.0	4.0
14	3.375	-	-	-	-	-
15	3.625	1	0.2	0.8	0.2	0.8
16	3.875	1	0.2	0.8	0.2	0.8
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

8 July 74
Begin time: 1825 GMT Sample duration: 120 sec
Z(ACT)=25070 ; R(ACT)= 29.2 ; Z(MOD)= 31900 ; R(MOD)= 52.7

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1500	6000
2	0.375	-	-	-	1200	4800
3	0.625	-	-	-	900	3600
4	0.875	-	-	-	650	2600
5	1.125	-	-	-	450	1800
6	1.375	154	51.7	206.8	300	1200
7	1.625	286	84.8	339.2	200	800
8	1.875	257	69.2	276.8	110	440
9	2.125	279	69.6	278.4	69.6	278.4
10	2.375	107	25.1	100.4	25.1	100.4
11	2.625	56	12.5	50.0	12.5	50.0
12	2.875	22	4.7	18.8	4.7	18.8
13	3.125	5	1.0	4.0	1.0	4.0
14	3.375	3	0.6	2.4	0.6	2.4
15	3.625	-	-	-	-	-
16	3.875	1	0.2	0.8	0.2	0.8
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

8 July 74
Begin time: 1827 GMT; Sample duration: 120 sec
Z(ACT)=32810 ; R(ACT)= 33.1 ; Z(MOD)= 39640 ; R(MOD)= 56.7

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1500	6000
2	0.375	-	-	-	1200	4800
3	0.625	-	-	-	900	3600
4	0.875	-	-	-	650	2600
5	1.125	-	-	-	450	1800
6	1.375	116	39.0	156	300	1200
7	1.625	297	88.1	352.4	200	800
8	1.875	259	69.7	278.8	110	440
9	2.125	266	66.4	265.6	66.4	265.6
10	2.375	114	26.8	107.2	26.8	107.2
11	2.625	78	17.4	69.6	17.4	69.6
12	2.875	34	7.3	29.2	7.3	29.2
13	3.125	15	3.1	12.4	3.1	12.4
14	3.375	6	1.2	4.8	1.2	4.8
15	3.625	4	0.8	3.2	0.8	3.2
16	3.875	1	0.2	0.8	0.2	0.8
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

8 July 74
Begin time: 1829 GMT; Sample duration: 120 sec
Z(ACT)=16050 ; R(ACT)= 18.7 ; Z(MOD)=18230 ; R(MOD)=27.4

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	800	3200
2	0.375	-	-	-	600	2400
3	0.625	-	-	-	450	1800
4	0.875	-	-	-	300	1200
5	1.125	-	-	-	200	800
6	1.375	97	32.6	130.4	150	600
7	1.625	232	68.8	275.2	90	360
8	1.875	186	50.1	200.4	60	240
9	2.125	160	39.9	159.6	39.9	159.6
10	2.375	54	12.7	50.8	12.7	50.8
11	2.625	31	6.9	27.6	6.9	27.6
12	2.875	17	3.6	14.4	3.6	14.4
13	3.125	3	0.6	2.4	0.6	2.4
14	3.375	-	-	-	-	-
15	3.625	2	0.4	1.6	0.4	1.6
16	3.875	1	0.2	0.8	0.2	0.8
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

8 July 74
Begin time: 1831 GMT Sample duration: 120 sec
Z(ACT)= 7080 ; R(ACT)= 10.7; Z(MOD)= 7600 ; R(MOD)= 13.8

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	400	1600
2	0.375	-	-	-	300	1200
3	0.625	-	-	-	230	920
4	0.875	-	-	-	150	600
5	1.125	-	-	-	120	480
6	1.375	100	33.6	134.4	80	320
7	1.625	191	56.6	226.4	50	200
8	1.875	130	35.0	140	35.0	140
9	2.125	86	21.5	86	21.5	86
10	2.375	30	7.0	28	7.0	28
11	2.625	10	2.2	8.8	2.2	8.8
12	2.875	3	0.6	2.4	0.6	2.4
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

Table B-1. Drop Distribution Obtained on Board NOAA Ship "Researcher" (continued)

28 July 74
Begin time: N/A — Sample duration: 120 sec
Z(ACT)= 1160 ; R(ACT)= 1.3 ; Z(MOD)= 1240 ; R(MOD)= 2.1

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	130	520
2	0.375	-	-	-	100	400
3	0.625	-	-	-	70	280
4	0.875	-	-	-	40	160
5	1.125	-	-	-	25	100
6	1.375	19	6.8	27.2	12	48
7	1.625	18	5.3	21.2	6.2	24.8
8	1.875	12	3.2	12.8	3.2	12.8
9	2.125	7	1.8	7.2	1.8	7.2
10	2.375	3	.7	2.8	.7	2.8
11	2.625	2	0.4	1.6	0.4	1.6
12	2.875	2	0.4	1.6	0.4	1.6
13	3.125	1	0.2	0.8	0.2	0.8
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

28 July 74
Begin time: N/A — Sample duration: 120 sec
Z(ACT)= 7480 ; R(ACT)= 5.0 ; Z(MOD)= 8680 ; R(MOD)=11.2

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	400	1600
2	0.375	-	-	-	330	1320
3	0.625	-	-	-	260	1040
4	0.875	-	-	-	180	720
5	1.125	-	-	-	130	520
6	1.375	21	7.1	28.4	70	280
7	1.625	33	9.8	39.2	40	160
8	1.875	25	6.7	26.8	15	60
9	2.125	25	6.2	24.8	6.2	24.8
10	2.375	11	2.6	10.4	2.6	10.4
11	2.625	8	1.8	7.2	1.8	7.2
12	2.875	11	2.4	9.6	2.4	9.6
13	3.125	5	1.0	4.0	1.0	4.0
14	3.375	4	0.8	3.2	0.8	3.2
15	3.625	3	0.6	2.4	0.6	2.4
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

28 July 74
Begin time: N/A — Sample duration: 120 sec
Z(ACT)= 4160 ; R(ACT)=4.4 ; Z(MOD)= 8920 ; R(MOD)= 21.6

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	750	3000
2	0.375	-	-	-	580	2320
3	0.625	-	-	-	500	2000
4	0.875	-	-	-	480	1920
5	1.125	-	-	-	270	1080
6	1.375	27	9.1	36.4	180	720
7	1.625	52	15.4	61.6	100	400
8	1.875	50	13.5	54.0	50	200
9	2.125	37	9.2	36.8	9.2	36.8
10	2.375	9	2.1	8.4	2.1	8.4
11	2.625	4	0.9	3.6	0.9	3.6
12	2.875	3	0.6	2.4	0.6	2.4
13	3.125	4	0.8	3.2	0.8	3.2
14	3.375	1	0.2	0.8	0.2	0.8
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

28 July 74
Begin time: N/A — Sample duration: 120 sec
Z(ACT)= 890 ; R(ACT)= 1.2 ; Z(MOD)= 1330 ; R(MOD)= 3.1

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	200	800
2	0.375	-	-	-	160	640
3	0.625	-	-	-	120	480
4	0.875	-	-	-	80	320
5	1.125	-	-	-	50	200
6	1.375	24	8.1	32.4	22	88
7	1.625	16	4.7	18.8	11	44
8	1.875	11	3.0	12.0	5.8	23.2
9	2.125	11	2.7	10.8	2.7	10.8
10	2.375	2	0.5	2.0	0.5	2.0
11	2.625	2	0.4	1.6	0.4	1.6
12	2.875	1	0.2	0.8	0.2	0.8
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

28 July 74
Begin time: N/A — Sample duration: 120 sec
Z(ACT)= 5530 ; R(ACT)= 5.5 ; Z(MOD)= 9920 ; R(MOD)= 21.3

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	750	3000
2	0.375	-	-	-	580	2320
3	0.625	-	-	-	500	2000
4	0.875	-	-	-	480	1920
5	1.125	-	-	-	270	1080
6	1.375	64	21.5	86.0	180	720
7	1.625	82	24.3	97.2	100	400
8	1.875	54	14.5	58.0	50	200
9	2.125	30	7.5	30.0	7.5	30.0
10	2.375	7	1.6	6.4	1.6	6.4
11	2.625	5	1.1	4.4	1.1	4.4
12	2.875	7	1.5	6.0	1.5	6.0
13	3.125	6	1.2	4.8	1.2	4.8
14	3.375	2	0.4	1.6	0.4	1.6
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

28 July 74
Begin time: N/A — Sample duration: 120 sec
Z(ACT)= 6070 ; R(ACT)=6.9 ; Z(MOD)= 11600 ; R(MOD)= 27.6

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1300	5200
2	0.375	-	-	-	999	3996
3	0.625	-	-	-	870	3480
4	0.875	-	-	-	706	2800
5	1.125	-	-	-	400	1600
6	1.375	80	26.9	107.6	230	920
7	1.625	99	29.4	117.6	120	480
8	1.875	65	17.5	70.0	55	220
9	2.125	50	12.5	50.0	12.5	50
10	2.375	18	4.2	16.8	4.2	16.8
11	2.625	9	2.0	8.0	2.0	8.0
12	2.875	6	1.3	5.2	1.3	5.2
13	3.125	2	0.4	1.6	0.4	1.6
14	3.375	2	0.4	1.6	0.4	1.6
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

Table B-1. Drop Distribution Obtained on Board NOAA Ship "Researcher" (continued)

28 July 74
Begin time: N/A Sample duration: 120 sec
Z(ACT)= 690 ; R(ACT)= 1.7 ; Z(MOD)= 1010 ; R(MOD)= 4.4

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	850	3400
2	0.375	-	-	-	600	2400
3	0.625	-	-	-	420	1680
4	0.875	-	-	-	230	920
5	1.125	-	-	-	100	400
6	1.375	94	31.6	126.4	27	108
7	1.625	50	14.8	59.2	14.8	59.2
8	1.875	14	3.8	15.2	3.8	15.2
9	2.125	1	0.2	0.8	0.2	0.8
10	2.375	1	0.2	0.8	0.2	0.8
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

28 July 74
Begin time: N/A Sample duration: 120 sec
Z(ACT)= 310 ; R(ACT)= 0.8 ; Z(MOD)= 750 ; R(MOD)= 3.8

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	850	3400
2	0.375	-	-	-	600	2400
3	0.625	-	-	-	420	1680
4	0.875	-	-	-	230	920
5	1.125	-	-	-	100	400
6	1.375	34	11.4	45.6	27	108
7	1.625	24	7.1	28.4	7.1	28.4
8	1.875	7	1.9	7.6	1.9	7.6
9	2.125	1	0.2	0.8	0.2	0.8
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

28 July 74
Begin time: N/A Sample duration: 120 sec
Z(ACT)= 620 ; R(ACT)= 1.4 ; Z(MOD)= 980 ; R(MOD)= 4.2

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	850	3400
2	0.375	-	-	-	600	2400
3	0.625	-	-	-	420	1680
4	0.875	-	-	-	230	920
5	1.125	-	-	-	100	400
6	1.375	73	24.5	98.0	27	108
7	1.625	31	9.2	36.8	9.2	36.8
8	1.875	12	3.2	12.8	3.2	12.8
9	2.125	7	1.8	7.2	1.8	7.2
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

28 July 74
Begin time: N/A Sample duration: 120 sec
Z(ACT)= 8260 ; R(ACT)= 9.8 ; Z(MOD)= 11730 ; R(MOD)= 27.9

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1300	5200
2	0.375	-	-	-	999	3996
3	0.625	-	-	-	870	3480
4	0.875	-	-	-	700	2800
5	1.125	-	-	-	400	1600
6	1.375	163	54.8	219.2	230	920
7	1.625	185	54.9	219.6	120	480
8	1.875	90	24.2	96.8	55	220
9	2.125	81	20.2	80.8	20.2	80.8
10	2.375	8	1.9	7.6	1.9	7.6
11	2.625	4	0.9	3.6	0.9	3.6
12	2.875	4	0.9	3.6	0.9	3.6
13	3.125	6	1.2	4.8	1.2	4.8
14	3.375	1	0.2	0.8	0.2	0.8
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

28 July 74
Begin time: N/A Sample duration: 120 sec
Z(ACT)= 3810 ; R(ACT)= 5.4 ; Z(MOD)= 8840 ; R(MOD)= 23.4

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	999	3996
2	0.375	-	-	-	870	3480
3	0.625	-	-	-	700	2800
4	0.875	-	-	-	540	2160
5	1.125	-	-	-	390	1560
6	1.375	150	50.4	201.6	220	880
7	1.625	131	38.8	155.2	120	480
8	1.875	52	14.0	56.0	45	180
9	2.125	22	5.5	22.0	5.5	22.0
10	2.375	1	0.2	0.8	0.2	0.8
11	2.625	-	-	-	-	-
12	2.875	3	0.6	2.4	0.6	2.4
13	3.125	5	1.0	4.0	1.0	4.0
14	3.375	1	0.2	0.8	0.2	0.8
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

28 July 74
Begin time: N/A Sample duration: 120 sec
Z(ACT)= 830 ; R(ACT)= 2.0 ; Z(MOD)= 1770 ; R(MOD)= 7.3

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	650	2600
2	0.375	-	-	-	520	2080
3	0.625	-	-	-	400	1600
4	0.875	-	-	-	260	1040
5	1.125	-	-	-	180	720
6	1.375	74	24.9	99.6	90	360
7	1.625	74	21.9	87.6	21.9	87.6
8	1.875	20	5.4	21.6	5.4	21.6
9	2.125	1	0.2	0.8	0.2	0.8
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

Table B-1. Drop Distribution Obtained on Board NOAA Ship "Researcher" (continued)

28 July 74
Begin time: N/A Sample duration: 120 sec
Z(ACT)= 110 ; R(ACT)= 0.2 ; Z(MOD)= 220 ; R(MOD)= 1.3

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	300	1200
2	0.375	-	-	-	220	880
3	0.625	-	-	-	150	600
4	0.875	-	-	-	90	360
5	1.125	-	-	-	45	180
6	1.375	21	7.1	28.4	7.1	28.4
7	1.625	1	0.3	1.2	0.3	1.2
8	1.875	-	-	-	-	-
9	2.125	-	-	-	-	-
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

28 July 74
Begin time: N/A Sample duration: 120 sec
Z(ACT)= 100 ; R(ACT)= 0.3 ; Z(MOD)= 220 ; R(MOD)= 1.3

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	300	1200
2	0.375	-	-	-	220	880
3	0.625	-	-	-	150	600
4	0.875	-	-	-	90	360
5	1.125	-	-	-	45	180
6	1.375	17	5.7	22.8	5.7	22.8
7	1.625	7	2.1	8.4	2.1	8.4
8	1.875	2	0.5	2.0	0.5	2.0
9	2.125	-	-	-	-	-
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

28 July 74
Begin time: N/A Sample duration: 120 sec
Z(ACT)= 200 ; R(ACT)= 0.5 ; Z(MOD)= 510 ; R(MOD)= 3.3

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	950	3800
2	0.375	-	-	-	750	3000
3	0.625	-	-	-	500	2000
4	0.875	-	-	-	240	960
5	1.125	-	-	-	100	400
6	1.375	34	11.4	45.6	11.4	45.6
7	1.625	8	2.4	9.6	2.4	9.6
8	1.875	4	1.1	4.4	1.1	4.4
9	2.125	-	-	-	-	-
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

28 July 74
Begin time: N/A Sample duration: 120 sec
Z(ACT)= 560 ; R(ACT)= 0.4 ; Z(MOD)= 440 ; R(MOD)= 3.2

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	950	3800
2	0.375	-	-	-	750	3000
3	0.625	-	-	-	500	2000
4	0.875	-	-	-	240	960
5	1.125	-	-	-	100	400
6	1.375	34	11.4	45.6	11.4	45.6
7	1.625	2	0.6	2.4	0.6	2.4
8	1.875	1	0.3	1.2	0.3	1.2
9	2.125	-	-	-	-	-
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

28 July 74
Begin time: N/A Sample duration: 120 sec
Z(ACT)= 500 ; R(ACT)= 0.2 ; Z(MOD)= 370 ; R(MOD)= 2.9

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	950	3800
2	0.375	-	-	-	750	3000
3	0.625	-	-	-	500	2000
4	0.875	-	-	-	240	960
5	1.125	-	-	-	100	400
6	1.375	12	4.0	16.0	4.0	16.0
7	1.625	1	0.3	1.2	0.3	1.2
8	1.875	-	-	-	-	-
9	2.125	-	-	-	-	-
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

28 July 74
Begin time: N/A Sample duration: 120 sec
Z(ACT)= 840 ; R(ACT)= 0.6 ; Z(MOD)= 2300 ; R(MOD)= 9.8

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	950	3800
2	0.375	-	-	-	750	3000
3	0.625	-	-	-	600	2400
4	0.875	-	-	-	400	1600
5	1.125	-	-	-	220	880
6	1.375	22	7.4	29.6	110	440
7	1.625	4	1.2	4.8	43	172
8	1.875	7	1.9	7.6	1.9	7.6
9	2.125	1	0.2	0.8	0.2	0.8
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

Table B-1. Drop Distribution Obtained on Board NOAA Ship "Researcher" (continued)

Drop size category	Midpoint diameter (mm)	ACTUAL			MODIFIED	
		no.	number $m^{-3}(\Delta D)^{-1}$	number $m^{-3}mm^{-1}$	number $m^{-3}(\Delta D)^{-1}$	number $m^{-3}mm^{-1}$
28 July 74 Begin time: N/A Sample duration: 120 sec Z(ACT)= 150 ; R(ACT)= 0.4 ; Z(MOD)= 1260 ; R(MOD)= 6.9						
1	0.125	-	-	-	950	3800
2	0.375	-	-	-	750	3000
3	0.625	-	-	-	600	2400
4	0.875	-	-	-	400	1600
5	1.125	-	-	-	220	880
6	1.375	17	5.7	22.8	70	280
7	1.625	12	3.6	14.4	3.6	14.4
8	1.875	1	0.3	1.2	0.3	1.2
9	2.125	2	0.5	2.0	0.5	2.0
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

Table B-1. Drop Distribution Obtained on Board NOAA Ship "Researcher" (continued)

2 August 74
Begin time: 2126 GMT; Sample duration: 120 sec
Z(ACT)= 260; R(ACT)= 0.6 ; Z(MOD)= 1790 ; R(MOD)= 8.4

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1300	5200
2	0.375	-	-	-	999	3996
3	0.625	-	-	-	800	3200
4	0.875	-	-	-	500	2000
5	1.125	-	-	-	200	800
6	1.375	15	5.0	20.0	70	280
7	1.625	13	3.8	15.2	17	68
8	1.875	12	3.2	12.8	3.2	12.8
9	2.125	1	0.2	0.8	0.2	0.8
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

2 August 74
Begin time: 2128 GMT; Sample duration: 120 sec
Z(ACT)= 48; R(ACT)= 0.1 ; Z(MOD)= 110 ; R(MOD)= 0.7

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	350	1400
2	0.375	-	-	-	250	1000
3	0.625	-	-	-	120	480
4	0.875	-	-	-	50	200
5	1.125	-	-	-	17	68
6	1.375	7	2.3	9.2	2.3	9.2
7	1.625	2	0.6	2.4	0.6	2.4
8	1.875	2	0.5	2.0	0.5	2.0
9	2.125	-	-	-	-	-
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

2 August 74
Begin time: 2130 GMT Sample duration: 120 sec
Z(ACT)= 740 ; R(ACT)= 1.7 ; Z(MOD)= 1780 ; R(MOD)= 8.4

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1300	5200
2	0.375	-	-	-	999	3996
3	0.625	-	-	-	800	3200
4	0.875	-	-	-	500	2000
5	1.125	-	-	-	200	800
6	1.375	49	16.5	66.0	70	280
7	1.625	58	17.2	68.8	17.2	68.8
8	1.875	18	4.8	19.2	4.8	19.2
9	2.125	3	0.8	3.2	0.8	3.2
10	2.375	1	0.2	0.8	0.2	0.8
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

2 August 74
Begin time: 2132 GMT; Sample duration: 120 sec
Z(ACT)= 1050 ; R(ACT)= 2.0 ; Z(MOD)= 1950; R(MOD)= 8.6

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1300	5200
2	0.375	-	-	-	999	3996
3	0.625	-	-	-	800	3200
4	0.875	-	-	-	500	2000
5	1.125	-	-	-	200	800
6	1.375	61	20.5	82.0	70	280
7	1.625	59	17.5	70.0	17.5	70
8	1.875	16	4.3	17.2	4.3	17.2
9	2.125	8	2.0	8.0	2.0	8.0
10	2.375	1	0.2	0.8	0.2	0.8
11	2.625	1	0.2	0.8	0.2	0.8
12	2.875	1	0.2	0.8	0.2	0.8
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

2 August 74
Begin time: 2134 GMT; Sample duration: 120 sec
Z(ACT)= 200 ; R(ACT)= 0.6 ; Z(MOD)= 440 ; R(MOD)= 2.2

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	550	2200
2	0.375	-	-	-	400	1600
3	0.625	-	-	-	240	960
4	0.875	-	-	-	120	480
5	1.125	-	-	-	55	220
6	1.375	33	11.1	44.4	20	80
7	1.625	17	5.0	20.0	5.0	20
8	1.875	3	0.8	3.2	0.8	3.2
9	2.125	-	-	-	-	-
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

2 August 74
Begin time: 2136 GMT Sample duration: 120 sec
Z(ACT)= 290 ; R(ACT)= 0.8 ; Z(MOD)= 500 ; R(MOD)= 2.2

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	450	1800
2	0.375	-	-	-	320	1280
3	0.625	-	-	-	200	800
4	0.875	-	-	-	100	400
5	1.125	-	-	-	40	160
6	1.375	29	9.7	38.8	20	80
7	1.625	29	8.6	34.4	8.6	34.4
8	1.875	6	1.6	6.4	1.6	6.4
9	2.125	-	-	-	-	-
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

Table B-1. Drop Distribution Obtained on Board NOAA Ship "Researcher" (continued)

2 August 74
Begin time: 2138 GMT; Sample duration: 120 sec
Z(ACT)= 170 ; R(ACT)= 0.4 ; Z(MOD)= 360 ; R(MOD)= 1.8

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	450	1800
2	0.375	-	-	-	320	1280
3	0.625	-	-	-	200	800
4	0.875	-	-	-	100	400
5	1.125	-	-	-	40	160
6	1.375	15	5.0	20.0	12.0	48.0
7	1.625	15	4.4	17.6	4.4	17.6
8	1.875	5	1.3	5.2	1.3	5.2
9	2.125	-	-	-	-	-
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

2 August 74
Begin time: 2140 GMT; Sample duration: 120 sec
Z(ACT)= 1030; R(ACT)= 2.1; Z(MOD)= 2280 ; R(MOD)= 9.5

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1200	4800
2	0.375	-	-	-	999	3996
3	0.625	-	-	-	700	2800
4	0.875	-	-	-	450	1800
5	1.125	-	-	-	230	920
6	1.375	61	20.5	82.0	100	400
7	1.625	65	19.3	77.2	19.3	77.2
8	1.875	22	5.9	23.6	5.9	23.6
9	2.125	5	1.2	4.8	1.2	4.8
10	2.375	1	0.2	0.8	0.2	0.8
11	2.625	2	0.4	1.6	0.4	1.6
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

2 August 74
Begin time: 2142 GMT Sample duration: 120 sec
Z(ACT)= 1860 ; R(ACT)= 4.1 ; Z(MOD)= 2960 ; R(MOD)= 11.0

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1200	4800
2	0.375	-	-	-	999	3996
3	0.625	-	-	-	700	2800
4	0.875	-	-	-	450	1800
5	1.125	-	-	-	230	920
6	1.375	129	43.3	173.2	100	400
7	1.625	141	41.8	167.2	41.8	167.2
8	1.875	34	9.2	36.8	9.2	36.8
9	2.125	11	2.7	10.8	2.7	10.8
10	2.375	1	0.2	0.8	0.2	0.8
11	2.625	-	-	-	-	-
12	2.875	1	0.2	0.8	0.2	0.8
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

2 August 74
Begin time: 2144 GMT; Sample duration: 120 sec
Z(ACT)= 1080; R(ACT)= 2.2 ; Z(MOD)= 2310 ; R(MOD)= 9.6

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1200	4800
2	0.375	-	-	-	999	3996
3	0.625	-	-	-	700	2800
4	0.875	-	-	-	450	1800
5	1.125	-	-	-	230	920
6	1.375	71	23.8	95.2	100	400
7	1.625	75	22.2	88.8	22.2	88.8
8	1.875	17	4.6	18.4	4.6	18.4
9	2.125	2	0.5	2.0	0.5	2.0
10	2.375	1	0.2	0.8	0.2	0.8
11	2.625	3	0.7	2.8	0.7	2.8
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

2 August 74
Begin time: 2146 GMT; Sample duration: 120 sec
Z(ACT)= 1180 ; R(ACT)= 2.4 ; Z(MOD)= 1950 ; R(MOD)= 7.5

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	999	3996
2	0.375	-	-	-	900	3600
3	0.625	-	-	-	600	2400
4	0.875	-	-	-	380	1520
5	1.125	-	-	-	150	600
6	1.375	67	22.5	90.0	60	240
7	1.625	63	18.7	74.8	18.7	74.8
8	1.875	32	8.6	34.4	8.6	34.4
9	2.125	7	1.8	7.2	1.8	7.2
10	2.375	2	0.5	2.0	0.5	2.0
11	2.625	1	0.2	0.8	0.2	0.8
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

2 August 74
Begin time: 2148 GMT Sample duration: 120 sec
Z(ACT)= 830 ; R(ACT)= 1.9 ; Z(MOD)= 1590 ; R(MOD)= 7.0

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	999	3996
2	0.375	-	-	-	900	3600
3	0.625	-	-	-	600	2400
4	0.875	-	-	-	380	1520
5	1.125	-	-	-	150	600
6	1.375	69	23.2	92.8	60	240
7	1.625	54	16.0	64.0	16.0	64.0
8	1.875	24	6.5	26.0	6.5	26.0
9	2.125	4	1.0	4.0	1.0	4.0
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

Table B-1. Drop Distribution Obtained on Board NOAA Ship "Researcher" (continued)

2 August 74
Begin time: 2150 GMT; Sample duration: 120 sec
Z(ACT)= 680 ; R(ACT)= 1.7 ; Z(MOD)= 1460 ; R(MOD)= 6.8

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	999	3996
2	0.375	-	-	-	900	3600
3	0.625	-	-	-	600	2400
4	0.875	-	-	-	380	1520
5	1.125	-	-	-	150	600
6	1.375	61	20.5	82.0	60	240
7	1.625	60	17.8	71.2	17.8	71.2
8	1.875	14	3.8	15.2	3.8	15.2
9	2.125	2	0.5	2.0	0.5	2.0
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

2 August 74
Begin time: 2152 GMT; Sample duration: 120 sec
Z(ACT)= 700 ; R(ACT)= 1.7 ; Z(MOD)= 1480 ; R(MOD)= 6.8

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	999	3996
2	0.375	-	-	-	900	3600
3	0.625	-	-	-	600	2400
4	0.875	-	-	-	380	1520
5	1.125	-	-	-	150	600
6	1.375	61	20.5	82.0	60	240
7	1.625	54	16.0	64.0	16.0	64.0
8	1.875	15	4.0	16.0	4.0	16.0
9	2.125	4	1.0	4.0	1.0	4.0
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

2 August 74
Begin time: 2154 GMT Sample duration: 120 sec
Z(ACT)= 530 ; R(ACT)= 1.1 ; Z(MOD)= 800 ; R(MOD)= 2.9

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	550	2200
2	0.375	-	-	-	400	1600
3	0.625	-	-	-	230	920
4	0.875	-	-	-	120	480
5	1.125	-	-	-	60	240
6	1.375	44	14.8	59.2	27	108
7	1.625	21	6.2	24.8	6.2	24.8
8	1.875	15	4.0	16.0	4.0	16.0
9	2.125	6	1.5	6.0	1.5	6.0
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

2 August 74
Begin time: 2156 GMT; Sample duration: 120 sec
Z(ACT)= 360 ; R(ACT)= 0.9 ; Z(MOD)= 660 ; R(MOD)= 2.8

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	550	2200
2	0.375	-	-	-	400	1600
3	0.625	-	-	-	230	920
4	0.875	-	-	-	120	480
5	1.125	-	-	-	60	240
6	1.375	33	11.1	44.4	27.0	108
7	1.625	28	8.3	33.2	8.3	33.2
8	1.875	11	3.0	12.0	3.0	12.0
9	2.125	-	-	-	-	-
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

2 August 74
Begin time: 2158 GMT; Sample duration: 120 sec
Z(ACT)= 380 ; R(ACT)= 0.9 ; Z(MOD)= 660 ; R(MOD)= 2.8

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	550	2200
2	0.375	-	-	-	400	1600
3	0.625	-	-	-	230	920
4	0.875	-	-	-	120	480
5	1.125	-	-	-	60	240
6	1.375	41	13.8	55.2	27.0	108
7	1.625	28	8.3	33.2	8.3	33.2
8	1.875	6	1.6	6.4	1.6	6.4
9	2.125	3	0.8	3.2	0.8	3.2
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

Table B-1. Drop Distribution Obtained on Board NOAA Ship "Researcher" (continued)

18 Aug 74
Begin time: 0750 GMT; Sample duration: 120 sec
Z(ACT)= 3370; R(ACT)= 5.0 ; Z(MOD)=10680 ; R(MOD)= 29.6

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1200	4800
2	0.375	-	-	-	1000	4000
3	0.625	-	-	-	850	3400
4	0.875	-	-	-	650	2600
5	1.125	-	-	-	450	1800
6	1.375	43	14.4	57.6	300	1200
7	1.625	90	26.7	106.8	130	520
8	1.875	52	14.0	56.0	65	260
9	2.125	51	12.7	50.8	12.7	50.8
10	2.375	11	2.6	10.4	2.6	10.4
11	2.625	6	1.3	5.2	1.3	5.2
12	2.875	1	0.2	0.8	0.2	0.8
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

18 Aug 74
Begin time: 0752 GMT; Sample duration: 120 sec
Z(ACT)= 3780 ; R(ACT)= 5.6 ; Z(MOD)=10900 ; R(MOD)= 29.8

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1200	4800
2	0.375	-	-	-	1000	4000
3	0.625	-	-	-	850	3400
4	0.875	-	-	-	650	2600
5	1.125	-	-	-	450	1800
6	1.375	47	15.8	63.2	300	1200
7	1.625	109	32.3	129.2	130	520
8	1.875	58	15.6	62.4	65	260
9	2.125	44	11.0	44.0	11.0	44.0
10	2.375	18	4.2	16.8	4.2	16.8
11	2.625	7	1.6	6.4	1.6	6.4
12	2.875	1	0.2	0.8	0.2	0.8
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

18 Aug 74
Begin time: 0754 GMT Sample duration: 120 sec
Z(ACT)= 3490 ; R(ACT)= 5.5 ; Z(MOD)= 10460 ; R(MOD)= 29.2

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1200	4800
2	0.375	-	-	-	1000	4000
3	0.625	-	-	-	850	3400
4	0.875	-	-	-	650	2600
5	1.125	-	-	-	450	1800
6	1.375	91	30.6	122.4	300	1200
7	1.625	110	32.6	130.4	130	520
8	1.875	62	16.7	66.8	65	260
9	2.125	33	8.2	32.8	8.2	32.8
10	2.375	17	4.0	16.0	4.0	16.0
11	2.625	4	0.9	3.6	0.9	3.6
12	2.875	-	-	-	-	-
13	3.125	1	0.2	0.8	0.2	0.8
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

18 Aug 74
Begin time: 0756 GMT; Sample duration: 120 sec
Z(ACT)= 7410 ; R(ACT)= 10.0 ; Z(MOD)=13620 ; R(MOD)= 32.1

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1200	4800
2	0.375	-	-	-	1000	4000
3	0.625	-	-	-	850	8400
4	0.875	-	-	-	650	2600
5	1.125	-	-	-	450	1800
6	1.375	119	40.0	160	300	1200
7	1.625	159	47.1	188.4	130	520
8	1.875	100	26.7	106.8	65	260
9	2.125	73	18.2	72.8	18.2	73.8
10	2.375	23	5.4	21.6	5.4	21.6
11	2.625	16	3.6	14.4	3.6	14.4
12	2.875	6	1.3	5.2	1.3	5.2
13	3.125	3	0.6	2.4	0.6	2.4
14	3.375	-	-	-	-	
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

18 Aug 74
Begin time: 0758 GMT; Sample duration: 120 sec
Z(ACT)= 5810 ; R(ACT)= 9.7 ; Z(MOD)= 8430 ; R(MOD)=20.6

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	800	3200
2	0.375	-	-	-	660	2640
3	0.625	-	-	-	540	2160
4	0.875	-	-	-	400	1600
5	1.125	-	-	-	300	1200
6	1.375	147	49.4	197.6	170	680
7	1.625	175	51.9	207.6	85	340
8	1.875	135	36.3	145.2	45	180
9	2.125	75	18.7	74.8	18.7	74.8
10	2.375	16	3.8	15.2	3.8	15.2
11	2.625	6	1.3	5.2	1.3	5.2
12	2.875	1	0.2	0.8	0.2	0.8
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

18 Aug 74
Begin time: 0800 GMT Sample duration: 120 sec
Z(ACT)= 3730 ; R(ACT)= 5.2 ; Z(MOD)= 3470 ; R(MOD)= 9.1

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	500	2000
2	0.375	-	-	-	400	1600
3	0.625	-	-	-	300	1200
4	0.875	-	-	-	210	840
5	1.125	-	-	-	130	520
6	1.375	144	48.4	193.6	80	320
7	1.625	101	30.0	120	30.0	120
8	1.875	66	17.8	71.2	17.8	71.2
9	2.125	29	7.2	28.8	7.2	28.8
10	2.375	7	1.6	6.4	1.6	6.4
11	2.625	2	0.4	1.6	0.4	1.6
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

Table B-1. Drop Distribution Obtained on Board NOAA Ship "Researcher" (continued)

18 August 74
Begin time: 0802 GMT; Sample duration: 120 sec
Z(ACT)= 4750 ; R(ACT)= 7.7 ; Z(MOD)= 8240 ; R(MOD)= 20.3

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	800	3200
2	0.375	-	-	-	660	2640
3	0.625	-	-	-	540	2160
4	0.875	-	-	-	400	1600
5	1.125	-	-	-	300	1200
6	1.375	146	49.0	196	170	680
7	1.625	126	37.4	149.6	85	340
8	1.875	84	22.6	90.4	45	180
9	2.125	58	14.5	58.0	14.5	58.0
10	2.375	21	4.9	19.6	4.9	19.6
11	2.625	6	1.3	5.2	1.3	5.2
12	2.875	1	0.2	0.8	0.2	0.8
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

18 August 74
Begin time: 0804 GMT; Sample duration: 120 sec
Z(ACT)= 14990; R(ACT)= 19.6 ; Z(MOD)=27460 ; R(MOD)= 58.3

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1500	6000
2	0.375	-	-	-	1300	5200
3	0.625	-	-	-	1000	4000
4	0.875	-	-	-	850	3400
5	1.125	-	-	-	620	2480
6	1.375	153	51.4	205.6	450	1800
7	1.625	238	70.6	282.4	280	1120
8	1.875	197	53.0	212.0	150	600
9	2.125	167	41.7	246.8	41.7	246.8
10	2.375	72	16.9	67.6	16.9	67.6
11	2.625	40	8.9	35.6	8.9	35.6
12	2.875	9	1.9	7.6	1.9	7.6
13	3.125	1	0.2	0.8	0.2	0.8
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

18 August 74
Begin time: 0806 GMT Sample duration: 120 sec
Z(ACT)=19580 ; R(ACT)= 23.7; Z(MOD)= 34150; R(MOD)= 64.1

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1500	6000
2	0.375	-	-	-	1300	5200
3	0.625	-	-	-	1000	4000
4	0.875	-	-	-	850	3400
5	1.125	-	-	-	620	2480
6	1.375	125	42.0	168.0	450	1800
7	1.625	195	57.8	231.2	280	1120
8	1.875	194	52.2	208.8	150	600
9	2.125	239	59.6	238.4	59.6	238.4
10	2.375	111	26.1	104.4	26.1	104.4
11	2.625	52	11.6	46.4	11.6	46.4
12	2.875	15	3.2	12.8	3.2	12.8
13	3.125	1	0.2	0.8	0.2	0.8
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

18 August 74
Begin time: 0808 GMT; Sample duration: 120 sec
Z(ACT)= 6030; R(ACT)= 8.6 ; Z(MOD)=13730 ; R(MOD)= 34.5

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1400	5600
2	0.375	-	-	-	1200	4800
3	0.625	-	-	-	950	3800
4	0.875	-	-	-	700	2800
5	1.125	-	-	-	540	1800
6	1.375	166	55.8	223.2	300	1200
7	1.625	110	32.6	130.4	150	600
8	1.875	60	16.2	64.8	70	280
9	2.125	76	19.0	76.0	19.0	76.0
10	2.375	31	7.3	29.2	7.3	29.2
11	2.625	11	2.4	9.6	2.4	9.6
12	2.875	4	0.9	3.6	0.9	3.6
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

18 August 74
Begin time: 0810 GMT; Sample duration: 120 sec
Z(ACT)= 1580; R(ACT)= 3.7 ; Z(MOD)= 3070 ; R(MOD)= 13.8

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1400	5600
2	0.375	-	-	-	1200	4800
3	0.625	-	-	-	950	3800
4	0.875	-	-	-	700	2800
5	1.125	-	-	-	450	1800
6	1.375	208	70.0	280.0	100	400
7	1.625	98	29.1	116.4	29.1	116.4
8	1.875	16	4.3	17.2	4.3	17.2
9	2.125	3	0.8	3.2	0.8	3.2
10	2.375	3	0.7	2.8	0.7	2.8
11	2.625	3	0.7	2.8	0.7	2.8
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

18 August 74
Begin time: 0812 GMT Sample duration: 120 sec
Z(ACT)= 460 ; R(ACT)= 1.1 ; Z(MOD)= 2260 ; R(MOD)= 12.3

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1400	5600
2	0.375	-	-	-	1200	4800
3	0.625	-	-	-	950	3800
4	0.875	-	-	-	700	2800
5	1.125	-	-	-	450	1800
6	1.375	71	23.9	95.6	100	400
7	1.625	23	6.8	27.2	6.8	27.2
8	1.875	4	1.1	4.4	1.1	4.4
9	2.125	4	1.0	4.0	1.0	4.0
10	2.375	1	0.2	0.8	0.2	0.8
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

Table B-1. Drop Distribution Obtained on Board NOAA Ship "Researcher" (continued)

18 August 74
Begin time: 0814 GMT; Sample duration: 120 sec
Z(ACT)= 290 ; R(ACT)= 0.8 ; Z(MOD)= 2170 ; R(MOD)= 12.2

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1400	5600
2	0.375	-	-	-	1200	4800
3	0.625	-	-	-	950	3800
4	0.875	-	-	-	700	2800
5	1.125	-	-	-	450	1800
6	1.375	40	13.4	53.6	100	400
7	1.625	31	9.2	36.8	9.2	36.8
8	1.875	3	0.8	3.2	0.8	3.2
9	2.125	-	-	-	-	-
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

18 August 74
Begin time: 0816 GMT; Sample duration: 120 sec
Z(ACT)= 300 ; R(ACT)= 0.8 ; Z(MOD)= 2140; R(MOD)= 12.1

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1400	5600
2	0.375	-	-	-	1200	4800
3	0.625	-	-	-	950	3800
4	0.875	-	-	-	700	2800
5	1.125	-	-	-	450	1800
6	1.375	57	19.1	76.4	100	400
7	1.625	22	6.5	26.0	6.5	26.0
8	1.875	-	-	-	-	-
9	2.125	1	0.2	0.8	0.2	0.8
10	2.375	1	0.2	0.8	0.2	0.8
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

18 August 74
Begin time: 0818 GMT Sample duration: 120 sec
Z(ACT)= 750 ; R(ACT)= 1.8 ; Z(MOD)= 1410 ; R(MOD)= 7.8

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1500	6000
2	0.375	-	-	-	1300	5200
3	0.625	-	-	-	1000	4000
4	0.875	-	-	-	540	2160
5	1.125	-	-	-	200	800
6	1.375	131	44.0	176.0	60	240
7	1.625	22	6.5	26.0	6.5	26.0
8	1.875	2	0.5	2.0	0.5	2.0
9	2.125	8	2.0	8.0	2.0	8.0
10	2.375	-	-	-	-	-
11	2.625	2	0.4	1.6	0.4	1.6
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

18 August 74
Begin time: 0820 GMT; Sample duration: 120 sec
Z(ACT)= 630 ; R(ACT)= 1.3 ; Z(MOD)= 4800 ; R(MOD)= 21.6

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1800	7200
2	0.375	-	-	-	1500	6000
3	0.625	-	-	-	1300	5200
4	0.875	-	-	-	1000	4000
5	1.125	-	-	-	600	2400
6	1.375	21	7.1	28.4	250	1000
7	1.625	39	11.6	46.4	55	220
8	1.875	22	5.9	23.6	5.9	23.6
9	2.125	5	1.2	4.8	1.2	4.8
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

18 August 74
Begin time: 0822 GMT; Sample duration: 120 sec
Z(ACT)= 400 ; R(ACT)= 0.9 ; Z(MOD)= 1450 ; R(MOD)= 8.0

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1500	6000
2	0.375	-	-	-	1300	5200
3	0.625	-	-	-	1000	4000
4	0.875	-	-	-	540	2160
5	1.125	-	-	-	200	800
6	1.375	31	10.4	41.6	60	240
7	1.625	31	9.2	36.8	9.2	36.8
8	1.875	10	2.7	10.8	2.7	10.8
9	2.125	2	0.5	2.0	0.5	2.0
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

18 August 74
Begin time: 0824 GMT Sample duration: 120 sec
Z(ACT)= 130 ; R(ACT)= 0.4 ; Z(MOD)= 1150 ; R(MOD)= 7.4

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	1500	6000
2	0.375	-	-	-	1300	5200
3	0.625	-	-	-	1000	4000
4	0.875	-	-	-	540	2160
5	1.125	-	-	-	200	800
6	1.375	46	15.5	62.0	60	240
7	1.625	3	0.9	3.6	0.9	3.6
8	1.875	1	0.3	1.2	0.3	1.2
9	2.125	-	-	-	-	-
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

Table B-1. Drop Distribution Obtained on Board NOAA Ship "Researcher" (continued)

Drop size category	Midpoint diameter (mm)	ACTUAL			MODIFIED	
		no.	number $m^{-3}(\Delta D)^{-1}$	number $m^{-3}mm^{-1}$	number $m^{-3}(\Delta D)^{-1}$	number $m^{-3}mm^{-1}$
18 August 74 Begin time: 0826 GMT; Sample duration: 120 sec Z(ACT)= 100 ; R(ACT)= 0.3 ; Z(MOD)= 1180; R(MOD)= 7.5						
1	0.125	-	-	-	1500	6000
2	0.375	-	-	-	1300	5200
3	0.625	-	-	-	1000	4000
4	0.875	-	-	-	540	2160
5	1.125	-	-	-	200	800
6	1.375	16	5.4	21.6	60	240
7	1.625	12	3.6	14.4	3.6	14.4
8	1.875	-	-	-	-	-
9	2.125	-	-	-	-	-
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

Table B-1. Drop Distribution Obtained on Board NOAA Ship "Researcher" (continued)

4 September 74
Begin time: 1845 GMT; Sample duration: 120 sec
Z(ACT)= 1806; R(ACT)= 2.8 ; Z(MOD)= 3872 ; R(MOD)= 9.8

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	650	2600
2	0.375	-	-	-	450	1800
3	0.625	-	-	-	320	1280
4	0.875	-	-	-	200	800
5	1.125	-	-	-	130	520
6	1.375	33	11.1	44.4	85	340
7	1.625	49	14.5	58.0	45	180
8	1.875	42	11.3	45.2	22	88
9	2.125	21	5.2	20.8	7.0	28.0
10	2.375	6	1.4	5.6	1.4	5.6
11	2.625	2	0.4	1.6	0.4	1.6
12	2.875	1	0.2	0.8	0.2	0.8
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

4 September 74
Begin time: 1847 GMT; Sample duration: 120 sec
Z(ACT)= 892 ; R(ACT)= 1.5; Z(MOD)= 3568 ; R(MOD)= 9.6

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	650	2600
2	0.375	-	-	-	450	1800
3	0.625	-	-	-	320	1280
4	0.875	-	-	-	200	800
5	1.125	-	-	-	130	520
6	1.375	20	6.7	26.8	85	340
7	1.625	32	9.5	38.0	45	180
8	1.875	16	4.3	17.2	22	88
9	2.125	13	3.2	12.8	7.0	28.0
10	2.375	3	0.7	2.8	0.7	2.8
11	2.625	1	0.2	0.8	0.2	0.8
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

4 September 74
Begin time: 1849 GMT Sample duration: 120 sec
Z(ACT)= 1196; R(ACT)= 1.8 ; Z(MOD)= 3730 ; R(MOD)= 9.8

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	650	2600
2	0.375	-	-	-	450	1800
3	0.625	-	-	-	320	1280
4	0.875	-	-	-	200	800
5	1.125	-	-	-	130	520
6	1.375	16	5.4	21.6	85	340
7	1.625	24	7.1	28.4	45	180
8	1.875	13	3.5	14.0	22	88
9	2.125	23	5.7	22.8	7	28.0
10	2.375	7	1.6	6.4	1.6	6.4
11	2.625	1	0.2	0.8	0.2	0.8
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

4 September 74
Begin time: 1851 GMT; Sample duration: 120 sec
Z(ACT)= 1027; R(ACT)= 1.8 ; Z(MOD)= 1750 ; R(MOD)= 4.5

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	300	1200
2	0.375	-	-	-	230	920
3	0.625	-	-	-	150	600
4	0.875	-	-	-	100	400
5	1.125	-	-	-	60	240
6	1.375	23	7.7	30.8	35	140
7	1.625	37	11.0	44.0	20	80
8	1.875	26	7.0	28.0	10	40
9	2.125	19	4.7	18.8	4.7	18.8
10	2.375	1	0.2	0.8	0.2	0.8
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

4 September 74
Begin time: 1853 GMT; Sample duration: 120 sec
Z(ACT)= 1197; R(ACT)= 2.2; Z(MOD)= 1575 ; R(MOD)= 4.3

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	300	1200
2	0.375	-	-	-	230	920
3	0.625	-	-	-	150	600
4	0.875	-	-	-	100	400
5	1.125	-	-	-	60	240
6	1.375	31	10.4	41.6	35	140
7	1.625	58	17.2	68.8	20	80
8	1.875	33	8.9	35.6	10	40
9	2.125	14	3.5	14.0	3.5	14.0
10	2.375	1	0.2	0.8	0.2	0.8
11	2.625	1	0.2	0.8	0.2	0.8
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

4 September 74
Begin time: 1855 GMT Sample duration: 120 sec
Z(ACT)= 1435 ; R(ACT)= 2.5 ; Z(MOD)= 3000 ; R(MOD)= 7.9

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	600	2400
2	0.375	-	-	-	450	1800
3	0.625	-	-	-	300	1200
4	0.875	-	-	-	180	720
5	1.125	-	-	-	110	440
6	1.375	48	16.1	64.4	70	280
7	1.625	63	18.7	74.8	35	140
8	1.875	21	5.6	22.4	15	60
9	2.125	17	4.2	16.8	6	24
10	2.375	7	1.6	6.4	1.6	6.4
11	2.625	1	0.2	0.8	0.2	0.8
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

Table B-1. Drop Distribution Obtained on Board NOAA Ship "Researcher" (continued)

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
4 September 74 Begin time: 1857 GMT; Sample duration: 120 sec Z(ACT)= 2265 ; R(ACT)= 3.6; Z(MOD)= 3280 ; R(MOD)= 8.2						
1	0.125	-	-	-	600	2400
2	0.375	-	-	-	450	1800
3	0.625	-	-	-	300	1200
4	0.875	-	-	-	180	720
5	1.125	-	-	-	110	440
6	1.375	33	11.1	44.4	70	280
7	1.625	68	20.2	80.8	35	140
8	1.875	46	12.4	49.6	15	60
9	2.125	28	7.0	28.0	6	24
10	2.375	8	1.9	7.6	1.9	7.6
11	2.625	4	0.9	3.6	0.9	3.6
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-
4 September 74 Begin time: 1859 GMT; Sample duration: 120 sec Z(ACT)= 1447 ; R(ACT)= 2.5 ; Z(MOD)= 2990 ; R(MOD)= 7.9						
1	0.125	-	-	-	600	2400
2	0.375	-	-	-	450	1800
3	0.625	-	-	-	300	1200
4	0.875	-	-	-	180	720
5	1.125	-	-	-	110	440
6	1.375	44	14.8	59.2	70	280
7	1.625	50	14.8	59.2	35	140
8	1.875	31	8.3	33.2	15	60
9	2.125	16	4.0	16.0	6	24
10	2.375	5	1.2	4.8	1.2	4.8
11	2.625	2	0.4	1.6	0.4	1.6
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	--	--
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

Table B-1. Drop Distribution Obtained on Board NOAA Ship "Researcher" (continued)

16 September 74
Begin time: 1020 GMT; Sample duration: 120 sec
Z(ACT)= 2186; R(ACT)= 3.1 ; Z(MOD)= 3100; R(MOD)= 7.0

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	500	2000
2	0.375	-	-	-	340	1360
3	0.625	-	-	-	250	1000
4	0.875	-	-	-	150	600
5	1.125	-	-	-	100	400
6	1.375	23	7.7	30.8	52	208
7	1.625	47	13.9	55.6	25	100
8	1.875	34	9.2	36.8	12	48
9	2.125	33	8.2	32.8	8.2	32.8
10	2.375	6	1.4	5.6	1.4	5.6
11	2.625	5	1.1	4.4	1.1	4.4
12	2.875	1	0.2	0.8	0.2	0.8
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

16 September 74
Begin time: 1022 GMT; Sample duration: 120 sec
Z(ACT)= 1270 ; R(ACT)= 2.0 ; Z(MOD)= 2680; R(MOD)= 6.7

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	500	2000
2	0.375	-	-	-	340	1360
3	0.625	-	-	-	250	1000
4	0.875	-	-	-	150	600
5	1.125	-	-	-	100	400
6	1.375	9	3.0	12.0	52	208
7	1.625	44	13.0	52.0	25	100
8	1.875	25	6.7	26.8	12	48
9	2.125	18	4.5	18.0	8.2	32.8
10	2.375	3	0.7	2.8	0.7	2.8
11	2.625	1	0.2	0.8	0.2	0.8
12	2.875	1	0.2	0.8	0.2	0.8
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

16 September 74
Begin time: 1024 GMT Sample duration: 120 sec
Z(ACT)= 2025 ; R(ACT)= 2.8 ; Z(MOD)= 3720; R(MOD)= 11.3

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	900	3600
2	0.375	-	-	-	700	2800
3	0.625	-	-	-	480	1920
4	0.875	-	-	-	300	1200
5	1.125	-	-	-	200	800
6	1.375	29	9.7	38.8	100	400
7	1.625	42	12.5	50.0	60	240
8	1.875	28	7.5	30.0	15	60
9	2.125	24	6.0	24.0	4.5	18.0
10	2.375	5	1.2	4.8	1.2	4.8
11	2.625	7	1.6	6.4	1.6	6.4
12	2.875	1	0.2	0.8	0.2	0.8
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

16 September 74
Begin time: 1026 GMT; Sample duration: 120 sec
Z(ACT)= 1390 ; R(ACT)= 2.3 ; Z(MOD)= 3700 ; R(MOD)= 11.2

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	900	3600
2	0.375	-	-	-	700	2800
3	0.625	-	-	-	480	1920
4	0.875	-	-	-	300	1200
5	1.125	-	-	-	200	800
6	1.375	37	12.4	49.6	100	400
7	1.625	49	14.5	58.0	60	240
8	1.875	29	7.8	31.2	15	60
9	2.125	13	3.2	12.8	3.2	12.8
10	2.375	4	0.9	3.6	0.9	3.6
11	2.625	2	0.4	1.6	0.4	1.6
12	2.875	1	0.2	0.8	0.2	0.8
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

16 September 74
Begin time: 1028 GMT; Sample duration: 120 sec
Z(ACT)= 880 ; R(ACT)= 1.3 ; Z(MOD)= 1055; R(MOD)= 2.3

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	200	800
2	0.375	-	-	-	100	400
3	0.625	-	-	-	75	300
4	0.875	-	-	-	50	200
5	1.125	-	-	-	30	120
6	1.375	20	6.7	26.8	15	60
7	1.625	20	5.9	23.6	7.5	30.0
8	1.875	19	5.1	20.4	5.1	20.4
9	2.125	9	2.2	8.8	2.2	8.8
10	2.375	3	0.7	2.8	0.7	2.8
11	2.625	1	0.2	0.8	0.2	0.8
12	2.875	1	0.2	0.8	0.2	0.8
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

16 September 74
Begin time: 1030 GMT Sample duration: 120 sec
Z(ACT)= 2380 ; R(ACT)= 3.8 ; Z(MOD)= 4000 ; R(MOD)= 10.3

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	900	3600
2	0.375	-	-	-	550	2200
3	0.625	-	-	-	400	1600
4	0.875	-	-	-	250	1000
5	1.125	-	-	-	150	600
6	1.375	41	13.8	55.2	80	320
7	1.625	71	21.0	84.0	45	180
8	1.875	50	13.5	54	20	80
9	2.125	31	7.7	30.8	7.7	30.8
10	2.375	9	2.1	8.4	2.1	8.4
11	2.625	3	0.7	2.8	0.7	2.8
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

Table B-1. Drop Distribution Obtained on Board NOAA Ship "Researcher" (continued)

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
16 September 74 Begin time: 1032 GMT; Sample duration: 120 sec Z(ACT)= 1215 ; R(ACT)= 2.3 ; Z(MOD)= 1550; R(MOD)= 4.1						
1	0.125	-	-	-	400	1600
2	0.375	-	-	-	250	1000
3	0.625	-	-	-	160	640
4	0.875	-	-	-	100	400
5	1.125	-	-	-	65	260
6	1.375	54	18.1	72.4	30	120
7	1.625	56	16.6	66.4	20	80
8	1.875	27	7.3	29.2	7.3	29.2
9	2.125	14	3.5	14.0	3.5	14.0
10	2.375	1	0.2	0.8	0.2	0.8
11	2.625	-	-	-	-	-
12	2.875	1	0.2	0.8	0.2	0.8
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-
16 September 74 Begin time: 1034 GMT; Sample duration: 120 sec Z(ACT)= 1730 ; R(ACT)= 3.3 ; Z(MOD)= 1780 ; R(MOD)= 4.4						
1	0.125	-	-	-	400	1600
2	0.375	-	-	-	250	1000
3	0.625	-	-	-	160	640
4	0.875	-	-	-	100	400
5	1.125	-	-	-	65	260
6	1.375	101	33.9	135.6	30	120
7	1.625	85	25.2	100.8	20	80
8	1.875	38	10.2	40.8	10.2	40.8
9	2.125	9	2.2	8.8	2.2	8.8
10	2.375	4	0.9	3.6	0.9	3.6
11	2.625	-	-	-	-	-
12	2.875	2	0.4	1.6	0.4	1.6
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-
16 September 74 Begin time: 1036 GMT Sample duration: 120 sec Z(ACT)= 390 ; R(ACT)= 0.9; Z(MOD)= 280 ; R(MOD)= 1.2						
1	0.125	-	-	-	160	640
2	0.375	-	-	-	120	480
3	0.625	-	-	-	80	320
4	0.875	-	-	-	50	200
5	1.125	-	-	-	30	120
6	1.375	42	14.1	56.4	12	48
7	1.625	26	7.7	30.8	3.5	14.0
8	1.875	6	1.6	6.4	1.6	6.4
9	2.125	2	0.5	2.0	0.5	2.0
10	2.375	1	0.2	0.8	0.2	0.8
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-
16 September 74 Begin time: 1038 GMT; Sample duration: 120 sec Z(ACT)= 170 ; R(ACT)= 0.5 ; Z(MOD)= 230 ; R(MOD)= 0.9						
1	0.125	-	-	-	80	320
2	0.375	-	-	-	50	200
3	0.625	-	-	-	40	160
4	0.875	-	-	-	28	112
5	1.125	-	-	-	18	72
6	1.375	27	9.1	36.4	10	40
7	1.625	13	3.9	15.6	3.9	15.6
8	1.875	2	0.5	2.0	0.5	2.0
9	2.125	1	0.2	0.8	0.2	0.8
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

Table B-1. Drop Distribution Obtained on Board NOAA Ship "Researcher" (continued)

16 Sept 74
Begin time: 1112 GMT; Sample duration: 120 sec
Z(ACT)= 339 ; R(ACT)= 0.9 ; Z(MOD)= 403 ; R(MOD)= 1.3

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(AD)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(AD)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	60	240
2	0.375	-	-	-	50	200
3	0.625	-	-	-	40	160
4	0.875	-	-	-	30	120
5	1.125	-	-	-	24	96
6	1.375	45	15.1	60.4	15.1	60.4
7	1.625	25	7.4	29.6	7.4	29.6
8	1.875	7	1.9	7.6	1.9	7.6
9	2.125	1	0.2	0.8	0.2	0.8
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

16 Sept 74
Begin time: 1114 GMT; Sample duration: 120 sec
Z(ACT)= 407 ; R(ACT)= 1.1 ; Z(MOD)= 501 ; R(MOD)= 1.8

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(AD)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(AD)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	95	380
2	0.375	-	-	-	96	304
3	0.625	-	-	-	62	248
4	0.875	-	-	-	46	184
5	1.125	-	-	-	34	136
6	1.375	67	22.5	90	22.5	90.0
7	1.625	34	10.1	40.4	10.1	40.4
8	1.875	6	1.6	6.4	1.6	6.4
9	2.125	-	-	-	-	-
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.375	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

16 Sept 74
Begin time: 1116 GMT Sample duration: 120 sec
Z(ACT)= 960 ; R(ACT)= 2.3 ; Z(MOD)= 1098; R(MOD)= 3.3

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(AD)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(AD)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	130	520
2	0.375	-	-	-	110	440
3	0.625	-	-	-	85	340
4	0.875	-	-	-	68	272
5	1.125	-	-	-	50	200
6	1.375	102	34.3	137.2	34.3	137.2
7	1.625	67	19.9	79.6	19.9	79.6
8	1.875	20	5.4	21.6	5.4	21.6
9	2.125	4	1.0	4.0	1.0	4.0
10	2.375	1	0.2	0.8	0.2	0.8
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

16 Sept 74
Begin time: 1118 GMT; Sample duration: 120 sec
Z(ACT)= 2925 ; R(ACT)= 6.0 ; Z(MOD)=3669 ; R(MOD)= 10.1

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(AD)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(AD)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	450	1800
2	0.375	-	-	-	350	1400
3	0.625	-	-	-	270	1080
4	0.875	-	-	-	210	840
5	1.125	-	-	-	150	600
6	1.375	153	51.4	205.6	100	400
7	1.625	192	56.9	227.6	56.9	227.6
8	1.875	74	11.8	47.2	11.8	47.2
9	2.125	32	8.0	32.0	80	32.0
10	2.375	5	1.2	4.8	1.2	4.8
11	2.625	1	0.2	0.8	0.2	0.8
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

16 Sept 74
Begin time: 1120 GMT; Sample duration: 120 sec
Z(ACT)= 2432 ; R(ACT)= 4.8 ; Z(MOD)= 2871 ; R(MOD)= 7.3

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(AD)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(AD)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	280	1120
2	0.375	-	-	-	220	880
3	0.625	-	-	-	170	680
4	0.875	-	-	-	130	520
5	1.125	-	-	-	95	380
6	1.375	130	43.7	174.8	70	280
7	1.625	139	41.2	164.8	41.2	164.8
8	1.875	44	11.8	47.2	11.8	47.2
9	2.125	14	3.5	14.0	3.5	14.0
10	2.375	10	2.3	9.2	2.3	9.2
11	2.625	2	0.4	1.6	0.4	1.6
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

16 Sept 74
Begin time: 1122 GMT Sample duration: 120 sec
Z(ACT)= 1123 ; R(ACT)= 2.6 ; Z(MOD)= 1261 ; R(MOD)= 3.6

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(AD)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(AD)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
1	0.125	-	-	-	140	560
2	0.375	-	-	-	110	440
3	0.625	-	-	-	90	360
4	0.875	-	-	-	68	272
5	1.125	-	-	-	50	200
6	1.375	105	35.3	141.2	35.3	141.2
7	1.625	76	22.5	90.0	22.5	90.0
8	1.875	23	6.2	24.8	6.2	24.8
9	2.125	7	1.8	7.2	1.8	7.2
10	2.375	1	0.2	0.8	0.2	0.8
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

Table B-1. Drop Distribution Obtained on Board NOAA Ship "Researcher" (continued)

Drop size category	Midpoint diameter (mm)	ACTUAL no.	ACTUAL number $m^{-3}(\Delta D)^{-1}$	ACTUAL number $m^{-3}mm^{-1}$	MODIFIED number $m^{-3}(\Delta D)^{-1}$	MODIFIED number $m^{-3}mm^{-1}$
16 Sept 74 Begin time: 1124 GMT; Sample duration: 120 sec Z(ACT)= 897 ; R(ACT)= 1.85; Z(MOD)= 972 ; R(MOD)= 2.4						
1	0.125	-	-	-	80	320
2	0.375	-	-	-	70	280
3	0.625	-	-	-	52	208
4	0.875	-	-	-	38	152
5	1.125	-	-	-	27	108
6	1.375	57	19.1	76.4	19.1	76.4
7	1.625	37	11.0	44.0	11.0	44.0
8	1.875	27	7.3	29.2	7.3	29.2
9	2.125	11	2.7	10.8	2.7	10.8
10	2.375	-	-	-	-	-
11	2.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-
16 Sept 74 Begin time: 1126 GMT; Sample duration: 120 sec Z(ACT)= 274 ; R(ACT)= .69 ; Z(MOD)= 386 ; R(MOD)= 1.3						
1	0.125	-	-	-	60	240
2	0.375	-	-	-	50	200
3	0.625	-	-	-	40	160
4	0.875	-	-	-	30	120
5	1.125	-	-	-	22	88
6	1.375	22	7.4	29.6	15	60
7	1.625	30	8.9	35.6	8.9	35.6
8	1.875	5	1.4	5.6	1.4	5.6
9	2.125	-	-	-	-	-
10	2.375	-	-	-	-	-
11	.625	-	-	-	-	-
12	2.875	-	-	-	-	-
13	3.125	-	-	-	-	-
14	3.375	-	-	-	-	-
15	3.625	-	-	-	-	-
16	3.875	-	-	-	-	-
17	4.125	-	-	-	-	-
18	4.375	-	-	-	-	-
19	4.625	-	-	-	-	-
20	4.875	-	-	-	-	-

Appendix C

Z-R Relationship Derived Through Use of a Cumulative Distribution Function (CDF)

C.1. Rationale: Statistical Considerations

The representativeness of the drop size distribution sampled with a device such as the foil impactor is discussed in a series of papers by Cornford (1967, 1968a, 1968b). Using Poisson statistics, he examined the number density of drops which must be sampled to define accurately the drop size distribution and particle size concentration. Cornford concluded that approximately 400 drops must be counted in each size category (he used .25-mm increments) for the resulting measured drop spectra to be within ±10% of reality on 95% of occasions. If the drop spectra need only be measured to within ±50% on 95% of occasions, only 23 drops must be counted in each size category. There is, of course, some compensation of sampling errors between adjacent size categories when the drop size distribution is integrated to compute, for example, water mass. Thus, it is Cornford's conclusion that drops in concentrations of between 10 and 100 m^{-3} can be defined fairly accurately by an instrument of the foil impactor type. He further concludes, however, that measurements with a foil impactor almost certainly will not be representative of the number of large drops when they occur in concentrations of less than about 2 m^{-3}.

The sampling volume problems inherent in determining representative concentrations of drops at the large end of the spectrum are well recognized. The number density of drops in each size increment varies greatly from shower to shower and is primarily a function of rainfall rate and sampling location within the shower. In the procedure for selecting suitable foil data, only those traverses through rainshaft cores which yielded an integrated sample size of at least several hundred drops were considered for detailed analysis. Although this does not satisfy the strict number density criteria for all size categories established by Cornford, it does serve to eliminate those showers which were not intense enough to produce a representative drop spectrum. It can be seen from the selected and composited drop size distributions shown in Appendix A that no exceptional deviations from an exponential decay are evident at the large end of the spectra.

C.2. Use of the Cumulative Distribution Function

A cumulative distribution function (CDF) has been developed and applied in the hope of eliminating problems associated with small sampling volumes at the large end of the spectrum. As mentioned, because of compensation of sampling errors between adjacent size ranges, the integration of a measured drop size spectrum to determine total water mass is inherently more accurate than the determination of the spectra itself. The CDF transforms the number density of drops within each size category to force conformation to an exponential curve which is physically consistent with respect to both total water content and total drop concentration. This serves to smooth out the sampling irregularities at the large drop sizes and should, in theory, provide a more

realistic indication of the actual drop distribution (assuming that such a distribution is of the preconceived exponential form). To our knowledge, this technique has not been applied outside of NOAA/NHEML. In this appendix, the best-fit Z-R relationship to data points computed from the transformed (CDF) drop distributions is presented and discussed.

C.3. Development of the Cumulative Distribution Function

The foil impactor instrument suffers from a problem common to all airborne measurement devices that rely upon the direct collection of particulate matter in the atmosphere--it cannot sample a volume of cloud large enough to insure a statistically acceptable concentration of drops in all size categories. The sampling volume problem increases in severity as the drop diameter becomes larger. In the larger raindrop size categories (corresponding to drops > 3 mm in diameter), it is not unusual to sample with the foil impactor only a few drops during an aircraft traverse through a cloud volume of 1 to 10 m^3. The use of a cumulative distribution function alleviates problems caused by reasonable statistical fluctuations in the sampled data set if it can be assumed that there exists one theoretical function that can characterize the real drop distribution within all clouds or rainshafts of interest.

A distribution of the type suggested by Marshall and Palmer (1948) has been generally used to characterize raindrop spectra in a variety of cloud conditions. This function has the form

$$N(D) = N_o e^{-\lambda D} \tag{A.1}$$

with the slope, λ , related to rainfall rate through the expression

$$\lambda = 4.1R^{-0.21} \text{ mm}^{-1} \text{ (R in mm hr}^{-1}\text{)} \tag{A.2}$$

and N_o given the value: 8000 m^{-3} mm^{-1}. Note that this distribution function is strictly valid only for drop spectra which display an exponential decrease in concentration with increasing size, and it should not be applied if bimodal (or otherwise non-exponential) real distributions are suspected.

Figure C.1 shows a raindrop distribution generated through (A.1) with the data given in table C.1.[7] Let us assume that the real raindrop size spectrum in a given rainshaft is represented by the curve (line) in figure C.1. Now suppose that 1 m^3 of the rainshaft is sampled with a foil impactor and the data appear as shown in table C.1 and the histogram in figure C.2. In comparing figure C.1 with figure C.2, one can see that the drop concentrations in the two smallest size categories, each of which has a relatively large data sample, remain unchanged, while in the fourth size category and greater, the sampled data set departs significantly from the assumed real exponential drop distribution. Curve A in figure C.2, a best fit to the sampled data, gives values of 11556 and 3.08 for N_o and λ, respectively. The differences at the

[7]The data set of table C.1 has been developed as an idealistic example of how the CDF operates. It is not part of the GATE data set.

large end of the spectrum between the collected data and the real distribution can be interpreted as due to sampling volume problems, and thus the best-fit curve A in figure C.2 does not provide an accurate representation of the assumed real drop size distribution (curve C in figure C.2 or the curve in figure C.1).

The use of a cumulative distribution function partly eliminates sampling volume problems. The integration of (A.1) to find the total number of drops (N_T) over all size categories yields

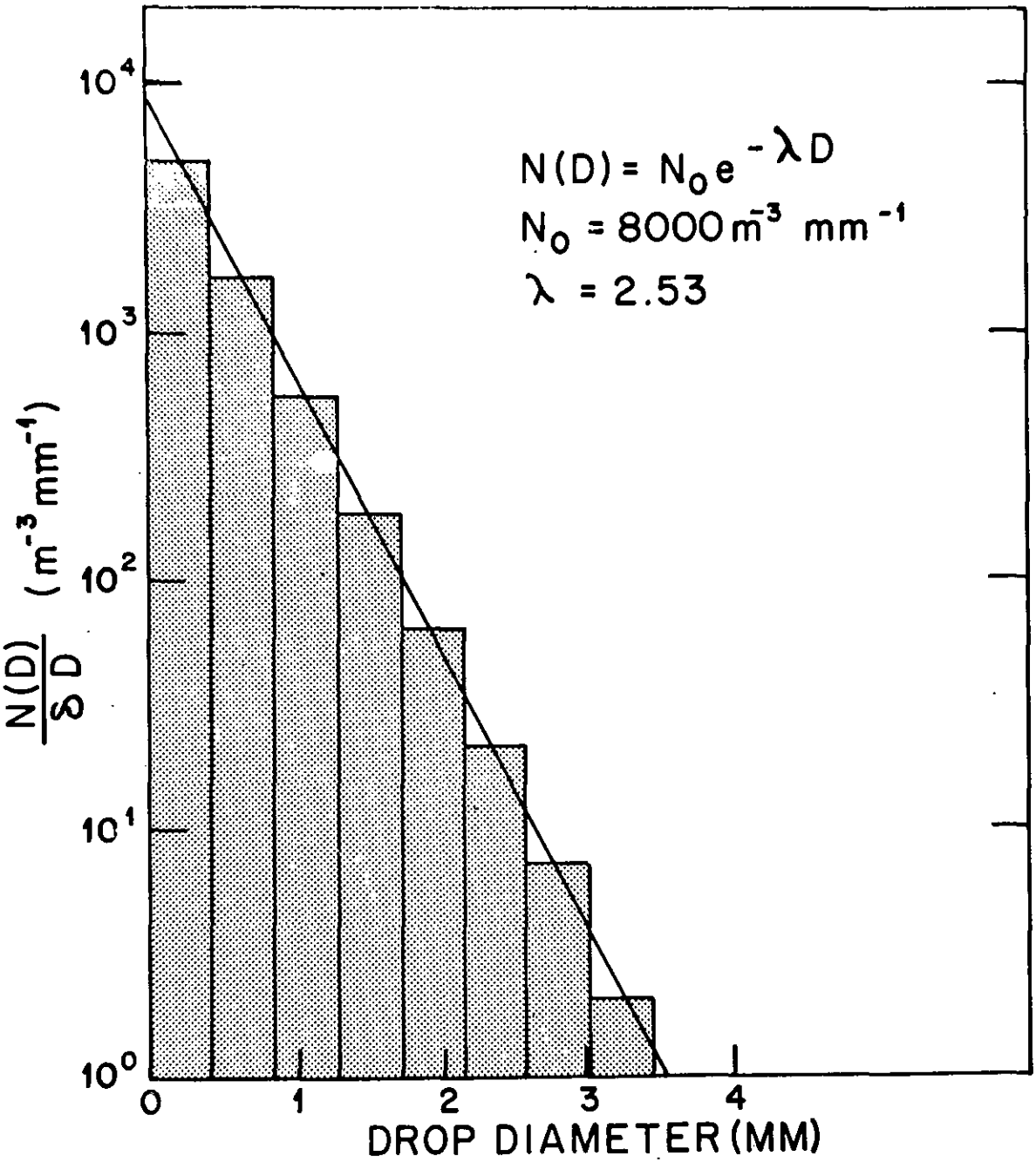


Figure C.1. An idealistic assumed Marshall-Palmer drop size distribution.

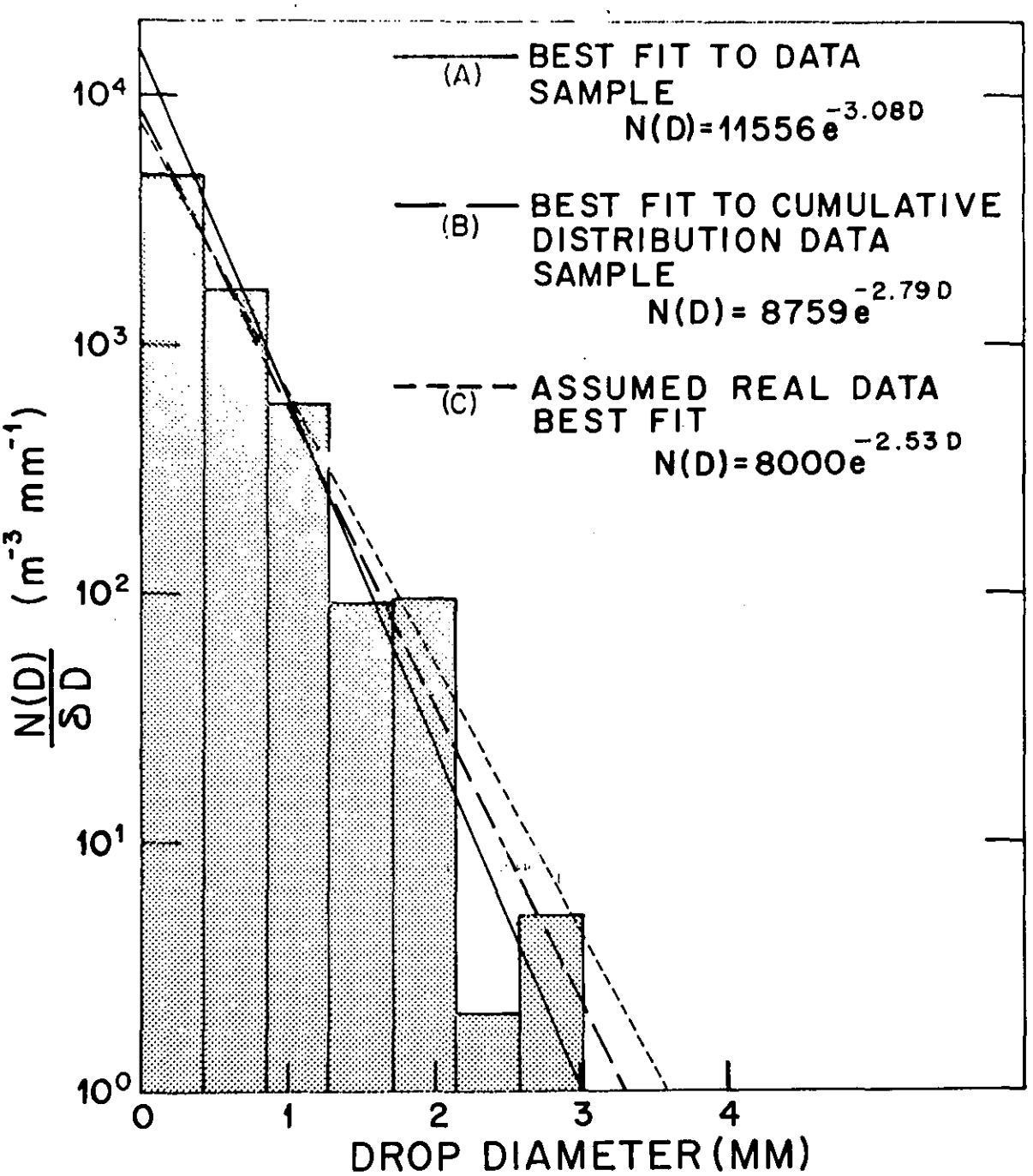
Table C-1. Drop Distribution Data

Size category	Minimum diameter (mm)	Mean diameter (mm)	Maximum diameter (mm)	Assumed real drop concentration[1] no m^{-3} δD	Assumed real drop concentration no m^{-3} mm^{-1}	Sample drop distribution[2] no/m^3/δD	Sample drop distribution no m^{-3} mm^{-1}	Expected drop concentration[3] no m^{-3} mm^{-1}
1	0	0.216	0.432	2102	4866	2102	4866	4794
2	0.432	0.648	0.864	705	1632	705	1632	1436
3	0.864	1.080	1.296	236	541	248	575	430
4	1.296	1.512	1.728	79	183	39	90	129
5	1.728	1.944	2.110	27	63	40	93	39
6	2.160	2.376	2.592	9	21	1	2	12
7	2.592	2.808	3.024	3	7	2	5	3
8	3.024	3.240	3.456	1	2	0	0	1
9	3.456	3.672	3.888	0	0	0	0	0
10	3.888	4.104	4.320	0	0	0	0	0

[1]Calculated from exponential distribution: $N(D) = N_o e^{-\lambda D}$ with N_o assumed 8000 m^{-3} mm^{-1} and λ of 2.53 derived from assumed rainfall rate of 10 mm hr^{-1}.

[2]Hypothetical 1 m^3 data sample which might be obtained from real distribution by use of foil impactor.

[3]Derived from cumulative distribution function.



C.2. Best-fit curves drawn to (A) histogram of sampled drop sizes shown, (B) real drop sizes shown transformed through use of a cumulative distribution function, and (C) assumed real distribution shown in figure C.1.

$$N_T = \frac{N_o}{\lambda}\left[1 - e^{-\lambda D}\right]\Big|_0^\infty \tag{A.3}$$

which gives

$$N_T = \Sigma N_i = \frac{N_o}{\lambda} \quad . \tag{A.4}$$

The total water content of the experimental distribution can be found by integrating the expression

$$M = \int_0^\infty \frac{\pi\rho D^3}{6} N_o e^{-\lambda D} dD \tag{A.5}$$

which, when solved, gives

$$M = \frac{\pi\rho N_o}{6} \frac{\Gamma(4)}{\lambda^4} \quad . \tag{A.6}$$

The mass (liquid water content) can also be computed independently from

$$M = \frac{\rho\pi}{6} \; \Sigma N_i D_i^{\,3} \tag{A.7}$$

where N_i and D_i are the concentration of drops and mean mass drop diameter,[8] respectively, of interval i. Substituting (A.4) into (A.6) and solving for λ gives

$$\lambda = \left[\frac{\pi\rho\Gamma(4)}{6}\right]^{1/3} N_T^{\,1/3} \; M^{-1/3} \quad . \tag{A.8}$$

The cumulative distribution function therefore provides a Y-axis intercept (N_o) and a slope (λ) to a best-fit exponential curve. N_o and λ are physically consistent with respect to total water content (M) and total drop concentration (N_T). Note that the calculated values of M and N are derived from the observed data set and thus are subject to errors caused by sampling volume problems discussed earlier. However, the effect of sampling volume errors on total mass and total concentration is not nearly as great as that on the drop concentration within each interval. The use of the cumulative distribution function, defined as

$$C(D) = \frac{N_o}{\lambda}\,(1 - e^{-\lambda D}) \quad , \tag{A.9}$$

[8]The "mean mass diameter" is not necessarily located at the midpoint diameter of each interval, although the latter is generally used in practice to compute the total mass.

serves to smooth out the sampling irregularities at the larger drop sizes and should, in theory, provide a better indication of the real drop distribution.

It can be seen from curve B in figure C.2 that the best-fit relationship derived through use of the cumulative distribution function approximates the assumed actual distribution (curve C in figure C.2) much more closely than does the best fit to the sampled data (curve A in figure C.2). The calculated values of $N_o = 8759$ and $\lambda = 2.79$ from the cumulative distribution function are very close to the assumed real values of $N = 8000$ and $\lambda = 2.53$.

C.4. Application to GATE Drop Distribution Data Obtained from Foil

Figure C.3 shows the five selected drop size distributions for August 10, 1974, as transformed through use of the CDF. The best-fit expression of the form

$$N(D) = N_o e^{-\lambda D}$$

is given for each case. This can be compared with the data given in figure 5.

Figure C.4 is a plot of all the Z-R data points derived through a CDF transformation of the raw spectra (see Appendix A for a complete listing) and gives the best-fit curve to the data. The best-fit curve to the untransformed data (fig. 7) is also given for comparison. The best-fit curve for the CDF-transformed foil data is found to have the form

$$Z = 238R^{1.57} \tag{A.10}$$

Table C.2 shows the rainfall rate (mm hr^{-1}) as a function of Z(dB) for eight daily GATE Z-R relationships calculated from CDF-transformed drop distribution data collected near cloud base by the foil impactor on the DC-6 aircraft. These results can be compared with those of the untransformed foil data shown in table 7. The daily variability in rain rates computed from radar reflectivities of 35 to 50 dB does not appear to be of significance. Some divergence in the calculated daily rain rates for very heavy rainfalls ($Z > 50$ dB) is observed. Figure C.5 shows a plot for all of the daily Z-R relationships calculated from the CDF-transformed drop distribution data.

Figure C.6 shows the best-fit Z-R relationship as a function of three rain rates ($R > 0$, $R > 7.5$ mm hr^{-1}, and $R > 12.5$ mm hr^{-1}) for the CDF-transformed data. This can be compared to figure 8. These curves from the CDF data appear to be somewhat more sensitive to rain rate stratification than those shown for the untransformed data. The complete Z-R data stratified as a function of rain rate is given in table C.3, which is analogous to table 8.

The use of the CDF transformation has not been a conventional technique for previously published analyses of Z-R relationships. For consistency with other observations (table 1), therefore, we have not emphasized the CDF results in the main section of the report. However, use of the CDF to eliminate sampling volume problems at the large end of the droplet spectra has obvious advantages and may provide results which are more representative of the actual rainfall-reflectivity relationship.

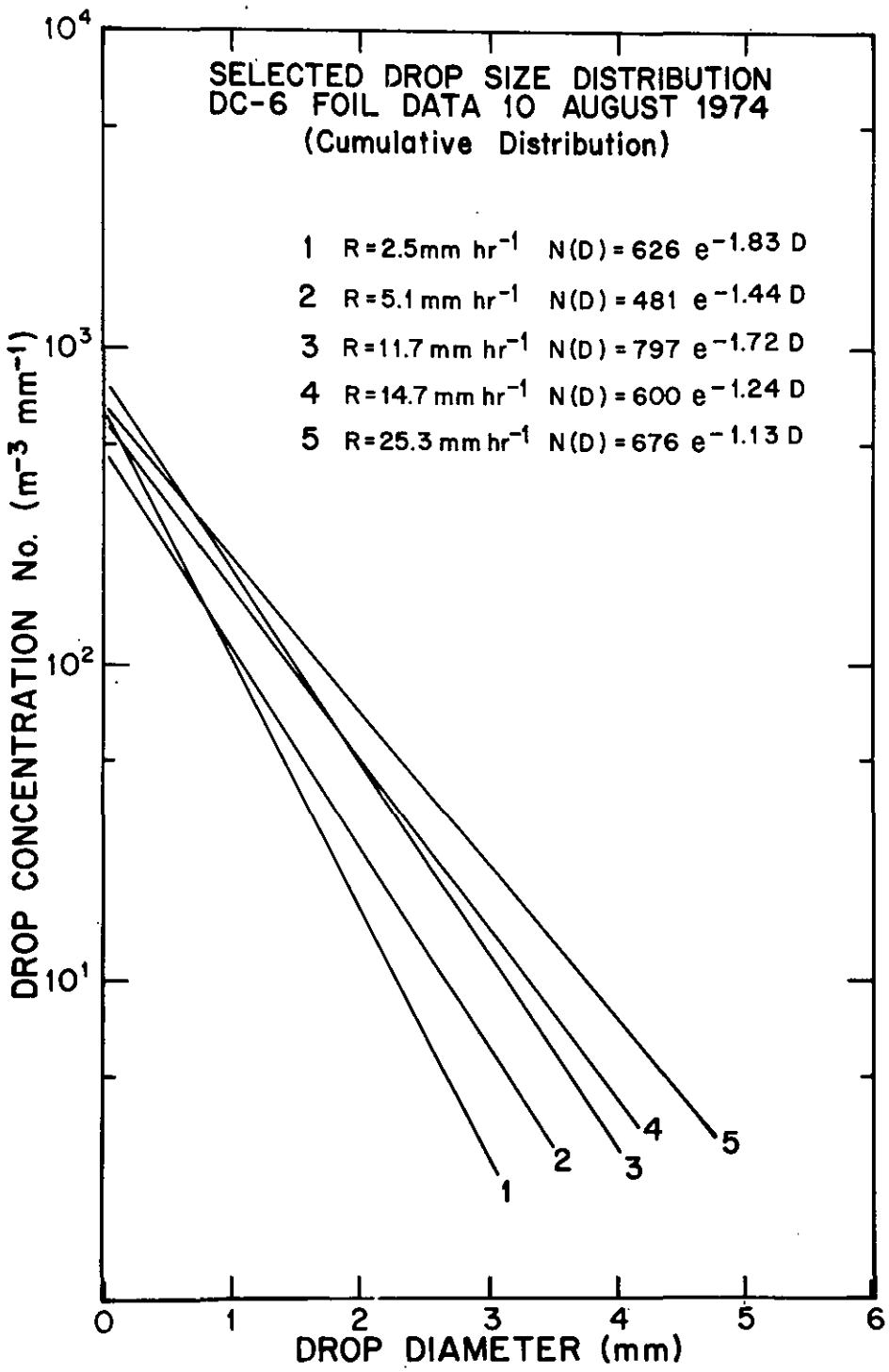


Figure C.3. As in figure 5, except drop size distributions transformed through use of the CDF.

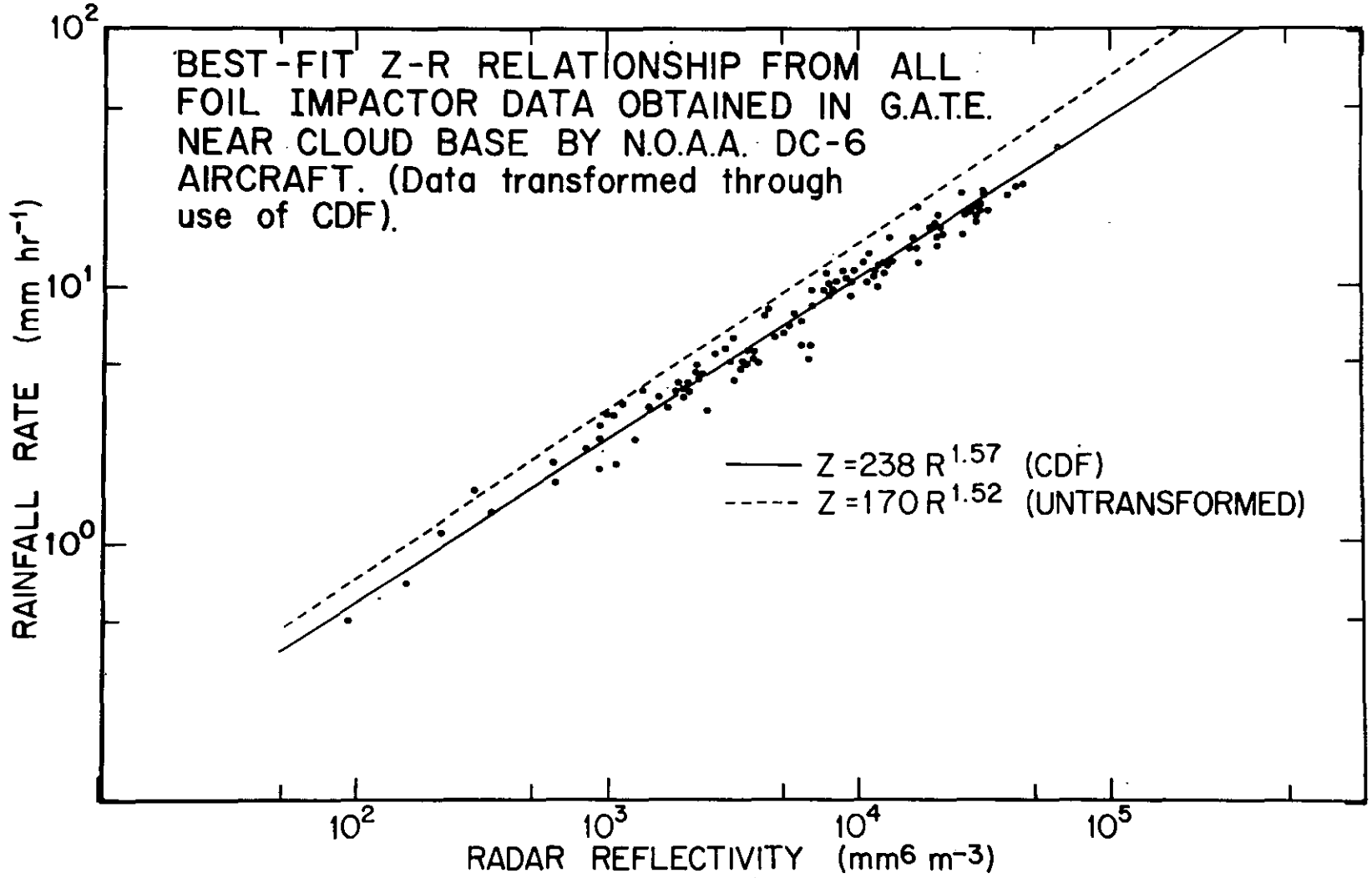


Figure C.4. Best-fit Z-R relationship drawn to all data points obtained through an analysis of DC-6 foil data transformed through use of the CDF. Best-fit curve to the untransformed data (fig. 7) included for comparison.

Table C-2. Rainfall Rates (mm hr^{-1}) as a Function of Z (db) for Eight Daily Z-R Relationships Obtained at Cloud Base During GATE (CDF data)

Z(db)	$230R^{1.58}$	$251R^{1.57}$	$269R^{1.47}$	$235R^{1.49}$	$343R^{1.46}$	$493R^{1.36}$	$259R^{1.56}$	$204R^{1.68}$
60	200	196	268	273	236	270	199	157
55	97	94	123	126	107	116	95	79
50	47	45	56	58	49	50	46	40
45	23	22	26	27	22	21	22	20
40	11	10	12	12	10	9	10	10
35	5	5	5	6	5	4	5	5
30	3	2	2	3	2	2	2	3
25	1	1	1	1	1	1	1	1
20	1	1	1	1	< 1	< 1	1	1

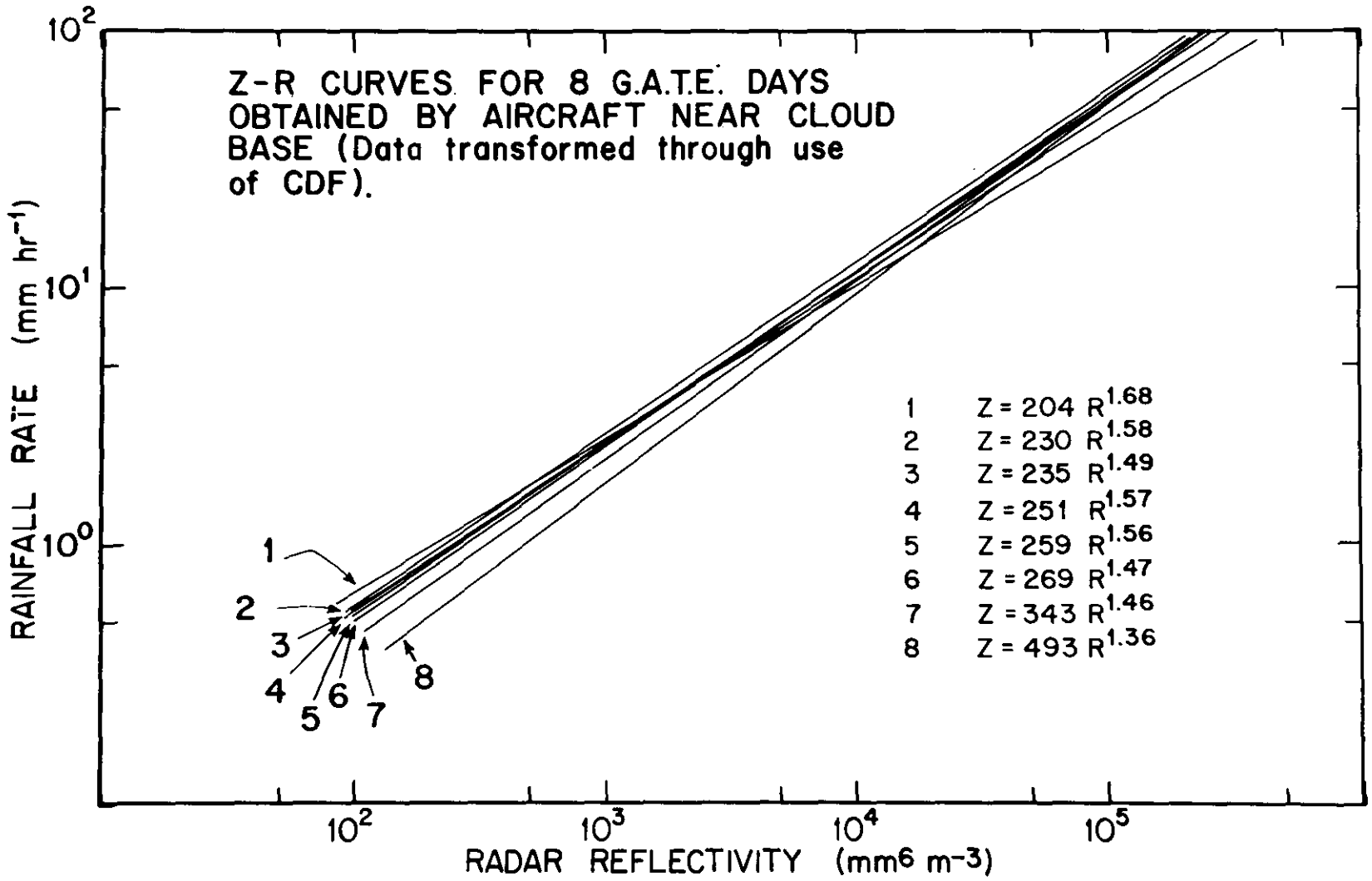


Figure C.5. As in figure 6, except data transformed through use of the CDF.

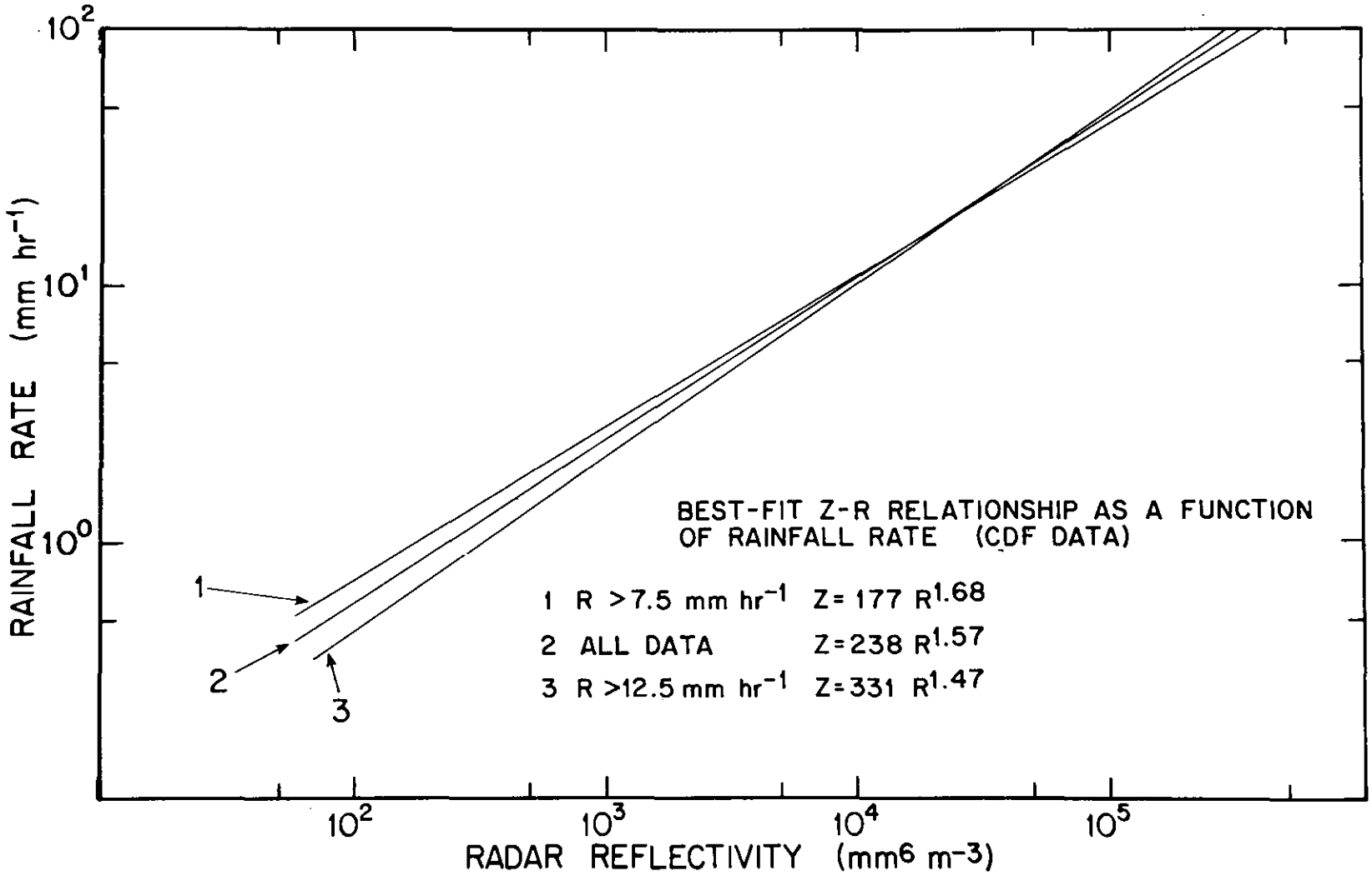


Figure C.6. As in figure 8, except data transformed through use of the CDF.

Table C-3. Cloud-Base Best-fit Z-R Relationships as a Function of Rainfall Rate (Data Transformed with CDF)

Stratification	No. data points	Z-R relationship	Correlation coefficient	R at 50 db mm hr^{-1}	R at 45 db mm hr^{-1}	R at 40 db mm hr^{-1}	R at 35 db mm hr^{-1}
All data	107	$Z = 238\ R^{1.57}$	0.986	47	23	11	5
R > 2.5 mm hr^{-1}	97	$Z = 235\ R^{1.58}$	0.979	46	22	11	5
R > 5.0 mm hr^{-1}	71	$Z = 268\ R^{1.53}$	0.959	48	23	11	5
R > 7.5 mm hr^{-1}	56	$Z = 177\ R^{1.68}$	0.947	43	22	11	6
R > 10.0 mm hr^{-1}	46	$Z = 203\ R^{1.63}$	0.927	45	22	11	5
R > 12.5 mm hr^{-1}	30	$Z = 331\ R^{1.47}$	0.861	49	22	10	5

Appendix D

Program Listings and Sample Output for Foil and Distrometer Data Analysis

Foil Program - Listing and Sample Output

A fortran listing is provided for the NOAA/NHEML foil data processing program. This program takes as input a histogram of number densities of drops obtained per ten .43-mm-diameter intervals during the aircraft traverse of a rainshaft and produces as output a series of tables and graphs. These tables and graphs show drop concentration in units L^{-4}, computed water contents, mean and median diameters and volume diameters, computed values of reflectivity (Z) and rain rate (R), best-fit curves to the distribution data, and derived values of λ and N_o in the exponential best-fit equation. This set of information is derived for both the actual data and that transformed through use of the cumulative distribution function (expected data). A linear best fit to the Z and R data points is computed for both the actual and CDF data. (See distrometer output in next section for example.)

The program consists of a main section (in which all data is read, all bookkeeping functions are handled, and all output is written) and nine subroutines (CALC, RAIN, V WATER, V DROP, MEDIAN, LEASTQ, REGR, PLOTT, and ZRFIT) in which computations are performed. The listing contains a number of comment cards designed to assist the reader in interpreting the purpose of each section of the program.

```
C *****   PROGRAM FOIL    EML  ****
C         THIS PROGRAM CALCULATES OBSERVED AND EXPECTED WATER DROP SIZE
C  DISTRIBUTIONS FROM FOIL IMPACTOR DATA.
C
C         MAIN PROGRAM SETS UP INPUT, OUTPUT, AND CALLS SUBROUTINES TO DO MOST
C  CALCULATIONS.
C
      REAL NOW,NW,LWCMW,LWCW,MVODIW,MEDIAW,NMPW,NT
      INTEGER WATER,YR,DA,CLD,PASS,FRAME,TIME
      DIMENSION NOW(25),NW(25),DW(25),SIGMAW(25),LWCMW(25),PLWCW(25),NMP
     1W(25),DIMG(25)
      DIMENSION FD(25),CD(25),PFD(25),PCD(25),ENO(25),XNC(25)
      DIMENSION ANG(4)
      COMMON G(25,280),YR,MO,DA,CLD,PASS,FRAME
      COMMON /CONS/PI
      COMMON /V/VOL
      COMMON /INC/M,WATER,NN
      COMMON /ICE/MICE
      COMMON /DATA/TC,PMB
      COMMON /TODROP/AR(10)
      COMMON /ZRCAL/DATA(200,2),II
C
C  ****   DEFINITIONS   ****
C  **********  INPUT CONSTANTS  **********
C        DIMG       --  VECTOR IMAGE DIAMETERS  (MM)
C        AR         --  VECTOR OF CONSTANTS NEEDED FOR COTTONS TERMINAL VELOCITY
C                       SUBROUTINE
C        BLANK      --  SYMBOL FOR PLOT
C        ANG        --  VECTOR OF SYMBOLS FOR PLOT
C
C  **********  INPUT VARIABLES  **********
C        TIME       --  TIME OF CLOUD PASS (GMT)
C        ALT        --  FLIGHT ALTITUDE  (KM)
C        TEMP       --  FLIGHT TEMPERATURE  (DEG C)
C        TC         --  SURFACE TEMPERATURE  (DEG C)
C        PMB        --  SURFACE PRESSURE  (MB)
C        YR         --  YEAR  (2 DIGITS)
C        MO         --  MONTH  (2 DIGITS)
C        DA         --  DAY  (2 DIGITS)
C        CLD        --  CLOUD IDENTIFICATION (4 ALPHANUMERIC)
C        PASS       --  PASS IDENTIFICATION  (4 ALPHANUMERIC)
C        WATER      --  1  (CONSTANT)
C        NN         --  TOTAL NUMBER OF FRAMES
C        NUM        --  NUMBER OF FRAMES FOR RUNNING MEAN
C        M          --  TOTAL NUMBER OF SIZE INTERVALS
C        DW         --  VECTOR OF MIDPOINTS OF SIZE INTERVALS
C        G          --  ARRAY OF NUMBER OF DROPLETS PER FRAME
C
C
C  **********  INDICATOR PARAMETERS  **********
C        ICHK       --  0 FOR OBSERVED CALCULATIONS, 1 FOR EXPECTED CALCULATIONS
C        NJ         --  NUMBER OF PARAMETERS ON PLOT
C        LS         --  STARTING INDICATOR FOR RUNNING MEANS
C        LE         --  ENDING INDICATOR FOR RUNNING MEANS
C        LSAVE1     --  SAVE LOCATION FOR LE
C        LSAV2      --  SAVE LOCATION FOR LS
C
C  **********  OTHER PARAMETERS  **********
C        VOL        --  TOTAL VOLUME OF PASS
C        NOW        --  VECTOR OF NUMBER OF DROPS PER INTERVAL
C        NW         --  VECTOR OF CONCENTRATIONS PER INTERVAL
C        NT         --  TOTAL CONCENTRATION  (GM/CU CM)
C        ALAM       --  LAMBDA IN BEST-FIT EQUATIONS
```

```
C        XNO        -- TOTAL CONCENTRATION * LAMBDA  (/CU CM)
C
C
C  ********** OUTPUT  **********
C        ZW         -- RADAR REFLECTIVITY   (MM6/CU M)
C        LWCW       -- TOTAL LIQUID WATER CONTENT  (GM/CU M)
C        SUMNW      -- TOTAL CONCENTRATION  (/CU M)
C        ZMIAMI     -- RADAR REFLECTIVITY USING MIAMI FORMULA  (MM6/CU M)
C        RW         -- RAINFALL INTENSITY  (MM/HR)
C        ADW        -- AVERAGE DIAMETER  (MM)
C        MEDIAW     -- MEDIAN DIAMETER  (MM)
C        AVDW       -- AVERAGE VOLUME DIAMETER  (MM)
C        MVODIW     -- MEDIUM VOLUME DIAMETER  (MM)
C        A          -- CONSTANT IN BEST FIT EQUATION
C        B          -- EXPONENT IN BEST FIT EQUATION
C        BM         -- EXPONENT IN MARSHALL-PALMER EQUATION
C        XNC        -- VECTOR OF CONCENTRATIONS FROM BEST FIT EQUATION
C        NMPW       -- VECTOR OF CONCENTRATIONS FROM MARSHALL-PALMER EQUATION
C        LMCMW      -- VECTOR OF LIQUID WATER CONTENTS PER INTERVAL
C        PLWCW      -- VECTOR OF PERCENTAGES OF TOTAL LIQUID WATER CONTENT PER
C                      INTERVAL
C        SIGMAW     -- VECTOR OF STANDARD DEVIATIONS OF CONCENTRATIONS
C        F(D)       -- CUMULATIVE DISTRIBUTION OF OBSERVED CONCENTRATIONS PER
C                      INTERVAL
C        C(D)       -- CUMULATIVE DISTRIBUTION OF EXPECTED CONCENTRATIONS PER
C                      INTERVAL
C        PF(D)      -- PERCENTAGES OF OBSERVED CONCENTRATIONS
C        PC(D)      -- PERCENTAGES OF EXPECTED CONCENTRATIONS
C        CHISQ      -- CHI-SQUARE GOODNESS OF FIT STATISTIC
C
      NJ=4
      II=0
      READ (5,46) (DIMG(J),J=1,22)
   46 FORMAT (10F8.3)
      READ (5,45) (AR(J),J=1,9)
   45 FORMAT (5F14.11)
      READ (5,16) BLANK,(ANG(KK),KK=1,NJ)
   16 FORMAT (5A1)
 5003 READ (5,2051) TIME,ALT,TEMP,TC,PMB
 2051 FORMAT (I10,F10.3,2F10.1,F10.2)
      IF (TIME.EQ.0) CALL ZRFIT
      IF (TIME.EQ.0) CALL EXIT
      WRITE (6,2052) TIME,ALT,TEMP,TC,PMB
 2052 FORMAT (1H1,I10,F10.3,2F10.1,F10.2)
      II=II+1
      READ (5,10) YR,MO,DA,CLD,PASS
   10 FORMAT (3I10,6X,A4,6X,A4)
      WRITE (6,2053) YR,MO,DA,CLD,PASS
 2053 FORMAT (1H0,3I10,6X,A4,6X,A4)
 5001 READ (5,15) WATER,NN,NUM
   15 FORMAT (3I10)
      READ (5,20) M
   20 FORMAT (I10)
      VOL=NN*.09955
C
C *** VOL IS CUBIC METERS PER FIVE INCHES OF FUIL WITH TAS OF 100 M PER SEC
C
      ICHK=0
      LS=0
      LE=NN-1
      DO 50 L=1,M
      IF (NUM.LE.18) GO TO 49
      READ (5,25) DW(L),(G(L,K),K=1,18)
   25 FORMAT (F5.3,18F4.0)
      READ (5,250) (G(L,K),K=19,NUM)
  250 FORMAT (20F4.0)
```

```
  252 FORMAT (1H0,F5.3,18F4.0)
  251 FORMAT (1H ,5X,20F4.0)
      GO TO 50
   49 READ (5,25) DW(L),(G(L,K),K=1,NUM)
   50 CONTINUE
 1017 FORMAT (1H1,57X,12HACTUAL VALUE,/)
  504 LS=LS+1
      LE=LE+1
      DO 60 K=1,M
      SUM=0.0
      DO 40 L=LS,LE
      SUM=SUM+G(K,L)
   40 CONTINUE
      NOW(K)=SUM
   60 CONTINUE
 1000 FORMAT (1H ,48X,31HWATER DROPLET SIZE-DISTRIBUTION)
 1001 FORMAT (1H ,45X,36HCUMULUS EXPERIMENTS     MIAMI,FLORIDA)
 1012 FORMAT (1H ,60X,6HMAY 19,I2)
 1013 FORMAT (1H ,60X,7HJUNE 19,I2)
 1014 FORMAT (1H ,60X,7HJULY 19,I2)
 1015 FORMAT (1H ,60X,9HAUGUST 19,I2)
 1026 FORMAT (1H ,60X,12HSEPTEMBER 19,I2)
 1006 FORMAT (1H0,35X,5HDATE ,I2,1H/,I2,1H/,I2,15X,6HCLOUD ,A4,5X,5HPASS
     1 ,A4)
 1007 FORMAT (1H ,20X,5HTIME ,I10,3HGMT,10X,11HFLIGHT ALT ,F10.3,2HKM,10
     1X,12HFLIGHT TEMP ,F10.1,1HC)
C
C     CALL SUBROUTINES TO CALCULATE DESIRED QUANTITIES
C
      PI=3.1416
      CALL CALC (NOW,DW,NW,SUMNW,SIGMAW,ZW,LWCW,LWCMW,ADW,AVDW,PLWCW,LS,
     1LE)
 1008 FORMAT (1H0,25X,3HZ =,F9.1,8HMM6/CU M,6X,6HLWC = ,F5.3,7HGM/CU M,6
     1X,5HCON= ,F7.1,5H/CU M)
      CALL RAIN (L,DW,NW,RW,NMPW,BM)
      ZMIAMI=300.*RW**1.4
 1023 FORMAT (1H ,40X,4HR = ,F5.2,5HMM/HR,8X,9HZMIAMI = ,F9.1,9H MM6/CU
     1M)
      IF (ICHK.NE.1) GO TO 2
      DATA(II,1)=ZW
      DATA(II,2)=RW
    2 CONTINUE
      CALL MEDIAN (SUMNW,NW,DW,MEDIAW)
      CALL MEDIAN (LWCW,LWCMW,DW,MVUDIW)
 1009 FORMAT (1H ,20X,10HAVE DIA = ,F4.2,2HMM,6X,10HMED DIA = ,F4.2,2HMM
     1,6X,14HAVE VOL DIA = ,F4.2,2HMM,6X,14HMED VOL DIA = ,F4.2,2HMM)
      CALL LEASTQ (NW,DW,A,B)
 1010 FORMAT (1H0,33X,5HN C =,F10.1,5H EXP(,F6.2,3H D),15X,16HN MP = 200
     10 EXP(,F6.1,3H D))
      DO 3040 I=1,M
      XNC(I)=A*EXP(B*DW(I))
 3040 CONTINUE
 1011 FORMAT (1H0)
 1020 FORMAT (1H0,12X,4HDIMG,6X,1HD,12X,1HN,10X,5H N C ,9X,4HN MP,10X,3H
     1LWC,11X,4HPLWC,9X,2HNO,7X,5HSIGMA)
 1021 FORMAT (1H ,12X,4H(MM),5X,4H(MM),7X,7H(/CU M),6X,7H(/CU M),6X,7H(/
     1CU M),6X,9H(GM/CU M),9X,3H(_),17X,9H(GM/CU M))
 1022 FORMAT (1H ,10X,F6.3,4X,F6.3,4X,F8.2,6X,F8.2,6X,F8.2,6X,F7.4,8X,F6
     1.2,6X,F5.0,6X,F7.2)
C
C  IF FREQUENCY DISTRIBUTIONS AND EXPECTED VALUES BEING CALCULATED, SKIP
C  PLOT AND CHECK FOR RUNNING MEAN.
C
C  ALL UNITS CONVERTED TO CM IN PROBABILITY DISTRIBUTION CALCULATIONS.
C
      IF (ICHK.EQ.1) GO TO 6002
```

```
      CALL PLOTT (NW,NMPW,PLWCW,DW,BLANK,ANG)
      CONST=1.46459
      NT=SUMNW*1E-06
      ALAM=CONST*NT**0.3333333*(LWCW*1E-06)**(-0.3333333)
      XNU=NT*ALAM
 3000 FORMAT (1H1,40X,30HPROBABILITY DISTRIBUTIONS ON N,///)
 3001 FORMAT (1H ,15X,4HF(D),15X,4HL(D),15X,5HPF(D),15X,5HPC(D),15X,8HOB
     1SERVED,10X,8HEXPECTED)
 3002 FORMAT (1H ,13X,8H/(CU CM),11X,8H/(CU CM),12X,8H/(CU CM),12X,8H/(C
     1U CM),15X,6HNUMBER,12X,6HNUMBER,/)
      CHISQ=0.0
      ADD=0.0
C
C  FOR METHOD OF EXPECTED NUMBER CALCULATION, SEE SAX OR COTTON
C
      ENOSUM=0.0
      DELD=(DW(2)-DW(1))
      DWM=DW(1)-DELD*.5
      CDM=NT*(1.-EXP(-ALAM*DWM**.1))
      DO 3005 I=1,M
      ADD=ADD+NW(I)*1E-06
      FD(I)=ADD
      DWP=DW(I)+DELD*.5
      CDP=NT*(1.-EXP(-ALAM*DWP**.1))
      ENO(I)=CDP-CDM
      ENO(I)=ENO(I)*1E+06*VOL
      ENOSUM=ENO(I)+ENOSUM
      CD(I)=ENOSUM/(VOL*1E+06)
      DWM=DWP
      CDM=CDP
 3020 PFD(I)=FD(I)/NT
      PCD(I)=CD(I)/NT
      CHISQ=CHISQ+(ENO(I)-NOW(I))**2/ENO(I)
 3005 CONTINUE
 3007 FORMAT (1H ,10X,E10.4,10X,E10.4,10X,E10.4,10X,E10.4,10X,F10.2,10X,
     1F10.2)
 3009 FORMAT (1H ,///,10X,13HCHI-SQUARE = ,F10.3,///)
 3030 FORMAT (1H , 24H  N(0) -- THEORETICAL = ,E10.4,//,25H LAMBDA -- TH
     1EORETICAL = ,E10.4)
      LSAV1=LE
      LSAV2=LS
      LS=0
      LE=0
      DO 6000 I=1,M
      G(1,1)=ENO(I)
 6000 CONTINUE
 6001 FORMAT (1H1,56X,14HEXPECTED VALUE,/)
      ICHK=1
      GO TO 504
C
C  IF RUNNING MEAN CALCULATION, RETRIEVE LS AND LE AND START AGAIN.  IF NOT
C  READ IN NEW PASS INFORMATION.
C
C  TIME = 0 MEANS STOP.
C
 6002 IF (LSAV1.LT.NUM) GO TO 6003
      GO TO 5003
 6003 LE=LSAV1
      LS=LSAV2
      GO TO 504
      END
      SUBROUTINE CALC (ND,D,N,SUMN,SIGMA,Z,LWC,LWCM,AD,AVD,PLWC,LS,LE)
C
C        CALCULATES RADAR REFLECTIVITY, LIQUID WATER CONTENT, CONCENTRATION,
C  AVERAGE DIAMETER, AVERAGE VOLUME DIAMETER, PERCENT LIQUID WATER, AND SIGMA.
C
```

```
      REAL   ND,LWC,LWCM,N,NMEAN,NI,ND,NE,LWCS
      INTEGER WATER,YR,DA,CLD,PASS,FRAME
      DIMENSION D(25),N(25),SIGMA(25),LWCM(25),PLWC(25),ND(25),NI(280)
      COMMON G(25,280),YR,MO,DA,CLD,PASS,FRAME
      COMMON /CONS/PI
      COMMON /V/VOL
      COMMON /INC/M,WATER,NN
      SUMN=0.
      Z=0.0
      LWC=0.
   80 FORMAT (1H ,40X,6HVOL = ,F8.3,10X,13HNO. FRAMES = ,I5)
      ND=0.
      NE=0.
C
C  DENSITY OF WATER
C
      RHOW=1.0
      DO 55 K=1,M
      SUMM=0.0
C
C  CONCENTRATION = NUMBER/VOLUME
C
      N(K)=ND(K)/VOL
      SUMN=SUMN+N(K)
      NMEAN=N(K)/NN
      L=0
      DO 130 LL=LS,LE
      L=L+1
      NI(L)=G(K,LL)/VOL
      SUMM=SUMM+(NI(L)-NMEAN)**2
  130 CONTINUE
      SIGMA(K)= SQRT(SUMM/(NN-1))
      AB=N(K)*D(K)
      AC=N(K)*D(K)**3
      AF=N(K)*D(K)**6
      Z=Z+AF
      ND=ND+AB
      NE=NE+AC
C
C  LIQUID WATER CONTENT
C
  120 RHO=RHOW
  125 CTS=RHO*PI/6.
      LWCS=CTS*AC
      LWCM(K)=LWCS*1.E-3
      LWC=LWC+LWCM(K)
   55 CONTINUE
      THIRD=1./3.
C
C  AVERAGE DIAMETER AND AVERAGE VOLUME DIAMETER
C
      AD=ND/SUMN
      IF(NE/SUMN.LT.0) WRITE(6,869)
  869 FORMAT(1H0,31H NEGATIVE ERROR IN CALC 001671)
      AVD=(NE/SUMN)**THIRD
      DO 56 I=1,M
C
C  PERCENT LIQUID WATER CONTENT
C
      PLWC(I)=LWCM(I)/LWC*100.0
   56 CONTINUE
      RETURN
      END
      SUBROUTINE RAIN (L,D,N,R,NMP,BM)
C
C         CALCULATES RAINFALL RATE, EXPONENT FOR MARSHALL-PALMER DISTRIBUTION,
```

```
C  AND CONCENTRATIONS USING BEST-FIT (METHOD OF LEAST SQUARES) MARSHALL-PALMER
C  LINE.
C
      REAL   N,NMP
      INTEGER WATER
      DIMENSION D(25),N(25),NMP(25)
      COMMON /CONS/PI
      COMMON /DATA/TC,PMB
      COMMON /TODROP/AR(10)
      COMMON /INC/M,WATER,NN
      RZ=PI/6.
      RT=0.0
      DO 75 L=1,M
C
C  GET TERMINAL VELOCITY AT EACH SIZE INTERVAL
C
  100 CALL VWATER (L,D,V)
  101 RS=N(L)*(D(L)**3)*V
      RT=RT+RS
   75 CONTINUE
      R=RZ*RT*3.6E-5
C
C  EXPONENT IN MARSHALL-PALMER EQUATION
C
      BO=4.1*R**(-0.21)
      BM=-BO
      DO 102 I=1,M
      NMP(I)=2000.*EXP(BM*D(I))
  102 CONTINUE
      RETURN
      END
      SUBROUTINE VWATER (L,D,V)
C
C        SETS UP CONSTANTS NEEDED FOR COTTONS TERMINAL VELOCITY SUBROUTINE.
C
      DIMENSION D(25)
      COMMON /DATA/TC,PMB
      COMMON /TODROP/AR(10)
      TKK=TC+273.15
      VIS=2.46E-6*TKK**0.745
      G=980.0
      P=PMB*1.0E3
      RO=0.287E7
      DA=P/(RO*TKK)
      RD=D(L)*0.05
      CALL VDROP (DA,G,VIS,RD,RF,VD,TKK)
      V=VD
      RETURN
      END
      SUBROUTINE VDROP(DA,G,VIS,RD,RF,VD,TKK)
C
C        COTTONS TERMINAL VELOCITY SUBROUTINE.
C
      COMMON /TODROP/AR(10)
      U(B,VIS,RD,A,DA,G)=(-B*VIS*RD/4.0+ SQRT(B**2*VIS**2*RD**2/16.0+8.0PSU2    5
     1*A*RD**5*DA*G/3.0))/(DA*RD**2*A)                                  PSU2    6
      RE(VD,RD,VIS,DA)=2.0*VD*RD*DA/VIS                                 PSU2    7
      IF (RD.GT.0.01) GO TO 50                                          PSU2    8
      VD=2.0*RD**2*G/(9.0*VIS)                                          PSU2    9
      RF=RE(VD,RD,VIS,DA)                                               PSU2   10
      IF (RF.LE.0.5) GO TO 70                                           PSU2   11
      A=4.5                                                             PSU2   12
      B=24.0                                                            PSU2   13
      VD=U(B,VIS,RD,A,DA,G)                                             PSU2   14
      RF=RE(VD,RD,VIS,DA)                                               PSU2   15
      IF (RF.LE.1.0) GO TO 70                                           PSU2   16
```

```
      A=1.72792                                                         PSU2  17
      B=26.1461                                                         PSU2  18
      VD=U(B,VIS,RD,A,DA,G)                                             PSU2  19
      RF=RE(VD,RD,VIS,DA)                                               PSU2  20
      IF (RF.LE.20.0) GO TO 70                                          PSU2  21
      A=0.70342                                                         PSU2  22
      B=45.709                                                          PSU2  23
      VD=U(B,VIS,RD,A,DA,G)                                             PSU2  24
      RF=RE(VD,RD,VIS,DA)                                               PSU2  25
      IF (RF.LE.130.0) GO TO 70                                         PSU2  26
      A=0.388162                                                        PSU2  27
      B=81.2314                                                         PSU2  28
      VD=U(B,VIS,RD,A,DA,G)                                             PSU2  29
      RF=RE(VD,RD,VIS,DA)                                               PSU2  30
      GO TO 70                                                          PSU2  31
   50 VU=0.08573154                                                     PSU2  32
      DO 60 I=1,9                                                       PSU2  33
      VU=VU+AK(I)*(20.0*RD)**I                                          PSU2  34
   60 CONTINUE                                                          PSU2  35
      VU=VU*1.0E2                                                       PSU2  36
      IF ((1.18E-3/DA).LE.1.0) GO TO 80
      Y=0.43*ALOG10(1.18E-3/DA)-0.4*(ALOG10(1.18E-3/DA))**2.5           PSU2  37
      VD=VU*10.0**Y*(1.0+0.0023*(1.1-DA/1.18E-3)*(293.15-TKK))          PSU2  38
      RF=RE(VD,RD,VIS,DA)                                               PSU2  39
      RETURN
   80 VD=VU
      RF=RE(VD,RD,VIS,DA)
   70 RETURN
      END
      SUBROUTINE MEDIAN (TOTAL,N,D,MED)
C
C        CALCULATES MEDIAN AND MEDIAN VOLUME DIAMETERS.
C
      REAL   N,INCR,MED
      INTEGER WATER
      DIMENSION N(25),D(25)
      COMMON /INC/M,WATER,NN
      HALF=TOTAL/2.
      SUB=0.
      SUBS=0.
      DO 300 IB=1,M
      SUB=SUBS+N(IB)
      IF (SUB.GE.HALF) GO TO 305
      SUBS=SUB
      GO TO 300
  305 IF (IB.EQ.1) GO TO 306
      GO TO 307
  300 CONTINUE
  306 DIF=SUB-SUBS
      DIFF=HALF-SUBS
      DELT=DIF/5
      INCR=DIFF/DELT*1.0E-2
      MED=.200+INCR
      GO TO 308
  307 DIF=SUB-SUBS
      DIFF=HALF-SUBS
      DELT=DIF/24
      INCR=DIFF/DELT*1.0E-2
      MED=(D(IB)-.125)+INCR
  308 RETURN
      END
      SUBROUTINE LEASTQ (N,D,A,B)
C
C        CALCULATES BEST-FIT LINE AND MARSHALL-PALMER LINE BY METHOD OF LEAST
C  SQUARES.
C
```

```
      REAL   N,NZRO,LAM
      INTEGER WATER
      DIMENSION X1(25),X2(25),N(25),D(25)
      COMMON /INC/M,WATER,NN
      COMMON /ICE/MICE
      DO 400 I=1,M
      IF (WATER.EQ.1) GO TO 410
      IF (MICE.EQ.2) GO TO 410
      IF (I.EQ.1) GO TO 415
      GO TO 410
  415 X2(I)=0.
      X1(I)=0.
      GO TO 400
  410 IF (N(I).LE.0.) GO TO 411
      X2(I)=ALOG(N(I))
      GO TO 412
  411 X2(I)=0.0
  412 X1(I)=D(I)
  400 CONTINUE
      CALL REGR (X2,X1,NZRO,LAM)
      A= EXP(NZRO)
      B=LAM
      RETURN
      END
      SUBROUTINE REGR (X2,X1,NZRO,LAM)
C
C        REGRESSION ROUTINE NEEDED BY LEAST SQUARES SUBPROGRAM.
C
      REAL   NZRO,LAM
      INTEGER WATER
      DIMENSION X1(25),X2(25)
      COMMON /INC/M,WATER,NN
      T1=0.0
      T2=0.0
      T3=0.0
      T4=0.0
      DO 405 I=1,M
      T1=T1+X1(I)*X2(I)
      T2=T2+X1(I)
      T3=T3+X2(I)
      T4=T4+X1(I)**2
  405 CONTINUE
      LAM=( M*T1-T2*T3)/( M*T4-T2**2)
      NZRO=T3/ M-LAM*(T2/ M)
      RETURN
      END
      SUBROUTINE PLOTT (N,NMP,PLWC,D,BLANK,ANG)
C
C        PLOTS OBSERVED CONCENTRATION, MARSHALL-PALMER CONCENTRATION, AND
C  PERCENT LIQUID WATER VERSUS DIAMETER OF DROP.
C
      REAL   N,NMP
      INTEGER WATER,YR,DA,CLD,PASS,FRAME
      DIMENSION N(25),NMP(25),PLWC(25),A(4),SYM(4),ANG(4),D(25),OUT(200)
      DIMENSION FI8(25),FUN(25)
      COMMON G(25,280),YR,MO,DA,CLD,PASS,FRAME
      COMMON /INC/M,WATER,NN
 4000 FORMAT (1H1,60X,17HN (/CU M/DELTA D))
 4001 FORMAT (1H0,11X,3H.01,17X,2H.1,19X,1H1,19X,2H10,17X,3H100,17X,4H10
     200)
 4002 FORMAT (1H ,9X,114H0 -1-----------------1-----------------1---
     1---------------1-----------------1-----------------1---------
     2-)
      NJ=4
      DO 34 J=1,M
      IF (N(J).LE.0.) GO TO 50
```

```
      FIB(J)=N(J)
      GO TO 34
   50 FIB(J)=0.0
   34 CONTINUE
      CALL LEASTQ (FIB,D,AA,B)
      DO 13 II=1,M
      FUN(II)=ALOG10(AA* EXP(B*D(II)))*9.5
      IF (N(II).LE.0.) GO TO 40
      FI=ALOG10(N(II))*9.5
      GO TO 42
   40 FI=0.0
   42 IF (NMP(II).LE.0.) GO TO 41
      GI=ALOG10(NMP(II))*9.5
      GO TO 43
   41 GI=0.0
   43 A(1)=FI
      A(2)=GI
      A(3)=PLWC(II)
      A(4)=FUN(II)
   10 DO 15 I=1,NJ
      IJ=NJ-I+1
      DO 14 J=1,NJ
      JJ=NJ-J+1
      IF (A(IJ)-A(JJ)) 14,14,11
   11 F=A(IJ)
      A(IJ)=A(JJ)
      A(JJ)=F
   14 CONTINUE
   15 CONTINUE
      DO 22 JB=1,NJ
      IF (A(JB).EQ.FI) GO TO 23
      IF (A(JB).EQ.GI) GO TO 24
      IF (A(JB).EQ.PLWC(II)) GO TO 25
      IF (A(JB).EQ.FUN(II)) GO TO 33
   23 SYM(JB)=ANG(1)
      GO TO 22
   24 SYM(JB)=ANG(2)
      GO TO 22
   25 SYM(JB)=ANG(3)
      GO TO 22
   33 SYM(JB)=ANG(4)
   22 CONTINUE
      DO 32 IK=1,112
   32 OUT(IK)=BLANK
      DO 20 K=1,NJ
      IF (A(K).EQ.PLWC(II)) GO TO 53
      IF (A(K)) 51,20,54
   54 ALK=A(K)/.5
      KA=IFIX(ALK)+41
      GO TO 52
   51 ALK= ABS(A(K))/.5
      KA=40-IFIX(ALK)
      IF (KA.LE.0) GO TO 20
      GO TO 52
   53 ALK=A(K)/.5
      KA=IFIX(ALK)
      IF (KA.LE.0) GO TO 20
   52 OUT(KA)=SYM(K)
   20 CONTINUE
   19 FORMAT (1H ,5X,F5.3,1X,1H1,11(A1))
   26 FORMAT (1H ,11X,1H1)
   13 CONTINUE
   27 FORMAT (1H ,12X,113H1---------1---------1---------1---------1----
     1----1---------1---------1---------1---------1---------1---------1-
     2-)
   28 FORMAT (1H ,12X,1H0,18X,2H10,18X,2H20,18X,2H30,18X,2H40,18X,2H50)
```

```
   29 FORMAT (1H0,54X,26HLWC (PERCENT/CU M/DELTA D))
   30 FORMAT (1H0,15X,5HDATE ,I2,1H/,I2,1H/,I2,10X,6HCLOUD ,A4,10X,5HPAS
     1S ,A4)
   31 FORMAT (1H0,15X,5HS = N,10X,8H* = N MP,10X,8H) = PLWC,10X,17HX = B
     1EST FIT TO N)
      RETURN
      END
      SUBROUTINE ZRFIT
C
C *** THIS SUBROUTINE CALCULATES A LINEAR BEST FIT TO ALL Z/R DATA POINTS
C
      COMMON /ZRCAL/DATA(200,2),II
      DIMENSION X(200),Y(200)
C      DIMENSION DATA(100,2),X(100),Y(100)
C      READ(5,1) N
C1    FORMAT(I3)
      N=II
       IF(N.GT.200) STOP
C      READ(5,2)((DATA(I,J),J=1,2),I=1,N)
C2    FORMAT(F6.0, F7.2)
       DO 3 I = 1,N
       X(I) = ALOG (DATA(I,1))
       Y(I) = ALOG(DATA(I,2))
 3     CONTINUE
C  CALCULATE THE AVERAGES OF THE DATA , THE SUMS, AND THE SUMS OF THE SQUARES
       XSUM = 0.
       DO 11 I =1,N
 11    XSUM = XSUM + X(I)
       XAVG = XSUM/N
C
       YSUM = 0.
      DO 12 I = 1,N
 12    YSUM = YSUM + Y(I)
       YAVG = YSUM/N
C
       XSUMSQ = 0.
      DO 13 I = 1,N
 13    XSUMSQ = XSUMSQ + X(I)**2
C
       YSUMSQ = 0.
      DO 14 I = 1,N
 14    YSUMSQ = YSUMSQ + Y(I)**2
C
       XYSUM = 0.
      DO 15I = 1,N
 15    XYSUM = XYSUM + (X(I)*Y(I))
C
C  REGRESSION OF Y ON X WHERE Y = AZERO + AONE * X
C
       DENOM1 = N*XSUMSQ - XSUM**2
      AZERO = (YSUM*XSUMSQ - XSUM*XYSUM)/ DENOM1
       AONE = (N * XYSUM - XSUM*YSUM)/DENOM1
C
C  REGRESSION OF X ON Y WHEREX = BZERO + BONE * Y
C
       DENOM2 = N * YSUMSQ - YSUM**2
       BZERO = (XSUM * YSUMSQ - YSUM * XYSUM) / DENOM2
      BONE = (AONE * DENOM1) / DENOM2
C  CALCULATE THE CORRELATION COEFFICIENT, R
       R = SQRT (AONE * BONE )
C  THE WRITE STATEMENTS FOLLOW
      WRITE(6,101)((DATA(I,J), J=1,2), I=1,N)
       WRITE(6,102) XAVG, YAVG, XSUM, XSUMSQ, YSUM, YSUMSQ
       WRITE(6,103)  AZERO, AONE, BZERO, BONE, R
 101  FORMAT (1H0, 2F15.3)
 102  FORMAT(1H1,6X,4HXAVG,11X,4HYAVG,16X,4HXSUM,10X,6HXSUMSQ,10X,
```

```
     1  4HYSUM,10X,6HYSUMSQ// 2F15.5,5X,4F15.5)
 103  FORMAT(1H0,9HA-ZERO = ,F10.5,15X,8HA-ONE = ,F10.5//,9HB-ZERO = ,
     1F10.5,15X,8HB-ONE = ,F10.5///,40H      THE CORRELATION COEFFICIENT
     2, R IS ,F6.5///)
      WRITE (6,104) N
 104  FORMAT(1H0,33HTHE NUMBER OF DATA POINTS USED = ,I5)
C
C
C  FINDING A AND B IN THE EXPRESSION, Z = A*R**B WHERE LOG = X AND LOG R = Y.
      A1 = EXP(BZERO)
      B1 = BONE
      A2 = EXP(-AZERO/AONE)
      B2 = 1/AONE
      WRITE(6,200)
 200  FORMAT(1H1,90HFROM THE REGRESSION OF LOGR ON LOGZ, WE GET A = A1 A
     1ND B = B1, IN THE EQUATION Z = A*R**B,     //)
      WRITE(6,201) A1, B1
 201  FORMAT(1H0, 10H     A1 = ,F6.2, 10H     B1 = ,F6.2/////)
      WRITE(6,202)
 202  FORMAT(1H0, 90HFROM THE REGRESSION OF LOGZ ON LOGR, WE GET A = A2
     1AND B = B2, IN THE EQUATION Z = A*R**B,//)
      WRITE(6,203) A2, B2
 203  FORMAT(1H0, 10H      A2 = ,F6.2,10H      B2 = ,F6.2)
      RETURN
      END
```

140900 .152 27.0 28.5 990.00

	74			8		10											
	1			17		17											
	9																
.216	9.	3.	5.	11.	6.	16.	5.	6.	5.	12.	7.	10.	8.	9.	12.	10.	12.
.648	4.	9.	9.	15.	7.	14.	11.	8.	15.	10.	7.	11.	8.	9.	9.	13.	16.
1.080	12.	11.	15.	18.	12.	17.	19.	11.	9.	12.	16.	7.	4.	5.	7.	4.	15.
1.512	7.	13.	13.	13.	14.	22.	23.	18.	11.	2.	5.	2.	0.	0.	0.	2.	5.
1.944	8.	8.	6.	6.	8.	11.	14.	16.	9.	3.	0.	0.	0.	0.	0.	0.	0.
2.376	10.	1.	3.	3.	2.	2.	2.	1.	7.	3.	1.	0.	0.	0.	0.	0.	0.
2.808	5.	4.	2.	2.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3.240	0.	2.	0.	1.	0.	1.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3.672	1.	2.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

ACTUAL VALUE

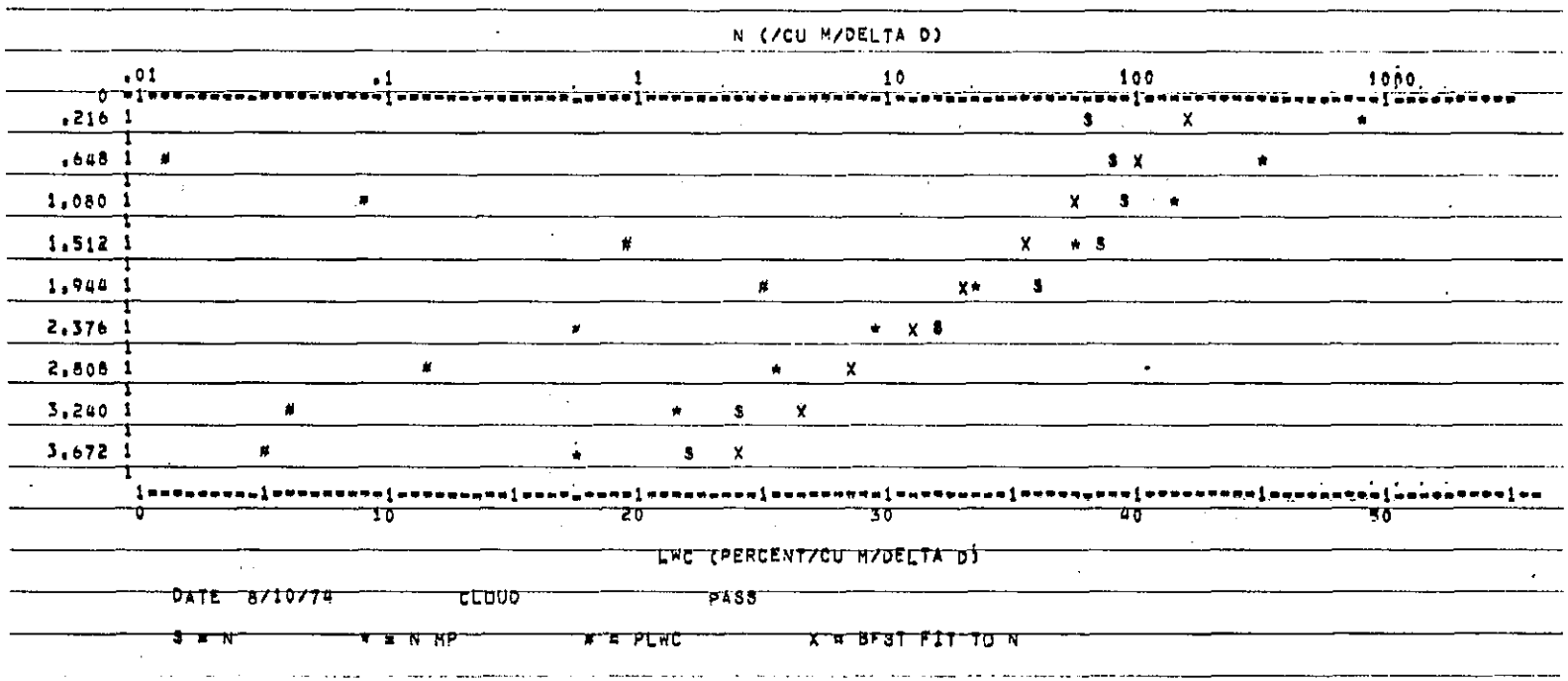
WATER DROPLET SIZE-DISTRIBUTION
CUMULUS EXPERIMENTS MIAMI, FLORIDA
AUGUST 1974

DATE 8/10/74 CLOUD PASS
TIME 140900GMT FLIGHT ALT .152KM FLIGHT TEMP 27.0C
VOL = 1.692 NO. FRAMES = 17

Z = 19626.7MM6/CU M LWC = .793GM/CU M CON= 479.2/CU M
R = 19.29MM/HR ZMIAMI = 18904.1 MM6/CU M
AVE DIA = 1.11MM MED DIA = 1.05MM AVE VOL DIA = 1.47MM MED VOL DIA = 1.99MM

N C = 299.0 EXP(-1.27 D) N MP = 2000 EXP(-2.2 D)

DIMG (MM)	D (MM)	N (/CU M)	N C (/CU M)	N MP (/CU M)	LWC (GM/CU M)	PLWC (%)	NO	SIGMA (GM/CU M)
.112	.216	86.27	227.24	1242.91	.0005	.06	146.	2.02
.332	.648	103.41	131.29	480.03	.0147	1.86	175.	1.97
.686	1.080	114.63	75.85	185.39	.0756	9.53	194.	2.86
1.026	1.512	88.63	43.82	71.60	.1604	20.22	150.	4.55
1.352	1.944	52.59	25.32	27.65	.2023	25.50	89.	3.17
1.667	2.376	20.68	14.63	10.68	.1453	18.31	35.	1.61
1.971	2.808	8.27	8.45	4.12	.0959	12.09	14.	.92
2.266	3.240	2.95	4.88	1.59	.0526	6.63	5.	.35
2.552	3.672	1.77	2.82	.62	.0460	5.79	3.	.31


N (/CU M/DELTA D)
.01
.1
1
10
100
1000
0
.216
.648
1.080
1.512
1.944
2.376
2.808
3.240
3.672
0
10
20
30
40
50
LWC (PERCENT/CU M/DELTA D)
DATE 8/10/74
CLOUD
PASS
$ = N
* = N MP
# = PLWC
X = BEST FIT TO N

PROBABILITY DISTRIBUTIONS ON N

F(D) /(CU CM)	C(D) /(CU CM)	PF(D) /(CU CM)	PC(D) /(CU CM)	OBSERVED NUMBER	EXPECTED NUMBER
.6627-04	.1985-03	.1800+00	.4143+00	146.00	335.96
.1897-03	.3148-03	.3958+00	.6569+00	175.00	196.79
.3043-03	.3829-03	.6350+00	.7990+00	194.00	115.27
.3929-03	.4228-03	.8200+00	.8823+00	150.00	67.52
.4455-03	.4462-03	.9297+00	.9310+00	89.00	39.55
.4662-03	.4599-03	.9729+00	.9596+00	35.00	23.17
.4745-03	.4679-03	.9901+00	.9763+00	14.00	13.57
.4774-03	.4726-03	.9963+00	.9861+00	5.00	7.95
.4792-03	.4753-03	.1000+01	.9919+00	3.00	4.66

CHI-SQUARE = 333.932

N(0) -- THEORETICAL = .5933-02

LAMBDA -- THEORETICAL = .1238+02

EXPECTED VALUE

WATER DROPLET SIZE-DISTRIBUTION
CUMULUS EXPERIMENTS MIAMI,FLORIDA
AUGUST 1974

DATE 8/10/74 CLOUD PASS
TIME 140900GMT FLIGHT ALT .152KM FLIGHT TEMP 27.0C
VOL = 1.692 NO. FRAMES = 17

Z = 20425.0MM6/CU M LWC = .569GM/CU M CON= 475.3/CU M
R = 14.59MM/HR ZMIAMI = 12907.7 MM6/CU M
AVE DIA = .80MM MED DIA = .60MM AVE VOL DIA = 1.32MM MED VOL DIA = 2.40MM

N C = 259.4 EXP(-1.24 D) N MP = 2000 EXP(-2.3 D)

DIMG (MM)	D (MM)	N (/CU M)	N C (/CU M)	N MP (/CU M)	LWC (GM/CU M)	PLWC (%)	NO	SIGMA (GM/CU M)
.112	.216	198.52	198.51	1208.57	.0010	.18	336.	46.71
.332	.648	116.28	116.28	441.32	.0166	2.91	197.	27.36
.686	1.080	68.11	68.11	161.15	.0449	7.90	115.	16.03
1.026	1.512	39.90	39.90	58.85	.0722	12.70	68.	9.39
1.352	1.944	23.37	23.37	21.49	.0899	15.81	40.	5.50
1.667	2.376	13.69	13.69	7.85	.0961	16.91	23.	3.22
1.971	2.808	8.02	8.02	2.87	.0930	16.34	14.	1.89
2.266	3.240	4.70	4.70	1.05	.0836	14.71	8.	1.11
2.552	3.672	2.75	2.75	.38	.0713	12.54	5.	.65

Distrometer Program - Listing and Sample Output

A fortran listing is provided for the NOAA/NHEML distrometer data processing program which takes as input the drop concentration per expanded bin interval of .25 mm (19 bins shown in table 4) and derives the rain rate R by computing the mass of rain (grams) impacting upon 1 cm^2 of the distrometer sensor head per bin per sampling duration (listed as 120 sec). Radar reflectivity Z is computed directly from the concentration of drops accumulated in each bin size. The best-fit Z-R equation is formulated within subroutine ZR. The output data includes the number density and concentration (cm^{-3}) per each .25-mm bin, the calculated Z and R values, the rainfall depth in mm accumulated, and, as shown on the final page, the coefficient "a" and exponent "b" resulting from a linear regression best-fit of the Z-R data set to the expression: $Z = aR^b$.

```
C *** PROGRAM TO DERIVE Z/R DATA FROM JOSS RAINDROP DISTROMETER
      DIMENSION N(65),DIMEAN(65),DIAMIN(65),VT(65),VOL(65),NO(65),
     1REF(65),DEPTH(50),DUR(50),R(50),Z(50),RNU(65),RR(500),ZZ(500)
     2,DATA(500,2),ID(50)
      DIMENSION RDEPTH(50)
      INTEGER DUR,Q,S
      REAL N
      EXTERNAL SNAP
      Q=4
      S=5
      II=0
      READ (4,50) (DIMEAN(I),I=1,20)
   50 FORMAT (13F6.3)
   37 READ(4,38)JK
   38 FORMAT(I2)
      IF(JK.EQ.0)GO TO 48
      WRITE (S,100) (DIMEAN(I),I=1,20)
  100 FORMAT (1H1,6X,20F6.3,/)
C     READ(Q,15)(DUR(I),I=1,9)
C  15 FORMAT (9I4)
      SUM4=0.
      DO2I=1,JK
      II=II+1
      DEPTH(I)=0.
      R(I)=0.
      Z(I)=0.
      DUR(I)=120
      AREA=50.
C
C *** DUR IS SAMPLING DURATION IN SECONDS
C *** AREA IS CROSS/SECTIONAL AREA OF DISTROMETER SAMPLING HEAD
C
      PI=3.14159
      READ (4,16) (RNO(J),J=1,20)
   16 FORMAT (20F4.1)
      SUM1=0.
      SUM2=0.
      SUM3=0.
      DO 11 M=1,20
      A1=-(DIMEAN(M)/1.77)**1.147
      VT(M)=943.*(1.-EXP(A1))
      VOL(M)=VT(M)*AREA
      N(M)=RNU(M)*VOL(M)*1.0E-06*FLOAT(DUR(I))
      A3=N(M)*PI/(6000.*AREA)*DIMEAN(M)**3.
C
C *** VT IS TERMINAL VELOCITY COMPUTED FROM EXPRESSION OF BEST (1950)
C *** VOL IS SAMPLING VOLUME PER SECOND PER BIN
C *** N(M) IS NUMBER OF DROPS IN EACH QUARTER MM BIN PER SAMPLE DURATION
C *** A3 IS MASS OF RAIN (GRAMS) IMPACTING UPON 1 SQ CM OF DISTROMETER HEAD
C  (CONT) PER BIN PER SAMPLING DURATION
C
      SUM1=SUM1+A3
      REF(M)=RNO(M)*DIMEAN(M)**6.
      SUM2=SUM2+REF(M)
   11 CONTINUE
      DEPTH(I)=SUM1
      RDEPTH(I)=DEPTH(I)*10.
C
C *** RDEPTH IS DEPTH OF RAIN IN MM INTEGRATED OVER ALL BIN SIZES
C
      Z(I)=SUM2
      AK=3600./FLOAT(DUR(I))
```

```
      R(I)=DEPTH(I)*AK*10.
C
C *** R(I) IS RAIN DEPTH IN MM WHICH WOULD ACCUMULATE DURING ONE HOUR (MM/HR)
C
      WRITE (S,101) (RNO(J),J=1,20)
  101 FORMAT (1H ,6HCONC  ,20F6.1,/)
      WRITE (S,102) (N(J),J=1,20)
  102 FORMAT (1H ,6HNUMBER,20F6.1,/)
      WRITE (S,103) Z(I),R(I),RDEPTH(I)
  103 FORMAT (1H ,4HZ = ,F15.2,5X,4HR = ,F15.2,10X,17HDEPTH IN MM    = ,
     1 F15.2,/)
      ZZ(II)=Z(I)
      RR(II)=R(I)
      SUM3=SUM3+RDEPTH(I)
      SUM4=SUM4+SUM3
    2 CONTINUE
      WRITE (S,104) SUM4
  104 FORMAT (1H ,////,22H TOTAL RAIN FOR DAY = ,F15.2,7H  MM/HR)
      NN=0
      J=1
      DO 85 I=1,JK
      IF (R(I).LE.,01) NN=NN+1
      IF (R(I).LE.,01) GO TO 85
C
C *** THESE STATEMENTS ELIMINATE DATA FROM FORMULATION OF Z/R BEST FIT IF
C  CONITI  RAINFALL RATE IS LESS THAN AN ARBITRARY VALUE
C
      DATA(J,1)=Z(I)
      DATA(J,2)= R(I)
      J=J+1
   85 CONTINUE
      JK=JK-NN
      CALL ZR(DATA,JK,Q,S)
      GO TO 57
   48 JK=II
      NN=0
      J=1
      DO 86  I=1,JK
      IF (RR(I).LE.,01)  NN=NN+1
      IF(RR(I).LE.,01)  GO TO 86
      DATA(J,1)=ZZ(I)
      DATA(J,2)=RR(I)
      J=J+1
   86 CONTINUE
      JK=JK-NN
      CALL ZR(DATA,JK,Q,S)
      STOP
      END
      SUBROUTINE ZR(DATA,JK,Q,S)
C
C *** THIS SUBROUTINE COMPUTES BEST FIT RELATIUNSHIP TO Z/R DATA POINTS
C
      DIMENSION X(500), Y(500),DATA(500,2)
      INTEGER Q,S
      N=JK
   12 DO 23 I =1,N
      X(I) = ALOG(DATA(I,1))
      Y(I) = ALOG(DATA(I,2))
   23 CONTINUE
   50 CONTINUE
      XSUM =0.
      YSUM = 0.
      XSUMSQ = 0.
      YSUMSQ = 0.
      XYSUM =0.
      DO 30 I = 1,N
```

```
      XSUM = XSUM + X(I)
      YSUM = YSUM + Y(I)
      XYSUM = XYSUM + (X(I) * Y(I))
      XSUMSQ = XSUMSQ + X(I)**2
      YSUMSQ = YSUMSQ + Y(I)**2
   30 CONTINUE
      DATAN = FLOAT(N)
      XAVG = XSUM/DATAN
      YAVG = YSUM/DATAN
C     REGRESSION OF Y ON X, WHERE Y = AZERO + AONE * X
C
      DENOM1 = DATAN * XSUMSQ - XSUM**2
      AZERO = (YSUM * XSUMSQ - XSUM * XYSUM)/DENOM1
      AONE = (DATAN * XYSUM - XSUM * YSUM)/DENOM1
C
C  REGRESSION OF X ON Y, WHERE X = BZERO + BONE * Y
      DENOM2 = DATAN * YSUMSQ - YSUM**2
      BZERO = (XSUM * YSUMSQ - YSUM * XYSUM)/DENOM2
      BONE =  (AONE * DENOM1)/DENOM2
C  CALCULATE THE CORRELATION COEFFICIENT, R
      R = SQRT(AONE*BONE)
C  THE WRITE STATEMENTS FOLLOW
      WRITE(S,100)
      WRITE(S,101)((DATA(I,J), J=1,2), I=1,N)
       WRITE(S,102) XAVG, YAVG, XSUM, XSUMSQ, YSUM, YSUMSQ
       WRITE(S,103)  AZERO, AONE, BZERO, BONE, R
  100 FORMAT(1H0)
  101 FORMAT(10X,2F15,2)
 102  FORMAT(1H1,6X,4HXAVG,11X,4HYAVG,16X,4HXSUM,10X,6HXSUMSQ,10X,
     1  4HYSUM,10X,6HYSUMSQ// 2F15,5,5X,4F15,5)
  103 FORMAT(1H0,9HA-ZERO = ,F10,5,15X,8HA-ONE = ,F10,5//,1X,9HB-ZERO =
     1 ,
     2F10,5,15X,8HB-ONE = ,F10,5///,040H      THE CORRELATION COEFFICIENT
     3, R IS    ,F6,5///)
       WRITE (S,104) N
  104 FORMAT(1H0,33HTHE NUMBER OF DATA POINTS USED = , I5,///)
C
C
C  FINDING A AND B IN THE EXPRESSION, Z = A*R**B WHERE LOG = X AND LOG R = Y.
       A1 = EXP(BZERO)
       B1 = BONE
       A2 = EXP(-AZERO/AONE)
      B2 = 1./AONE
      WRITE(S,200)
 200  FORMAT(1H0,90HFROM THE REGRESSION OF LOGR ON LOGZ, WE GET A = A1 A
     1ND B = B1, IN THE EQUATION Z = A*R**B,     //)
       WRITE(S,201) A1, B1
 201 FORMAT(1H0, 10H      A1 = ,F8,2, 10H      B1 = ,F8,2/////)
       WRITE(S,202)
 202  FORMAT(1H0, 90HFROM THE REGRESSION OF LOGZ ON LOGR, WE GET A = A2
     1AND B = B2, IN THE EQUATION Z = A*R**B,//)
       WRITE(S,203) A2, B2
 203 FORMAT(1H0, 10H      A2 = ,F8,2,10H      B2 = ,F8,2)
      RETURN
      END
```

	.125	.375	.625	.875	1.125	1.375	1.625	1.875	2.125	2.375	2.625	2.875	3.125	3.375	3.625	3.875	4.125	4.375	4.625	4.875
[illegible]	650.0	450.0	320.0	200.0	130.0	85.0	45.0	22.0	7.0	1.4	.4	.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
[illegible]	171.6	395.1	473.3	407.0	329.7	253.4	151.8	81.7	28.1	6.0	1.6	.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Z = 3672.18 R = 9.84 DEPTH IN MM = .30

[illegible]	650.0	450.0	320.0	200.0	130.0	85.0	45.0	22.0	7.0	.7	.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
[illegible]	171.6	395.1	473.3	407.0	329.7	253.4	151.8	81.7	28.1	3.0	.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Z = 3556.16 R = 9.59 DEPTH IN MM = .32

[illegible]	650.0	450.0	320.0	200.0	130.0	85.0	45.0	22.0	7.0	1.6	.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
[illegible]	171.6	395.1	473.3	407.0	329.7	253.4	151.8	81.7	28.1	6.6	.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Z = 3729.70 R = 9.75 DEPTH IN MM = .33

[illegible]	300.0	230.0	150.0	100.0	60.0	35.0	20.0	10.0	4.7	.2	.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
[illegible]	76.3	202.0	221.9	203.5	152.2	104.3	67.5	37.1	18.8	.9	.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Z = 1749.42 R = 4.50 DEPTH IN MM = .15

[illegible]	300.0	230.0	150.0	100.0	60.0	35.0	20.0	10.0	3.5	.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
[illegible]	76.3	202.0	221.9	203.5	152.2	104.3	67.5	37.1	14.0	.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Z = 1573.57 R = 4.30 DEPTH IN MM = .14

[illegible]	500.0	450.0	300.0	150.0	110.0	70.0	35.0	15.0	6.0	1.6	.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
[illegible]	156.6	395.1	443.7	366.3	279.0	208.7	118.0	55.7	24.1	6.8	.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Z = 2897.25 R = 7.94 DEPTH IN MM = .26

[illegible]	500.0	450.0	300.0	150.0	110.0	70.0	35.0	15.0	6.0	1.9	.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
[illegible]	156.6	395.1	443.7	366.3	279.0	208.7	118.0	55.7	24.1	8.1	4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Z = 3260.11 R = 8.17 DEPTH IN MM = .27

[illegible]	500.0	450.0	300.0	150.0	110.0	70.0	35.0	15.0	6.0	1.2	.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
[illegible]	156.6	395.1	443.7	366.3	279.0	208.7	118.0	55.7	24.1	5.1	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Z = 2960.90 R = 7.92 DEPTH IN MM = .26

TOTAL RAIN FOR DAY = 2.02 MM/HR

3672.18	9.84
3556.16	9.59
3729.70	9.75
1749.42	4.50
1573.57	4.30
2897.25	7.94
3260.11	8.17
2960.90	7.92

XAVG	YAVG	XSUM	XSUMSQ	YSUM	YSUMSQ
7.94976	2.00361	63.59805	506.42126	16.02888	32.90120

A-ZERO = -5.69111 A-ONE = .96795

B-ZERO = 5.89503 B-ONE = 1.02552

THE CORRELATION COEFFICIENT, R IS .99632

THE NUMBER OF DATA POINTS USED = 8

FROM THE REGRESSION OF LOGR ON LOGZ, WE GET A = A1 AND B = B1, IN THE EQUATION Z = A*R**B,

A1 = 363.23 B1 = 1.03

FROM THE REGRESSION OF LOGZ ON LOGR, WE GET A = A2 AND B = B2, IN THE EQUATION Z = A*R**B,

A2 = 357.64 B2 = 1.03

3872.18	9.84
3568.18	9.59
3729.70	9.75
1749.49	4.50
1573.57	4.30
2997.25	7.94
3280.11	8.17
2990.90	7.92

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