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A New Data Base of Supercooled Cloud Variables for Altitudes up to 10,000 Feet AGL and the Implications for Low Altitude Aircraft Icing

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16. Abstract

About 7000 nautical miles (nmi) of airborne measurements in a variety of supercooled cloud types and weather conditions up to 10,000 feet (3 kilometers) above ground level (AGL) have been computerized to form a new Data Base of cloud variables applicable to low altitude aircraft icing studies. Half of the data is from the aircraft icing research flights conducted by the National Advisory Committee for Aeronautics (NACA) in 1946-50. The other half is from recent wintertime research flights by the Naval Research Laboratory and other organizations, mostly over the conterminous United States (CONUS) and nearby offshore areas. The Data Base includes liquid water content (LWC), cloud droplet median volume diameter (MVD), true outside air temperature (OAT), horizontal extent and altitude of uniform cloud intervals as well as information on cloud type, weather conditions, date and geographic location, and other data.

A variety of analyses are illustrated which yield these principal conclusions: The NACA and modern CONUS measurements generally agree in most aspects for similar amounts of data in similar cloud and weather conditions. The Intermittent Maximum and Continuous Maximum "envelopes" in the Federal Aviation Regulations, Part 25 (FAR-25), Appendix C, do not correctly describe the icing environment for altitudes up to 10,000 feet AGL. The average ice accretion rate appears to be independent of altitude between 2000 and 10,000 feet AGL.

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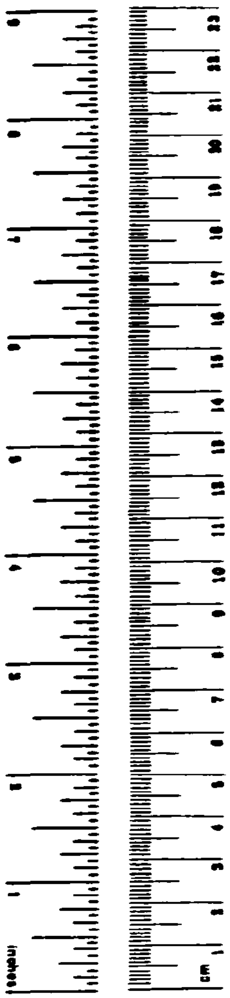
METRIC CONVERSION FACTORS

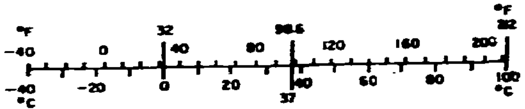
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in²	square inches	6.5	square centimeters	cm²
ft²	square feet	0.09	square meters	m²
yd²	square yards	0.8	square meters	m²
mi²	square miles	2.6	square kilometers	km²
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft³	cubic feet	0.03	cubic meters	m³
yd³	cubic yards	0.76	cubic meters	m³
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm²	square centimeters	0.16	square inches	in²
m²	square meters	1.2	square yards	yd²
km²	square kilometers	0.4	square miles	mi²
ha	hectares (10,000 m²)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m³	cubic meters	35	cubic feet	ft³
m³	cubic meters	1.3	cubic yards	yd³
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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*1 in ≡ 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.

PREFACE

This research project has benefitted from the assistance and experience of a number of people.

Ronald C. Beattie and Ben J. Julian of NRL provided invaluable technical assistance in the installation, maintenance, and improvement of NRL's airborne cloud physics instrumentation.

Appreciation is given to the following persons for their help and cooperation in providing quality processed data for inclusion in the new Data Base:

Wayne Sand, Marcia Politovich, and Todd Sherman of the University of Wyoming; Larry Jahnsen, Mark Humbert, Robert Anderson, and Don Takeuchi of Meteorology Research, Inc.; Jean-Francois Gayet of the Laboratoire Associe de Meteorologie Physique of the University of Clermont II in France; Lawrence Radke, Peter Hobbs, Art Rangno, and Douglas Bell of the University of Washington; Morton Glass of the Air Force Geophysical Laboratories (USAF/AFGL); and Porter Perkins of the NASA/Lewis Research Center.

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Credit is due to the following naval officers who were students in a meteorology course taught by the author during one year spent as the NAVAIR Research Associate Professor in Meteorology at the U.S. Naval Academy while this research project was under way. These officers, then midshipmen 1/c, participated in some of the NRL research flights and worked up segments of the data. They are: John Bitman, Vincent Calvente, Margaret DeLuca, T.B. Fleischer, Steve Fortunato, Victor McCree, William P. Morgan, David Mutzabaugh, Fred E. Smith, Louis S. Steckler, Milton Stretton, Edmund L. Turner, James T. Vazquez, and Mark Washington.

In addition, Ensigns Mary B. Clifford and Richard Cianflone helped substantially in preparing the NACA data for inclusion into the computerized Icing Data Base.

Bernie Ulfers at NRL gave valuable assistance in development of the computer codes for the computer graphics used in this report.

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LIST OF ABBREVIATIONS

AGL - above ground level

CONUS - Conterminous United States

FAA - Federal Aviation Administration

FAR-25 - Federal Aviation Regulations, Part 25

IFR - Instrument Flight Rules

IMC - Instrument Meteorological Conditions

kt - knot(s)

L.A.M.P. - Laboratoire Associe de Meteorologie Physique (Univ. Clermont II, France)

LWC - Liquid water content

MRI - Meteorology Research, Inc.

NACA - National Advisory Committee for Aeronautics

nmi - nautical mile

NRL - Naval Research Laboratory

OAT - Outside Air Temperature

UWSH - University of Washington (Seattle)

UWY - University of Wyoming

USAF/AFGL - United States Air Force/Air Force Geophysical Laboratories

USAF/ETAC - United States Air Force/Environmental Technical Applications Center

μm - micron (10^{-6} meter)

EXECUTIVE SUMMARY

This report is in response to a growing requirement over the last decade for a new assessment of aircraft icing conditions in wintertime clouds at altitudes up to about 10,000 ft. Currently, no helicopters and few general aviation aircraft are certified for flight in known icing conditions. This is because the current FAA criteria for design and certification of ice protection equipment results in relatively high power and payload penalties for smaller aircraft. The FAA criteria (promulgated in the Federal Aviation Regulations, Part 25 (FAR-25), Appendix C; also shown as Figures 1 to 6 of this report) were actually designed for large, transport-category aircraft capable of flying to 20,000 ft or more. For this reason, there have been concerns that the current criteria may be too severe for smaller aircraft which generally operate at altitudes below 10,000 ft.

The aircraft icing hazard comes from the fact that undisturbed cloud droplets generally remain liquid even at temperatures several tens of degrees below freezing-- a condition called supercooling. When they collide with a passing aircraft, the droplets freeze nearly instantaneously to form ice on exposed aircraft surfaces. The amount of ice depends primarily on the liquid water content (LWC) of the cloud, the size of the droplets, the temperature of the aircraft surfaces and, of course, on the horizontal extent of the supercooled clouds along the flight path. Information on the natural occurrence of these variables is obtained from research flights through subfreezing clouds.

The current FAA characterizations of supercooled clouds in FAR-25 are based on research flights undertaken about 35 years ago. Recent advances in cloud physics instrumentation have therefore prompted calls for new measurements and for a re-evaluation of the old data for accuracy and reliability. The net requirement is for a reliable, quantitative description of supercooled cloud characteristics over the altitude range from ground level to 10,000 ft.

In response to this requirement, the Naval Research Laboratory (NRL) has computerized about 7000 nautical miles (nmi) of airborne measurements in supercooled clouds at altitudes up to 10,000 ft (3 km) to form a new data base for low altitude, aircraft icing applications. Half of the data is from the National Advisory Committee for Aeronautics (NACA) aircraft icing studies of 1946-50 where ice accretion on rotating multicylinders was the primary measurement technique for LWC and droplet size. The other half is from recent research flights by NRL and other organizations using optical, cloud droplet size spectrometers manufactured by Particle Measuring Systems. These measure droplet sizes, with LWC being measured by electronic hot-wire devices as well as being computed from the recorded droplet size distribution.

The principal conclusions relevant to aircraft ice protection for altitudes up to 10,000 ft above ground level (AGL) are:

1. The NACA and modern data generally agree in most aspects, indicating that the NACA data are accurate and reliable except possibly for droplet diameters larger than 35 μm.

2. The "Intermittent Maximum" (convective cloud) and "Continuous Maximum" (layer cloud) ranges of cloud variables in FAR-25, App. C do not correctly describe the icing environment in the altitude interval from 0 to 10,000 ft AGL. The differences are in the following items:

a) The maximum observed LWC for convective clouds below 10,000 ft AGL is about half the "Intermittent Maximum" value. The maximum observed LWC for layer clouds below 10,000 ft AGL is about 50% larger than the "Continuous Maximum" value.

b) The new analyses reveal temperature dependences of droplet median volume diameter (MVD) that are not conveyed in the FAR-25 envelopes. The Continuous Maximum and Intermittent Maximum envelopes extend to fixed, maximum MVDs of 40 and 50μm, respectively. The modern data demonstrate that the maximum MVD in layer clouds decreases with decreasing temperature Both the NACA and modern CONUS data show that for convective clouds the average MVD exhibits the opposite behavior and increases with decreasing temperature.

c) The modern data show no credible MVDs larger than about 35μm for droplets in supercooled clouds below 10,000 ft AGL. The few MVDs that are reported to be larger than 35μm in the NACA data are questionable in view of the assessment by the NACA researchers themselves that these large MVDs are likely to contain large positive errors due to the limitations of the multicylinder technique.

3. The FAR-25 envelopes extend to at least -30°C but minimum temperatures observed in both the NACA and modern data below 10,000 ft AGL are -17°C for convective clouds and about -25°C for layer clouds. That is, convective clouds appear to be completely absent at temperatures less than about -17°C at altitudes below 10,000 ft AGL.

4. A review of the literature reveals no standard definition of horizontal extent nor do the FAR-25 regulations specify how horizontal extent is to be determined when cloud gaps are present. As a result, confusing and inconsistent interpretations occur in practice. It is suggested here that horizontal extent be defined as the distance traveled in supercooled clouds until the aircraft reaches a cloud gap of some specified minimum duration, such as 1 nmi, for example. With this definition it is found that the maximum, and to a lesser degree the average horizontal extent varies in an inverse manner with the LWC averaged over the clouds comprising the horizontal extent. But short horizontal extents are actually most common regardless of the avarage LWC value.

5. Finally, a new finding with respect to the altitude dependence of icing conditions is that between 2000 and 10,000 ft AGL, altitude makes practically no difference in the maximum amount of ice accretion to be expected per icing encounter when all supercooled cloud types are considered together.

INTRODUCTION

MOTIVATION FOR THE RESEARCH

This study was undertaken in response to a growing requirement for a reliable, quantitative description of low altitude, wintertime cloud characteristics that are relevant to aircraft icing. The liquid water content (LWC) and size distribution of droplets in supercooled clouds, as well as the cloud temperature and horizontal extent of icing conditions, are generally considered to be the most important environmental factors involved in ice accretion processes. Information on these variables at altitudes below 10,000 ft (3 km) or so is needed by helicopter manufacturers who want to produce rotorcraft capable of flying into known icing conditions. (At the present time, a few military types of helicopters are about the only rotorcraft equipped with ice protection devices.) The Federal Aviation Administration (FAA), as the responsible regulatory agency, needs the same information in order to specify icing environmental criteria for the manufacturers to use in designing ice protection equipment. The FAA and military also use this type of information for specifying the requirements of actual flight certification tests in icing conditions.

At the time this study was begun, the available data on the icing environment over the United States was almost entirely from research performed 30 to 35 years ago for similar reasons by the National Advisory Committee for Aeronautics (NACA). They obtained airborne measurements for use in design and certification of ice protection equipment for the expanding, postwar, commercial airline industry. Those measurements still form the basis of current design and certification criteria for the icing environment as promulgated in Federal Aviation Regulations, Part 25, Appendix C (FAR-25, App. C).

Presently any helicopter which is a candidate for icing certification must meet these same criteria that were developed for larger "transport category" aircraft designed to fly to altitudes of 20,000 ft or more. These criteria contain LWC values that could be prohibitive in terms of the power and payload penalties required to provide compensating ice protection equipment for many helicopters. For this reason there is an interest in finding out whether at altitudes of 10,000 ft or less, the altitude operating range for most helicopters, icing conditions may be significantly less severe than current regulations specify. If so, and if new icing criteria were to be issued that represented the less severe conditions and at the same time limited flight to altitudes below the appropriate level, then other light duty, low-performance aircraft might benefit as well. Questions have also arisen about the effect of snow or other mixed conditions on the rate of ice accretion. Low-altitude icing also implies a need to investigate geographical, topographical, or other mesoscale influences too. For example, LWC values may be enhanced in lake effect clouds, orographically assisted cloud formations, and clouds along cold fronts or in maritime air masses.

In addition to the engineering concerns, there have been calls for improved icing forecasts and for redefining the icing severity classifications in terms of quantitative LWC values instead of the relative and ambiguous terminology, "trace," "light," "moderate," etc. that is now in use.

Recent advances in cloud physics instrumentation have also prompted calls for the review of the 30 to 35 year old NACA data in order to assess their accuracy and reliability. In addition, it is of interest to determine how much of the data actually apply to altitudes below both 10,000 ft and 5000 ft, and how well the data represent the variety of weather and cloud conditions at these altitudes.

Finally, there was an obvious need to obtain new data with modern instrumentation. The results would naturally be compared with the NACA data to look for significant differences which may indicate either errors in one or both sets of data or, as some have suggested, true changes in cloud characteristics brought about by changes in pollution levels over the intervening years. New measurements may also be needed to supplement data from any cloud types, weather situations, or geographic locations inadequately sampled by the NACA researchers.

SCOPE OF THE RESEARCH PROJECT

In order to address these problems the FAA funded the Experimental Cloud Physics Section of the Naval Research Laboratory (NRL), beginning in January 1979, to perform research on these topics. Specifically, the research plan was as follows.

a) Obtain new measurements of LWC, droplet size spectra, true air temperature and other relevant variables using modern cloud physics instrumentation aboard NRL's research aircraft in subfreezing clouds below 10,000 ft and especially below 5000 ft.

b) Collect similar modern data that are available from other research groups.

c) Review the NACA data for accuracy, reliability, and applicability to altitudes below 10,000 ft and below 5000 ft.

d) Compile all acceptable data into a medium that is compatible with automatic data processing in order to form a new data base for analysis of the low-altitude icing environment.

e) Perform analyses of the data and, based on an assessment of all data obtained, recommend appropriate changes in the existing environmental icing criteria.

OTHER BACKGROUND INFORMATION

1. FAR-25, Appendix C, Atmospheric Icing Conditions

The primary reference data given in the Federal Aviation Regulations, Part 25, (FAR-25) to describe icing cloud characteristics are the LWC vs. Median Volume Diameter (MVD) relationships in figures 1 and 4 of Appendix C in that document. Those figures are reproduced here also as figures 1 and 4 of this report. Combinations of LWC and MVD that fall within the boundaries of these "envelopes" were reported to have sufficient probability of occurring simultaneously, that they were to be regarded as significant for ice protection considerations (Jones and Lewis, 1949, p. 2). NACA researchers also noted that the maximum observed LWCs were limited by the air temperature at cloud level. This temperature dependence has been worked into the icing "envelopes" by specifying the probable maximum values of LWC as a function of MVD and temperature. "Probable maximum" is the terminology used in NACA TN-1855 (Jones and Lewis, 1949), the source document for FAR-25, Appendix C. "Probable maximum" was defined as the maximum that would probably be encountered in all weather aircraft operations but does not represent the maximum that nature could produce (ibid., p. 5). No numerical probability was associated with the term "probable maximum" until a later statistical study (Lewis and Bergrun, 1952, pp. 19-20) concluded that the probable maximum LWCs [of FAR-25, App. C] correspond to an exceedance probability of about 0.1%. The "isotherms" drawn in 10°C increments from 32°F (0°C) to -22°F (-30°C) in figures 1 and 4 delimit the probable maximum values of LWC at each of these temperatures.

The NACA criteria originally specified in TN-1855 actually contained seven different types of icing conditions, each with a time or distance extent that varied with the corresponding type of cloud and LWC range. In practice, only two of these conditions, the "intermittent maximum" and the "continuous maximum," were promulgated in FAR-25. The philosophy behind the two-condition approach is presumably to ensure that aircraft de-icing equipment can handle relatively small LWCs for long periods of time, and relatively large LWCs for a short time in the most commonly experienced icing situations.

The explanatory text accompanying the figures in Appendix C of FAR-25 is quoted as follows for continuous maximum icing: "The maximum continuous intensity of atmospheric icing conditions (continuous maximum icing) is defined by the variables of the cloud liquid water content, the mean effective diameter of the cloud droplets, the ambient air temperature, and the interrelationship of these three variables as shown in figure 1 of [FAR-25, App. C]. The limiting icing envelope in terms of altitude and temperature is given in figure 2 of [FAR-25, App. C]. The interrelationship of cloud liquid water content with drop diameter and altitude is determined from figures 1 and 2. The cloud liquid water content for continuous maximum icing conditions of a horizontal extent other than 17.4 nautical miles (nmi) is determined by the value of liquid water content of figure 1, multiplied by the appropriate factor from figure 3." A similar explanatory text applies to the intermittent maximum conditions covered in figures 4, 5, and 6, and specifies a standard horizontal extent of 2.6 nmi.

No other rules or guidance for using these envelopes in design computations or in certification flight tests are given in FAR-25.

2. Cloud Liquid Water Content (LWC)

a. Engineering Significance

Nearly all ice that forms in flight on aircraft surfaces is due to the impaction and freezing of supercooled cloud droplets. Supercooled droplets are those which remain liquid even though the ambient cloud temperature is less than 0°C. This supercooled state is a metastable one, meaning that the droplets can remain liquid indefinitely unless the temperature becomes too low or the droplets are mechanically disturbed. Once disturbed, such as upon collision with an aircraft component, the droplets freeze rapidly depending on their size and on the temperature of the air and of the aircraft surfaces. Small droplets freeze instantaneously and form rime ice on aircraft surfaces. Large droplets tend to run back somewhat before freezing.

Despite the metastable state, supercooled clouds are the rule rather than the exception for ambient temperatures down to at least -10°C. Thus the rate of ice accretion on aircraft components is directly proportional to the liquid water content of the supercooled cloud in which the flight takes place.

b. Meteorological Considerations

The principal factors conducive to large values of LWC in clouds are warm, moist air masses and strong convection or forced updrafts within the cloud. Fortunately, for the aircraft icing problem, both of these factors are minimized in wintertime climates.

Higher temperatures permit the air masses to carry greater amounts of water vapor from which clouds must form. The greater the water vapor load in the subcloud air, the greater the possible LWC in the clouds formed from it.

The maximum LWC in a cloud also depends on the strength of the convection or the rate of updraft in the cloud. The higher surface temperatures that can induce strong convection are of course lacking in wintertime climates. There are exceptions, however, which are important in the altitude regime below 10,000 ft. One of these exceptions is the "lake effect" situation where relatively warm lake or ocean waters provide additional moisture and induce convection in colder air masses advecting across them. Notable occurrences of this phenomenon in North America are over the Great Lakes and over the ocean waters along the mid-Atlantic seaboard states, especially in the vicinity of the Gulf Stream. Another possible exception is the case of a strong cold front pushing into a warm, moist air mass. In this case again, both the greater water vapor content of the warm air and the forced lifting of this air over the cold frontal surface are conducive to greater than usual LWCs. A third exception is where forced lifting occurs on the windward side of mountain ranges. These orographic effects are known to be significant along the Appalachian range. They would be expected to have an even greater effect on LWC along the Pacific coast ranges where the maritime air masses are moist and the mountains are higher.

The greatest icing hazards occur in warm weather cumulonimbus (Cb) clouds, or developing thunderstorms, where LWCs up to 5 g/m^3 have been reported. However, the freezing level in these clouds is usually above 10,000 ft AGL, and icing hazards are therefore of little concern to aircraft at lower flight levels. Indeed the other hazards present in these clouds or storms will generally be far more worrisome. In any case, these cloud types are relatively easy to identify and are sufficiently localized or transient that they can normally be avoided.

Wintertime stratus not associated with cyclonic centers or with strong frontal systems is expected to be low in LWC both because of the low water vapor content of the surrounding cold air and the lack of significant convection. Observation also reveals that even in the deep and extensive altostratus and nimbostratus complexes comprising the general snow areas of cyclonic storms, liquid cloud droplets are almost completely absent in the subfreezing portions of the clouds (Lewis, 1969, p. 7), (Kline and Walker, 1951). Finally, during cold air outbreaks from central Canada into the central plains states, the western edge of the cold air mass is sometimes forced westward and upward over the gradually increasing elevation of the terrain. This "upslope flow" usually forces stratus formation but because of the dryness of the cold air mass the LWC is expected to be small in the upslope stratus.

This leaves frontal systems, lake effects and orographic situations as the principal candidates for contributing the most significant LWCs in wintertime cloud systems at altitudes below 10,000 ft AGL.

3. Cloud Droplet Size Distribution

Engineering Significance

The size distribution of cloud droplets and the percentage of liquid water represented by various droplet size intervals is also important. This is because the efficiency with which aircraft components collect droplets from the airstream varies with droplet diameter as well as airspeed and the size and shape of the aircraft component. Smaller droplets are more easily deflected and tend to follow the airstream around an object in their path. The larger the droplet, the greater its inertia and its tendency to slip across streamlines upon approaching an object. Thus, larger droplets will be collected with greater efficiency than smaller droplets. Therefore, whether the majority of the LWC resides in small or large droplets can be an important factor in the design of ice protection equipment.

Qualitatively speaking, blunt objects such as fuselages have relatively low collection efficiencies for all except the largest droplet sizes. This is because blunt objects distort the airstream farther ahead and give the droplets more time and therefore slower curving streamlines to follow to get out of the way. Sharp objects, such as the leading edge of rotor blades, have high collection efficiencies for all droplet sizes, especially along the outer portions of the blade where it is the thinnest. Also, the linear velocity of the blade increases with distance from the hub and adds to the increased efficiency of the outboard sections compared to the thicker, slower moving portions of the blade toward the hub.

For many applications it is often too cumbersome to work with elaborate droplet size distributions. There is a need for a simple, quantitative representation of droplet size distribution which would be meaningful for engineering computations as well as for statistical analyses of icing conditions. For this purpose the median volume diameter (MVD), also known as mass median diameter, is generally chosen. The MVD is useful because it is the droplet size which equally divides the LWC associated with a given droplet size distribution. Half of the LWC is in droplets larger than the MVD and half of the LWC is in droplets smaller than the MVD.

Because of the difficulty in accurately determining the droplet size distribution with the techniques available at the time, the NACA researchers preferred to use the term "mean effective diameter." This is an approximation to the MVD that is based on the apparent size distribution deduced from the relative amounts of ice that built up on the different diameter cylinders used by the NACA researchers to probe the clouds for LWC. The more closely the deduced size distribution matched the true size distribution, the better the corresponding mean effective diameter approximated the MVD.

NACA also defined a "maximum diameter" intended to represent the largest droplets that were present in detectable quantities. This variable was not accurately measured with the available technique employing a single, 4 or 6 inch diameter cylinder covered with sensitized blueprint paper. Eventually, the use of maximum diameter was abandoned as unreliable (Lewis et al., 1947), (Lewis and Hoecker, 1949).

This idea of maximum diameter has been reinstated in the new Icing Data Base because of the accurate, high-resolution droplet size spectra that are now available with the modern, optical, droplet size spectrometers. Here, the term "maximum diameter" has been defined to mean the droplet size below which 95% of all the LWC is contained.

4. Altitude Above Ground Level (AGL) as a Preferred Altitude Reference

In the author's opinion, altitudes referenced to ground level are preferable to pressure altitude or altitudes referenced to sea level when analyzing cloud properties or specifying aircraft certification criteria limited to low or intermediate altitudes. There are two reasons for this preference. Firstly, cloud formation is more directly relatable to altitude AGL. That is, given the same initial conditions of temperature, relative humidity and lapse rate, a cloud that forms due to convection at 4000 ft AGL over Washington, D.C., would also form at 4000 ft AGL over Denver, Colorado. The fact that the elevation at Denver is 5000 ft above Washington, D.C. has no bearing on the formation or properties of the clouds. For this reason, when clouds or cloud properties are analyzed or otherwise grouped by altitude, it is more meaningful to use altitudes AGL. For example, if some cloud property such as maximum LWC were to be catalogued according to pressure altitude, then the LWC at altitudes only 2000 ft AGL over Denver would be unfairly compared with LWCs at altitudes of 7000 ft AGL over locations near sea level. Secondly, suppose that it were decided that a new set of certification criteria would be acceptable if flight under this certification were not to exceed 5000 ft. Obviously, if this were 5000 ft pressure altitude, then an affected aircraft could never leave the ground at Denver. On the other hand, a 5000 ft AGL limitation would correctly allow the subject aircraft to fly up to 10,000 ft pressure altitude over Denver without encountering overall cloud conditions any worse than at 5000 ft AGL anywhere else.

RESULTS

THE NEW ICING DATA BASE

1. The Data Management Philosophy

A major part of this research effort involved collecting, screening, and compiling both new and old data into a coded medium for automatic data processing. It was realized, for example, that in addition to the immediate aircraft icing application, a data base of the envisioned magnitude ought to be of value for basic cloud physics studies as well as for use in attempting to test or improve existing icing forecast rules. Thus, besides the principal variables of LWC, droplet size, air temperature, and horizontal extent, it seemed prudent to include other relevant information in order to ensure maximum usefulness of the data base. This information includes cloud type, cloud base and cloud top heights and temperatures, airmass type, geographic location, and a brief description of the synoptic situation at the location of the measurements. Some of these types of auxiliary information had been reported along with much of the NACA data.

The first problem was to condense large amounts of modern data into a manageable data base. Modern, electronically based probes and instrumentation provide digitized measurements at the rate of once every second or so during flight. Clearly, some kind of averaging scheme was required in order to avoid being overwhelmed by vast numbers of individual measurements. But averages over arbitrary intervals, such as for 1 minute periods or for an entire pass through a cloud, were undesirable because they would wash out useful detail otherwise available with the modern, high-resolution measurements. There was a need to define a suitable averaging scheme which would satisfy the following requirements:

a) The averaging intervals should be short enough to resolve any significant changes in cloud characteristics along the flight path and represent natural variability without resulting in an unwieldy number of averages.

b) Intervals of uniform, constant conditions within clouds should be preserved whole so their durations and characteristics can be documented without the ambiguity that would occur if the average included voids or adjacent parcels having significantly different, or variable properties.

c) The scheme should resolve extremes of LWC and other variables without dilution.

d) The scheme should preserve altitude dependent changes in cloud properties observed during ascents or descents through clouds.

e) The scheme must be able to accommodate broken or scattered cloud conditions as well as widespread continuous clouds.

f) The scheme must be compatible with the existing NACA measurements so they can be compiled and validly compared to the modern data.

Basically, the requirement is to divide the cloud into intervals where conditions are apparently different (or to group data into intervals where conditions are approximately constant).

After several ideas were tested, it was concluded that the most logical and practical approach was to average the measurements only over continuous, uniform portions of clouds or cloud parcels until any of several key variables changed significantly. If the aircraft were still in continuous clouds at that time, a new averaging interval was immediately begun and continued until the next significant change in cloud properties occurred. Otherwise, the next average was not begun until the aircraft entered another continuous, uniform section of cloud.

These averaging intervals are referred to as "icing events." The key variables and the amount of change in any of them that will signal the termination of an averaging interval (icing event) are given as "Rules for Defining Uniform Cloud Intervals" in Table 1.

There was still the need for a selection rule that would avoid swamping the data base with numerous, inconsequential cloud parcels or fragments, yet would not seriously bias the representativeness of the data at small values of LWC. The practical solution was to limit averages to clouds or cloud sections that are at least 1 nmi wide (20 s at true airspeeds of 180 kt) unless momentary LWCs were greater than 0.5 g/m^3, or some other interesting property was worth documenting. This preserved extreme values of LWC associated with convective cells embedded in layer cloud systems, for example, but ignored brief cloud parcels in broken or scattered cloud systems with little vertical extent (and therefore with LWCs generally less than 0.1 g/m^3). These thin cloud layers are of little practical concern anyway, because they can be avoided in flight by minor changes in altitude.

Another advantage of the overall averaging scheme is that not only are data available on the extents of individual, uniform, cloud intervals, but the overall horizontal extent of continuous or semi-continuous icing conditions is available simply by summing the extent of consecutive events. (See later sections on Horizontal Extent for discussions of practical difficulties with this concept, however.)

Although these rules were designed for the modern data, the NACA data can be formally accommodated as well. The NACA measurements were timed exposures of rotating multicylinders in the airstream during flight through subfreezing clouds. The exposure times were usually 1 minute or more, and the data therefore represent an average over these intervals. The NACA data are published either as individual exposures or as averages of a group of exposures. Thus, there is no control over these intervals now, except to separate out from the groups the one exposure exhibiting the greatest average LWC, whenever that exposure was listed separately as well as being included in the average (Lewis, 1947).

2. The Data Coding Scheme

The means chosen for storing the data was the 80 column punchcard for computers. (Actually, a Hewlett Packard model 9825B desktop computer with cassette storage was used at NRL, but the 80 column format was retained

TABLE 1. RULES FOR DEFINING UNIFORM CLOUD INTERVALS

1. For Level Flight Through Continuous Cloud or Cloud Parcels 1 nmi or More in Extent.

RULES: LWC and other variables to be averaged over flight path in cloud until:

A - Aircraft exits main cloud,

B - Outside air temperature changes by ±1.5°C,

C - Outside air temperature rises above 0°C,

D - Droplet median volume diameter changes by ±2.5 μm,

E - Aircraft changes flight levels by ±500 ft (±150 meters),

F - Icing rate changes by ±50%,

G - Droplet concentration, N, changes by ±50% or ±200, whichever is less,

H - Measurement arbitrarily terminated,

J - Aircraft exits continuous cloud parcel,

K - Subsequent cloud droplet probe data invalidated by snow or ice particles in cloud.

2. For Vertical Profiles in Continuous Cloud.

RULE: Report representative values of cloud variables for every 500 ft (150 m) change in altitude.

because of its universal compatibility.) The information associated with each icing event is coded on a separate card. All data cards for icing events from the same cloud or cloud system are grouped behind a lead card which contains general information, such as cloud type, cloud base height, etc., that applies to all of the data cards in the group. The code for assigning data to card columns is given in Table A-1 of Appendix A. Explanations and examples of each data item are given in Tables A-2 and A-3.

The entire Icing Data Base as of this writing is reproduced in Table A-4. It contains nearly 7000 nmi of icing events. It is anticipated that more data will be added in the future in order to better represent frontal, orographic, and lake effect clouds. Plans also call for the addition of data from Mt. Washingtion, New Hampshire, and foreign data as they become available.

The Mt. Washington data, though available, were not included in the Data Base at this time for several reasons. The principal reason was that it is not clear how to compare mountaintop, near-surface data with airborne measurements. That is, it is not clear how the Mt. Washington data apply to aircraft operations which normally do not take place close to the summit or sides of mountains in Instrument Meteorological Conditions (IMC). At best the Mt. Washington data could probably be used to represent worst case, orographically induced LWCs for locations with similar elevations and windward slopes. The other reasons for not using the Mt. Washington data were that, in the available form, the data bear no date or time of day information, nor do they indicate the cloud type or synoptic weather category involved.

'DATA MILES' AS A MEASURE OF FREQUENCY OF OCCURRENCE

During the early phases of this project, it became clear that usage of "number of cases" or "number of events," as is conventionally done to represent the frequency of occurrence of any of the variables, was unsatisfactory. The deficiency was twofold. Firstly, momentary icing events would incorrectly carry just as much statistical weight as long-lasting events. Thus, there was no way to emphasize the statistical importance of an extended encounter with an extreme value of LWC, for example, compared to a relatively insignificant, brief encounter. Secondly, the reader would have no information as to whether a given number of events represents 5 miles or 500 miles of in-flight measurements.

"Data miles" were therefore chosen as the most informative measure of frequency of occurrence. The term is defined as the distance flown in nautical miles during an individual icing event (during an actual probe exposure for the NACA measurements). This convention automatically weights each icing event (or measurement of LWC, for example) by its duration or extent. The other principal advantage is that the reader can easily judge the statistical significance of a data set by the number of data miles it represents.

Duration in terms of distance rather than time was chosen because time duration is not as easy to standardize. The time duration of an event depends on the speed of the aircraft which makes comparison of the data somewhat ambiguous. However, for those purposes where it may be of interest, the time duration of each event is coded in columns 10-11 of each of the icing event data cards.

REVIEW OF THE NACA DATA

An interim report on this project (Jeck, 1980) gave an assessment of the NACA data, reported detailed results from the initial NRL research flights, and gave a preliminary comparison of the NRL measurements with the NACA data. The principal conclusions of the NACA review are as follows:

a) A large fraction of the NACA measurements was actually obtained at altitudes below 10,000 ft.

b) All synoptic conditions and cloud types appear to have been sampled but the number of data miles is small in some categories, especially frontal zones (see Appendix B, Table B-3).

c) Of the several measurement techniques that were tried, the NACA researchers regarded the multicylinder probes to be the most accurate and reliable for deducing LWC. They were eventually aware, however, that their measurements and computations of LWC were subject to at least 13 possible sources of error (Lewis and Bergrun, 1952, p. 16) some positive, some negative, and ranging in magnitude from a few percent up to possibly 100% or more. The net effect of all these possible sources of error is uncertain in the data as reported, but general agreement is found between the NACA data and the modern data. In the detailed comparisons there are also some remarkable similarities, but some differences too, as is shown in the remainder of this report.

The principal problems faced by the NACA researchers were the following:

In 1952, after the NACA researchers became aware of the seriousness of runoff errors for measurements at temperatures just below 0°C, they reexamined their data and concluded that not more than about 5% of the reported measurements would be affected (ibid.). A more significant problem may have been the underindication of average LWC from measurements where the multicylinder probe was exposed in clouds containing momentary voids. In order to correct for this, some of the NACA flights made use of a continuously recording, rotating-disk probe, or "cloud indicator" to document the actual duration of clouds and voids during exposure of the multicylinder probes. As a result, significantly larger values of average LWC were obtained in some cases when the more accurately determined cloud exposure intervals were used (Lewis and Hoecker, 1949, Table 1).

Droplet size distributions were finally given up as totally unreliable when NACA researchers concluded in 1949 that there were too many contradictions in droplet sizes as inferred from the multicylinder probes vs. the coated, fixed-diameter cylinder probes (ibid., p. 1, p. 16). However, the median volume diameters inferred from the multicylinder method alone were still regarded as accurate for "small" droplets but became increasingly inaccurate as the drop size increased. Also, large overestimates were more probable than large underestimates, especially at large values of droplet diameter (Lewis and Bergrun, 1952, p. 17).

ANALYSES AND COMPARISON OF THE NACA AND MODERN DATA

1. At What Altitude Do Icing Conditions Become Serious?

a. Maximum LWC vs. Altitude

A stated goal of the present study is to characterize the icing hazards in the atmosphere from sea level up to 10,000 ft above sea level (ASL). The magnitude of the LWC in supercooled clouds is one of the most important factors in assessing the potential severity of aircraft icing. In order to examine the dependence of LWC on altitude AGL, LWC data were sorted by altitude into the ten 1000 ft intervals between ground level and 10,000 ft AGL. Within each altitude interval, the LWC values were ranked according to cumulative frequencies of occurrence (i.e., the number of data miles accumulated with LWCs up to and including a given value of LWC). One can then determine the LWC values which represent the upper limit of occurrence for selected percentiles of the data miles. The results of such an analysis are shown graphically in figures 7 and 8 for the NACA and modern data, respectively.

A comparison of these two plots shows gross similarities in the altitude dependence of maximum LWC. In both plots the overall maximum observed LWC occurs between the altitudes of 7000 and 9000 ft AGL and has a value of 1.5 to 1.7 g/m^3; the maximum LWC then decreases with altitude up to 10,000 ft. This latter result is probably due to deficient sampling in convective clouds with the low bases and larger vertical extents that are needed to produce supercooled LWCs greater than 1.5 g/m^3 at altitudes above 8000 ft AGL. These convective clouds are scarce during the winter months during which most of the flight data were obtained. In the warmer months the freezing level is frequently above 10,000 ft AGL in clouds of the required depth and therefore larger values of supercooled LWC are still difficult to obtain at altitudes below 10,000 ft.

There are also comparable secondary maxima in both figures 7 and 8, one at the altitude intervals of 4000 to 6000 ft AGL and one at about 2000 ft AGL. The 4000 to 6000 ft AGL interval presumably corresponds to typical upper limits of the turbulent mixing layer in many wintertime situations. The base of the turbulent or subsidence inversion that resides in this altitude interval blocks the vertical development of the stratus or stratocumulus that forms underneath as a result of turbulent mixing. It is known that the maximum LWC developed within a cloud layer generally lies just below cloud top and depends in magnitude on the vertical thickness of the cloud layer. Thus the maximum LWCs will be found just below the turbulent or subsidence inversion whose upper limit appears to be at about 6000 ft AGL.

Percentile curves cumulative with altitude for the entire CONUS Data Base are given in figure 9.

b. Horizontal Extent of Icing Encounters vs. Altitude

These conclusions are further substantiated by figures 10 to 13 where the altitude dependence of horizontal extents of extended icing encounters has been plotted. Again, the NACA and modern data show some surprising similarities. In figure 10 the horizontal extent of the NACA layer cloud icing is seen to peak sharply at an altitude of about 4000 ft AGL. The modern data, figure 11, show a similar, but broader peak which spreads over the range of about 3000 to 5000 ft AGL. At about 8000 ft AGL the modern data show a second, sharper peak which does not appear in the NACA data. These horizontal extents for layer clouds indicate that the top of the turbulent mixing layer in wintertime stratus-forming conditions lies between 3000 and 5000 ft AGL.

The horizontal extents of extended icing encounters in convective clouds are considerably shorter and peak at altitudes above 5000 ft AGL as shown in figures 12 and 13. In these cases, one can also see remarkable similarities between the old and new results. Both show a double peak in horizontal extent with one sharp peak at about 8000 ft AGL and another peak, though poorly resolved in the NACA data, at about 6000 ft.

One question that is prompted by these considerations is whether there exists any "threshold" height above which icing conditions rapidly worsen. If such a threshold does occur, then it may be of practical importance to limit certification to altitudes below it. The altitude dependences of LWC and horizontal extent shown in figures 7 to 13 do not answer this question unambiguously. For example, if the 99th percentile curve is chosen as a guide, figures 7 and 8 show that LWC increases most rapidly between 4000 and 6000 ft AGL for both the NACA and modern data. At 4000 ft AGL the LWC is expected to be less than 0.6 g/m^3 for 99% of the miles flown in icing clouds. This 99% value doubles in the next 2000 feet to about 1.2 g/m^3 at 6000 ft AGL. This suggests that 4000 ft AGL should be considered as a threshold level above which icing conditions rapidly worsen.

On the other hand, figures 10 and 11 show that, in terms of the horizontal extent of extended icing conditions, flight levels of 3000 or 4000 ft AGL are already in a region of maximum horizontal extent. If half the maximum horizontal extent is used as a guide in this case, then about 2000 ft AGL should be considered as the threshold or limiting altitude according to the modern data in figure 11.

c. Altitude Dependence of Average Ice Accretion per Icing Encounter

Rather than relying on LWC or horizontal extent individually, a better indicator of icing severity would be the altitude dependence of the average ice accretion per icing encounter. This quantity is basically just the mass of ice accreted per unit area on an object moving at velocity V for a time t through a cloud with supercooled liquid water content W, as given by the equation

$$M = EWVtF \qquad (1)$$

where E is the collection efficiency of the object (wing section, rotor blade, etc.), and F is the freezing fraction which is assumed to be equal to unity here. The collection efficiency depends on the shape of the object and is also approximately a logarithmic function of the airspeed and the droplet diameter (Brun et al., 1955). For the present purposes, E can be taken as unity, or at least as approximately constant. Also note that the product Vt is just the horizontal extent, H, of the extended icing encounter so that Eq(1) reduces to M = WH. The altitude dependence of this product is plotted in figures 14 to 16. According to the NACA data in figure 14 the maximum ice accretion is reached at about 4000 ft AGL. In the modern data, figure 15, the maximum does not occur until 8000 ft AGL but that is of little significance since 80% of maximum is reached at altitudes as low as 3000 ft AGL. The combined effect of both data sets is shown in figure 16 where it is seen that above 2000 ft AGL, altitude makes practically no difference on the amount of ice accretion to be expected.

2. LWC Frequency of Occurrence Over the Entire 0 to 10,000 ft AGL Range

The frequency of occurrence of individual LWC values is shown in figures 17 to 19 for the entire altitude range up to 10,000 ft. The ordinate in each of these graphs is the total number of data miles flown in icing events with the observed LWC falling in the corresponding 0.1 g/m^3 wide interval along the abscissa. No distinction is made between layer and convective clouds in these graphs.

Note that the shape of the histograms is similar for the NACA and the modern data. The mode of the distributions is also seen to lie in the second LWC interval instead of the first. This result is no doubt an artifact due to the natural bias on the part of icing researchers against recording barely perceptible icing encounters, especially when the more severe conditions are of principal interest. Although it has little significance for the present purposes, a truly accurate LWC frequency distribution curve would continue to rise, probably more or less exponentially, for values of LWC approaching zero.

3. LWC vs. Median Volume Diameter (MVD)

Surprisingly, it is found that when either the NACA or modern data for individual icing events are plotted in the LWC vs. MVD format of the FAR-25, Appendix C icing envelopes, most of the datum points fall outside to the left of these envelopes! This result is exemplified in figure 20 for layer clouds. The questions that immediately arise are: how were the envelopes and their boundaries originally derived, and why were the MVDs cut off at 15 μm rather than being extended to smaller diameters?

Origins of the "Icing Envelopes" in FAR-25, Appendix C

Information printed on figures 1 and 4 of FAR-25, Appendix C states that NACA report TN-1855 (Jones and Lewis, 1949) is the source of data for these envelopes. Within TN-1855 the reader is referred to two earlier reports, TN-1393 (Lewis, 1947) and TN-1424 (Lewis et al., 1947) for the actual data on which the "continuous maximum" envelopes are based. Both TN-1393 and TN-1424 show numerous observations of MVDs in the range 7 to 15 μm. In fact, figure 6 of TN-1424 contains a probability curve which shows that 50% of the observed MVDs are smaller than 13 μm! None of these references contain any obvious statements that 15 μm was viewed as the minimum MVD worth consideration. However, such conclusions may have arisen implicitly from the discourse in TN-1393 on the subject of icing forecast problems. On page 16 of that report, it is proposed that a fixed MVD of 14 μm be assumed for layer clouds in order to simplify the problem of specifying icing intensities from a knowledge of cloud type and estimated LWC alone. Also, in a later section (page 22 of TN-1393) dealing with maximum, continuous LWCs that are likely to occur in layer clouds, a value of 15 μm is proposed as a reasonable estimate for MVDs to be expected concurrently with continuous maximum LWCs of 0.8 g/m^3. The authors then point out that LWCs of 0.5 g/m^3 along with MVDs of 25 μm should be considered as a definite probability in layer clouds too. These conclusions, coupled with a recollection (page 7 of TN-1393) that severe icing was observed on the windshield of their C-46 research aircraft with only 0.15 g/m^3 of LWC when the MVD was an unusually large 50 μm, apparently led the author to stress the potential importance of the larger MVDs because of the greater collection efficiencies associated with them.

It is suggested here that for the purposes of helicopter icing concerns, MVDs smaller than 15 µm should also be considered because the thin rotor blades are expected to have significant catch efficiencies for these smaller droplets as well.

4. Implications of the NACA Data Replotted

One question to be addressed by this research project is whether or not a single icing envelope can be devised to replace the two currently in use (the "continuous maximum" and "intermittent maximum" of FAR-25, App. C.), if certification is limited to some maximum altitude at or below 10,000 ft. That is, for altitudes below a certain level there may be little difference between layer and convective type clouds, as far as LWC is concerned. In order to determine the feasibility of this approach, first the NACA data and then the modern data will be analysed by cloud type.

a. Supercooled Layer Clouds Below 10,000 ft AGL

Figure 20 contains the NACA data for layer clouds at altitudes up to 10,000 ft AGL and for ambient temperatures from -10° to 0°C. Data for temperatures between -20° and -10°C are plotted in figure 21. There are practically no NACA data reported for temperatures below -20°C at altitudes below 10,000 ft AGL. By comparing figures 20 and 21, one may note that maximum LWCs are indeed decreased at the lower temperatures, but only for MVDs smaller than about 25 µm. Data are sparse at all temperatures for MVDs greater than 25 µm, but of the data that do exist above 25 µm, maximum LWCs appear to be generally greater in the temperature range -20° to -10°C than in the range -10° to 0°C.

It is of interest at this point to ask what kind of clouds or situations are associated with these larger MVDs in the NACA data. An examination of the Icing Data Base reveals that 9 out of the 13 events having MVDs greater than 30 µm are reported to be from altocumulus clouds. Eleven of these 13 events occurred in maritime polar (mP) air masses, and all except two or three occurred within 200 miles of a low pressure center or less than 200 miles behind a surface cold front. Nearly all MVDs greater than 30 µm occurred at altitudes above 5000 ft AGL. Half of these cases occurred in the presence of snow, while the other half had no precipitation information so that the presence of any precipitation is unknown. It is suggested later in this report that MVDs in excess of 35 µm are probably artifacts.

b. Supercooled Convective Clouds Below 10,000 ft AGL

Figure 22 contains the NACA data for convective clouds penetrated at altitudes below 10,000 ft AGL and for air temperatures from -10° to 0°C. Additional events recorded in air temperatures between -20° and -10°C are plotted in figure 23. It is obvious that there were many more data miles logged by NACA in layer clouds than in convective clouds below 10,000 ft. This is a natural result of the infrequent occurrence of convective systems in winter months--the time of year that the icing research flights took place.

5. Implications of the Modern Data

a. Supercooled Layer Clouds Below 10,000 ft AGL

Figure 24 contains the available modern data from layer clouds at altitudes up to 10,000 ft AGL and at temperatures from -10° to 0°C. Additional data are plotted in figure 25 for clouds at temperatures between -20° and -10°C, and in figure 26 for temperatures below -20°C. It is noted that the modern data exhibit a significant decrease in maximum observed MVDs at the lower temperatures, a trend not found in the NACA layer cloud data. The maximum MVDs retreat to below 15 μm at temperatures below -20°C. The main features common to both the NACA and modern CONUS data for layer clouds are the gradual decrease in maximum LWC with decreasing temperature, the concentrating of MVDs between 5 and 15 μm, the peaking of maximum LWCs at MVDs between 10 and 15 μm, and the infrequent occurrence of MVDs larger than about 30 μm.

b. 35 μm as the Upper Limit to MVDs for Cloud Droplets in Supercooled Layer Clouds at Altitudes Below 10,000 ft AGL

Researchers using the Particle Measuring Systems' (PMS) cloud droplet probes have found that indicated MVDs larger than about 35 μm are usually identifiable as artifacts resulting from the erratic response of the ASSP or FSSP cloud droplet size spectrometers to snowflakes or other ice particles. These faceted particles apparently cause spurious reflections of the particle-illuminating laser beam into the photodetector in these probes. The effect is usually evident as a random distribution of counts appearing throughout the entire particle size range to which the probe is sensitive. It is also found that these large MVDs are always associated with small droplet concentrations, usually less than 50 per cubic centimeter. This observation may be an indication of the fact that, in the presence of ice particles or snowflakes, cloud droplets tend to evaporate and the released water vapor redeposits on the snowflake population. However, the radius-cubed dependence of droplet mass or volume allows the few spurious counts in the larger particle size channels of the PMS probes to dominate the LWC computations and thereby strongly bias the indicated MVD to unusually large values.

It may be possible that MVDs larger than 35 μm actually occur in some portions of vigorously convective clouds; for example, some of the University of Wyoming data over the windward slopes of the Sierra Nevada mountains, but MVDs larger than 35 μm do not appear to be unambiguously present in supercooled layer clouds. Other large droplets, such as drizzle, cannot account for such large MVDs in supercooled clouds. Drizzle occurs in clouds only at temperatures above freezing, since these droplets are actually melted snowflakes or melted ice particles when they are associated with wintertime cloud systems. The only time these precipitation droplets are encountered at subfreezing temperatures is in the case of freezing rain or freezing drizzle where the droplets fall from warm clouds above an overlying warm frontal surface into a cold air mass below.

The modern data have all been screened in an attempt to eliminate ASSP or FSSP droplet size spectra which are obviously contaminated by snowflakes. The screening process is a bit subjective, however, and some cases are difficult to judge when the data source contains no visual accounts of in-cloud conditions and no information on the presence of precipitation at the time of the measurements. Cases in point are the three MRI icing events plotted in figure 24 with MVDs of 29, 31 and 32 μm. All three of these came from the same flight and cloud and are suspected of being influenced by snow or ice crystal artifacts, but no information about cloud conditions or precipitation is reported that would positively invalidate these MVDs.

The NACA MVDs larger than 30 μm are suspected of being grossly overestimated due to serious inaccuracies in the determination of large MVDs from rotating multicylinder data (Lewis and Bergrun, 1952, p. 17; Brun et al., 1955, p. 29). The error analysis of Brun et al., as summarized in their figure 27, shows that: at an airspeed of 200 kt, and with an error of ±5% in rotation multicylinder measurements, a derived MVD of 30 μm, the largest MVD considered in their error analyses, may be overestimated by as much as 35% or underestimated by up to 18%. Overestimation of the true MVD is more probable than underestimation. For an error of ±10% in multicylinder measurements, the uncertainty in a 30 μm MVD assignment is +70%, -27%. In any case, the rate of increase in the uncertainty is so great at 30 μm that MVD assignments larger than 30 μm appear to be out of the question.

c. Supercooled Convective Clouds Below 10,000 ft AGL

Figure 27 contains the data from convective clouds penetrated at altitudes up to 10,000 ft AGL and at temperatures between -10° and 0°C. Additional events recorded in air temperatures between -20° and -10°C are plotted in figure 28. These data compare favorably with the NACA data in figures 22 and 23 although the maximum LWCs are considerably larger for the modern data in the -10° to 0°C temperature range than they are for the NACA data. There were no occurrences of convective clouds at temperatures below -17°C at altitudes below 10,000 ft.

6. Temperature Dependence of Cloud Height, LWC and MVD

a. Temperature Dependence of Cloud Height and Occurrence

The distribution of supercooled layer cloud temperatures versus altitude AGL is given in figures 29 and 30 for the modern and NACA data sets, respectively. Interestingly, the coldest layer clouds were not found at 10,000 ft AGL, but at intermediate altitudes that were rather similar for both data sets. The data suggest that for temperatures below -15°C there is both a lower and upper limit to altitudes AGL at which layer clouds at these temperatures will be easily found. The lower the cloud temperature below -15°C, the narrower the permissible altitude range will be. For icing certification flights, the message is that the coldest layer clouds will most easily be found from 4000 to 6000 ft AGL. Examination of these low temperature records in the Data Base revealed that for both the NACA and modern data these coldest layer clouds occurred in the vicinity of the Great Lakes in January. These findings are examined in more detail in Appendix C.

The altitude distribution of supercooled convective cloud temperatures, figures 31 and 32, is different in at least two respects. One is that supercooled convective clouds colder than about -17°C have not been found at altitudes below 10,000 ft AGL. Secondly, there is an obvious and more consolidated upward trend in altitude AGL as one goes to lower cloud temperatures. This trend is again similar in both the NACA and modern data.

b. Temperature Dependence of Maximum Supercooled LWC by Cloud Category

Scatterplots of observed LWC vs. OAT at flight level are given in figures 33 and 34 for layer clouds in the modern and NACA data sets, respectively. Although there is a general decrease in maximum LWC with decreasing temperature, the trend shown by the data sets taken separately is by no means uniform. When the NACA and modern data sets are combined (not shown), however, a more uniform trend becomes apparent. The combined data sets should serve as a good basis for reexamining the probabilities of exceeding given values of LWC as a function of temperature for layer clouds. The solid line bounding the data points in figures 33 and 34 represents the maximum observed and expected LWC for CONUS based on the combined CONUS data set.

Figures 35 and 36 contain scatterplots of LWC vs. OAT for supercooled convective clouds below 10,000 ft AGL. The NACA and modern data are shown separately for comparison purposes but, as before, the combined data set reveals a clearer limit to the maximum LWC as a function of temperature. The apparent limit is represented by the solid line in figures 35 and 36. The slope of this limiting line is markedly steeper than for layer clouds.

The absence of observed LWCs above 0.6 g/m^3 in the NACA data (figure 36) at temperatures above about -7°C is due partly to the progressive failure of the ice accretion technique for measuring increasingly large LWCs at temperatures only a few degrees below freezing. This is the well-known "runoff" problem where, for a given temperature, there is a limit to the LWC that can be intercepted by the probe without some of the supercooled water running off or blowing off before it has time to freeze to the probe (Ludlam, 1951; Kleuters et al., 1977).

The modern measurements use hot wire devices and laser based probes for indicating LWC and therefore they do not have this problem. For the modern data (figure 35), the shortage of LWC values greater than 1.3 g/m^3 at temperatures above -10°C is probably due to the shortage of flights into large convective clouds with low, warm bases and with freezing levels that are high but still below 10,000 ft AGL. Such clouds typically occur in the springtime months.

Clouds with sufficiently deep extent below the freezing level could produce supercooled LWCs greater than 1.3 g/m^3, but freezing levels in the vicinity of 8000 ft AGL or higher would probably be required. This situation is of little concern for present purposes, assuming that helicopters or other light aircraft of interest would stay below a high freezing level in the presence of clouds anyway, or would at least avoid such large and obvious convective buildups as a normal precaution for avoiding possible turbulence, lightning, or hail.

The Data Base, as it currently stands, represents the general wintertime climate where freezing levels are well below 10,000 ft AGL, such that flight above the freezing level cannot generally be avoided.

Selected percentiles of LWC occurrences cumulative in each of the 5°C temperature intervals are plotted in figure 37. It is seen again, that for convective clouds, the observed maximum LWCs occur between -5° and -10°C or -10° and -15°C, depending on the percentile curve of interest. It must be remembered that the Data Base represents the typical wintertime environment with relatively low freezing levels. It does not include conditions in the interior of atypical, deep convective buildups having low, warm bases and potentially large LWCs above an elevated freezing level near 10,000 ft AGL.

c. Temperature Dependence of Extreme MVD by Cloud Category

The variation of extreme values of MVD vs. OAT is somewhat more complicated than for LWC. Figures 38 and 39 contain scatterplots of MVD vs. OAT for supercooled layer clouds from the modern and NACA data sets, respectively. The two data sets are not in very good agreement. For temperatures increasing above -15°C the modern data show an increase in maximum MVD up to a limiting value of about 35 µm as discussed earlier in this report. The NACA data set contains about a dozen MVDs between 35 and 50 µm at temperatures above -15°C, but these large MVDs are subject to considerable overestimation as described earlier. The solid lines drawn on figures 38 and 39 show the proposed dependence of maximum MVD vs. OAT for supercooled layer clouds below 10,000 ft AGL.

Figures 40 and 41 show scatterplots of MVD vs. OAT for convective clouds. In this case, both the NACA and modern data are in agreement and exhibit a trend that is just the opposite of that for layer clouds. That is, MVDs in supercooled convective clouds tend to increase with decreasing temperature. In fact, there is not so much of a change in maximum MVD with temperature as there is an apparent increase in minimum MVD with decreasing temperature! Also note that, except for two maverick MVDs at 45 µm in the NACA data set, all of the supercooled convective cloud MVDs are less than 35 µm.

7. Average Values of MVD by Cloud Category

Over the entire supercooled temperature range of 0° to -30°C and for altitudes up to 10,000 ft AGL, both the modern and NACA data sets agree that 18 µm is the average MVD for convective clouds. For layer clouds, the average MVD is 13 µm according to the modern data and the NACA data are in close agreement with an average of 14 µm.

HORIZONTAL EXTENT

1. Ambiguities in the Meaning and Measurement of Horizontal Extent

The term "horizontal extent" does not have a consistent, precisely defined meaning in the literature on aircraft icing. One usage indicates the distance flown during a given measurement interval until a cloud gap of some specified duration signals the end of the interval (Lewis and Hoecker, 1948, p. 3). Another, less precise usage occurs when statistically processed data are to be interpreted for engineering design purposes. An example is the problem of determining the probable maximum average LWC as a function of flight distance (horizontal extent) in general icing conditions (ibid., p. 9, 37). This usage is implied by the "horizontal extent" curves of FAR-25, App. C. There is no specification of allowable discontinuity to the icing conditions, or how large and frequent any cloud gaps may be. Even the measurement interval usage has not seen consistent specifications for allowable cloud gaps, which have run from 10 s (0.5 nmi at 180 kt) (ibid., p. 3) to 10 min. (30 nmi at 180 kt) (Perkins, 1959, p. 6). "Horizontal extent" does not seem to be used as a measure of the overall dimensions of wintertime cloud systems throughout which icing conditions can be expected.

In practice, values of horizontal extent associated with airborne measurements are more determined by the choice of sampling maneuvers and flight path than they are a description of the actual geographic extent of clouds and icing conditions. This is true of both the NACA and modern research flights where repetitive passes at different altitudes through the same cloud or cloud system are often executed. Otherwise, the choice of destinations, available flight time, and air traffic restrictions, strongly influence the ability of any research flight to pursue extended, unidirectional measurements in preferred directions and at preferred altitudes.

In order to clarify the usage as much as possible, we distinguish between two meanings of the term as applied in this report. One usage applies to the duration of individual icing events. The other applies to the sum of a number of icing events which together constitute an icing "encounter." The "encounter" is conceptually the same as the gap-delimited icing interval. The extent of an encounter is defined here as the total extent of a series of icing events consecutively penetrated until a gap of a stated, but selectable length is experienced. Accordingly, even though the values of LWC, MVD and other variables may differ from one event to another during the encounter, the aircraft experiences measurable icing conditions throughout, except for allowable gaps. The horizontal extent of individual icing events is probably of greater interest for cloud physics studies per se, while the icing encounter is probably more relevant to aircraft icing concerns.

2. Horizontal Extent of Individual Icing Events

The NACA data have been processed so that the "horizontal extent" of individual icing events (columns 12-13 in the Icing Data Base) is simply the distance flown during actual exposure of the multicylinder probes. These distances are computed from the reported values of true airspeed, individual exposure time, and the number of exposures represented in the reported LWC averages. Flight distances between individual exposures, even within the same averaging interval, are not counted. This convention permits the NACA data to be compared with the modern data since the basis of measurement, i.e., discrete exposure intervals, is then the same.

The extents of individual icing events have been plotted against LWC in figure 42 for the NACA data and figure 43 for the modern data. An inverse relationship is evident between LWC and the longest horizontal extents observed at any given value of LWC. This is a well-known result and is reflected in the "horizontal extent" curves of FAR-25, App. C. The NACA horizontal extents also show a notable bifurcation or double valuedness which does not appear in the modern data. This bifurcation is probably an artifact resulting from the grouping of measurement exposures by the NACA researchers.

The upper branch of the bifurcation consists of data points clustered along a line from about 18 nmi horizontal extent at a LWC of 0.1 g/m^3 to about 2 or 3 nmi for the largest values of LWC observed. These terminal values of horizontal extent are consistent with the standard horizontal extents of 17.4 nmi and 2.6 nmi specified in FAR-25, App. C for the Continuous Maximum and Intermittent Maximum criteria, respectively.

At this point, it is of interest to find out what conditions produced the extreme horizontal extents for the NACA data points labeled a through f in figure 42. A consultation of the original NACA publications revealed that only data point f was a single, 5 minute exposure within one cloud. The other data points in question represent from 12 to 25 exposures each! Thus it seems likely that at least the data from the CuCb clouds (data points "b" and "e") represent several passes through the cloud. Data points marked "a", "c", and "d" are from St, St or Sc, and As clouds, respectively and may have been unusual opportunities for long-duration sampling.

3. Horizontal Extent of Icing Encounters

In accordance with our definition stated above, the extents of entire "encounters" have been constructed from the Icing Data Base by adding horizontal extents of individual, consecutive, icing events until a specified cloud gap interval is experienced. Figures 44, 45, and 46 show the results for modern data up to 10,000 ft AGL where the maximum allowable cloud gaps are 1, 3, and 10 nmi, respectively. The horizontal extent for the encounter has been plotted against the overall average LWC for the encounter. The choice of cloud gap interval makes some difference for LWCs less than 0.4 g/m^3 but has little effect on encounters with larger LWCs. That is, icing events with large LWCs are not only less frequent but they are of short duration as well. They therefore add little to the horizontal extent of any encounter.

The published NACA data consist both of individual samples obtained miles apart in the cloud or cloud system and groups of samples already combined into an average LWC for the group. The large separations between the individual samples preclude their inclusion into larger encounters, as defined above. The existing groups cannot be further resolved into individual samples, except for some cases (Lewis, 1947) where the one sample having the greatest LWC of the group is listed separately. As a result, the NACA horizontal extents are already "locked in" and plots (not shown) of data for encounters with gaps up to 10 nmi are identical with those in figure 42.

4. Considerations for Horizontal Extent

In order to correct the discrepancy that currently exists in the meaning of horizontal extent, it is suggested here, that, for helicopter applications, at least, "horizontal extent" be linked to definable icing encounters for engineering design purposes. This would simplify the conversion of measurement data into design criteria. Icing encounters are defined by the maximum distance (gap) allowed between individual icing events or continuous icing intervals. A standard value of maximum, allowable, gap distance could be specified by the regulating agency. This would then permit an unambiguous determination of maximum horizontal extents from basic data, such as in figures 44 to 46.

Considering the NACA data alone, one could construct on figure 42 a smooth curve representing the average maximum observed horizontal extent as a function of LWC for encounters separated by gaps of 10 nmi or less. The curve could be determined, for example, by averaging the data points along and above the upper branch of the bifurcation for each increment in LWC. Such a curve for altitudes up to 10,000 ft AGL would range from about 20 nmi at 0.1 g/m^3 to about 5 nmi at 1 g/m^3.

The modern data more realistically exhibit longer maximum horizontal extents for LWCs less than 0.3 g/m^3. A smooth, or average curve representing some specified, cumulative frequency of occurrence value for horizontal extent vs. LWC could serve as a workable criterion for a specified maximum allowable gap distance. For example, the 99th percentile value of horizontal extent (i.e., the value of horizontal extent which is unexceeded 99% of the time) computed from the Data Base for each 0.1 g/m^3 LWC interval is shown superimposed on the scatterplots in figures 44 to 46.

CONCLUSIONS

The reader is cautioned to keep in mind the important fact that the conclusions presented here are based on data only in clouds at temperatures below 0°C and for altitudes below 10,000 feet AGL and 12,000 feet ASL. The reader is referred to the Executive Summary at the beginning of this report for the principal conclusions relevant to aircraft icing certification. Additional conclusions are given below.

1. Conclusions Based on Graphs and Analyses Detailed in this Report.

a. Supercooled LWCs up to 1.7 grams per cubic meter (g/m^3) have been found, but 99% of the observed values are less than 1.1 g/m^3 and 95% are less than 0.6 g/m^3 for all cloud types. The largest LWCs occur in convective clouds, cumulus (Cu) and cumulonimbus (Cb) usually within 100 to 300 nmi behind a cold front in maritime air masses, and especially in connection with orographic uplifting along the western slopes of the Cascade mountain range in California (and probably in Washington and Oregon as well). Except for these orographic influences, supercooled convective clouds are rare below 5000 ft AGL. Supercooled LWCs greater than the observed maximum of 1.7 g/m^3 may be possible below 10,000 ft AGL in deep convective clouds with bases which are relatively warm and below 4000 ft AGL. For example, given a freezing level at 9000 ft AGL and cloud base at 3000 ft AGL (+10°C), computations show that the practical maximum (i.e., two-thirds of the theoretical maximum) LWCs are 2.0 g/m^3 and 2.2 g/m^3 at 9000 ft and 10,000 ft (-2°C), respectively. Conditions approximatley matching these simultaneous requirements of deep convective cloud with base below 4000 ft AGL and freezing level near 10,000 ft AGL appear to be rare however, and no instances have been recorded in the Data Base.

b. The rate of decrease of maximum observed LWC with decreasing temperature at altitudes below 10,000 ft AGL appears to be about 0.2 g/m^3 per degree C for convective clouds and about 0.04 g/m^3 per degree C for layer clouds (see figures 33 to 36).

c. Average median volume diameters (MVDs) for cloud droplets in layer and convective clouds are about 13 μm and 18 μm, respectively, when measurements at all temperatures between 0° and -25°C are lumped together.

d. Horizontal extents are altitude dependent and preferred altitudes appear at 4000 to 6000 ft AGL and again at about 8000 ft AGL. Maximum LWCs are also variable with altitude and the average LWC increases slowly with increasing altitude AGL. However, the average value of the product of LWC and horizontal extent is practically independent of altitude between 2000 and 10,000 ft AGL. This latter result indicates that the average ice accretion to be expected per icing encounter is independent of altitude over this same 2000 to 10,000 ft range (see figure 16).

e. When all supercooled cloud data are considered together, the extreme values of LWC and MVD are approximated by the curves shown in figure 47 for three significant temperatures. The curve corresponding to -20°C reflects the abrupt drop in MVD which occurs at about -17°C when contributions from convective clouds (Cu, Cb) drop out. Convective clouds below 10,000 ft AGL do not appear to exist at temperatures below about -17°C. Figure 47 better represents the icing environment at altitudes up to 10,000 ft AGL than do the Continuous Maximum and Intermittent Maximum envelopes of FAR-25, Appendix C (see figures 1 and 4 of this report).

2. Conclusions Substantiated by the Icing Data Base but not Detailed in this Report.

a. Missing Data

Icing clouds closely associated with frontal wave cyclones, deep low pressure centers or winter storms, and strong lake effect situations are still not well represented in the Icing Data Base. Data are also scarce specifically for cases of very low ceilings. When an airfield has "gone IFR" (i.e., the local ceiling is 1000 ft or less and the local visibility is one mile or less) and the freezing level is near or below cloud base, then <u>any</u> aircraft that takes off or lands at that location can hardly avoid icing conditions. This type of weather condition is probably one of the greatest concerns to helicopters because the ceiling is too low to fly under, considering ground clearance requirements in most areas over land. Most of the cases of low ceiling and low freezing level in the Washington, DC area during the winter of 1981-82 were associated with the widespread cloudiness of frontal wave cyclones. This again emphasizes the need to obtain a representative amount of airborne measurements in these low pressure, low ceiling situations.

Data on freezing rain or freezing drizzle are essentially absent from the Icing Data Base at this writing.

b. Geographic Variations

Helicopters, whose flights are confined to certain geographic areas, may experience a frequency distribution of LWC that is markedly different from those shown in figure 19 which is an amalgam of all cloud types, synoptic and mesoscale conditions, and geographic locations. For example, helicopters servicing oil rigs offshore from the middle Atlantic and New England states would encounter extensive stratocumulus forming offshore during cold air outbreaks (Ludlam, 1980, plate 7.10). A study of the cloud cover imagery from the GOES-East meteorological satellite shows frequent occurrences of persistent stratocumulus formation in these offshore areas during the winter of 1981-82. The one NRL research flight that sampled these clouds at a location offshore from Cape Hatteras, North Carolina, recorded LWCs up to 1.2 g/m^3 at altitudes of 6000 to 7000 ft ASL. Of course, since the cloud base at that location was about 3400 ft these clouds could have been easily avoided by any aircraft. But the point is that certain geographic areas, particularly the offshore and mountainous areas, are scenes of peculiar synoptic scale or mesoscale effects which can significantly increase the possibility for encountering values of LWC that are in the upper reaches of the distribution curve.

3. Conclusions Based on In-Flight Observations and Experience

a. Effects of Snow

In the experience of the author and other researchers (Politovich and Sand, 1981, p. 17) snow has never accreted in noticeable amounts on the airframe of the research aircraft in flight. Neither has snow registered on the Rosemount model 871FA ice detectors. But snow may still contribute to icing on components of helicopters or in engine inlets of helicopters and other light aircraft. There may also be some combinations of airspeed and ambient temperature at which snow may stick to airframes. Indeed, during the winter of 1981-82 alone, newspapers carried reports of at least two light aircraft that were forced to land in snowstorms. One was a twin engine Beechcraft on which one engine failed at 6000 ft in a snowstorm shortly after takeoff from Baltimore-Washington International airport on December 15, 1981; the plane made an emergency belly landing on a highway after the second engine began to fail. The other incident occurred on December 26, 1981 when a Beechcraft Baron crashed in a field near Hayden, Colorado, during a blizzard in that Rocky Mountain area. All three persons aboard the plane were killed.

On the other hand, it is a well-known fact that snow has the beneficial effect of drying up supercooled droplets in a cloud. This effect is due to the reduced pressure of water vapor near an ice surface compared to a water surface. The result is that the water droplets in the cloud will evaporate as water vapor is taken out of the air in the cloud by any snowflakes or ice particles that may be there. Appreciable quantities of snow or other ice particles in a supercooled cloud will rather quickly "dry up" the supercooled cloud droplets.

Research data confirms this phenomenon and shows that the LWC and number concentration of supercooled cloud droplets are very small in the presence of notable snowfall along the flight path. Indeed, during flight through a snowstorm one may see nothing but "cloud" in all directions, but normally the "cloud" will not be sufficiently dense for its passage over the wing of the aircraft to be noticeable. In a typical water droplet cloud, one can easily see the cloud at least partially obscuring the wing tips.

This tenuous nature of a widespread snowstorm "cloud" was observed most notably by the author who was a passenger aboard a Boeing 727 in the same snowstorm that was associated with the Air Florida crash in Washington, DC on January 13, 1982. On a flight from St. Louis to Baltimore that same afternoon, the 727 type aircraft entered the top of the widespread cloud system at about 35,000 ft at the start of the descent toward Baltimore. The plane was in continuous "cloud" throughout the entire descent though neither the snow nor the "cloud" was sufficiently dense to be noticeable over the length of the wing. Only when the ground became visible at 2000 ft or less on final approach could the moderately heavy and steady snowfall be recognized. The relatively dark and definite background of trees outside the perimeter of the approach path were needed to make the snowflakes visible. A widespread snowstorm of this type might aptly be described as largely snow and no cloud in the sense of a distinguishable droplet cloud.

b. Effects of Graupel or Rain

Graupel and rain have both been observed to actually assist in the removal of accreted rime ice from the leading surface of the wings (Jeck, 1980, p. 64), (Politovich and Sand, 1981, p. 17). The accreted rime usually breaks away in 1 to 3-inch wide pieces at random positions along the wing. The instances noted by the author all occurred at ambient air temperatures of not more than 2 or 3 degrees celsius below freezing so that softening of the ice may have been expected anyway. In addition, the efficiency of this impact-assisted deicing is probably a function of flight speed and may therefore be less effective at the slower speeds of helicopters.

c. Variability of Cloud Conditions

Most of the research flights reflect considerable variability in cloud base height, cloud layer thickness, and the number of distinct layers as a function of position and time. In such circumstances, it can be appreciated, that the prediction of icing severity and extent at a given location or altitude would be difficult except perhaps for forecasting the worst icing conditions to be expected for a given period. (Jeck, 1980, p. 64)

REFERENCES

"Aerographer's Mate 1 & C," Naval Education and Training Support Command Manual No. NAVEDTRA 10362-B (1974), Government Printing Office, Washington, DC.

Borovikov, A.M., Khrgian, A.K., et al., Cloud Physics, Israel Program for Scientific Translations, Jerusalem, 1963.

Brun, R.J., Lewis, W., Perkins, P.J., and Serafini, J.S., "Impingement of Cloud Droplets on a Cylinder and Procedure for Measuring Liquid-Water Content and Droplet Sizes in Supercooled Clouds by Rotating Multicylinder Method," NACA Report No. 1215 (1955).

Feddes, R.G., "A Synoptic-Scale Model for Simulating Condensed Atmospheric Moisture," USAF/ETAC Report No. TN 74-4 (1974), USAF Environmental Technical Applications Center, Scott AFB, Illinois 62225.

Federal Aviation Regulations, Part 25 (FAR-25), "Airworthiness Standards: Transport Category Airplanes," Appendix C. Washington, DC 20591: U.S. Department of Transportation, Federal Aviation Administration, 1974.

"Forecasters' Guide on Aircraft Icing," Report No. AWS/TR-80/001 (1980), Air Weather Service (MAC), Scott AFB, Illinois 62225.

Fye, F.K., "The AFGWC Automated Cloud Analysis Model," AFGWC Technical Memorandum 78-002 (1978), HQ Air Force Global Weather Central, Offutt AFB, Nebraska 68113.

Jackson, G.C., "Icing Climatology for Northern Europe," Report No. AFWAL-TM-80-16-FSW (1980), Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, Ohio 45433.

Jeck, R.K., "Icing Characteristics of Low Altitude, Supercooled Layer Clouds," DOT/FAA Report No. FAA-RD-80-24 (1980).

Jones, A.R., and Lewis, W., "Recommended Values of Meteorological Factors to be Considered in the Design of Aircraft Ice-Prevention Equipment," NACA Technical Note TN-1855 (1949).

Kleuters, W., and Wölfer, G., "Some Recent Results on Icing Parameters," Proc. of Sept. 1977 meeting of the NATO Advisory Group for Aerospace Research and Development, Ottawa, Canada; Report No. AGARD-AR-127.

Kline, D.B., and Walker, J.A., "Meteorological Analysis of Icing Conditions Encountered in Low-Altitude Stratiform Clouds," NACA Technical Note TN-2306 (1951).

Lewis, W., "A Flight Investigation of the Meteorological Conditions Conducive to the Formation of Ice on Airplanes," NACA Technical Note TN-1393 (1947).

Lewis, W., and Bergrun, N.R., "A Probability Analysis of the Meteorological Factors Conducive to Aircraft Icing in the United States," NACA Technical Note TN-2738 (1952).

Lewis, W., and Hoecker, W.H., Jr., "Observations of Icing Conditions Encountered in Flight During 1948," NACA Technical Note TN-1904 (1949).

Lewis, W., Kline, D.B., and Steinmetz, C.P., "A Further Investigation of the Meteorological Conditions Conducive to Aircraft Icing," NACA Technical Note TN-1424 (1947).

Lewis, W., "Review of Icing Criteria," in Aircraft Ice Protection, Report of Symposium of April 28-30, 1969. DOT/FAA Flight Standards Service, 1969.

Ludlam, F.H., "The Heat Economy of a Rimed Cylinder," Quart. J. Roy. Met. Soc. 77, 663 (1951).

Ludlam, F.H., Clouds and Storms: The Behavior and Effect of Water in the Atmosphere. (The Pennsylvania State University Press, University Park, Pennsylvania, 1980).

Politovich, M., and Sand, W., "Atmospheric Conditions Contributing to Aircraft Icing," DOT/FAA Report No. FAA-CT-82-71 (1982).

Smith, R.D., "Atmospheric Moisture Parameterization," USAF/ETAC Report No. TN 74-1 (1974), USAF Environmental Technical Applications Center, Scott AFB, Illinois 62225.

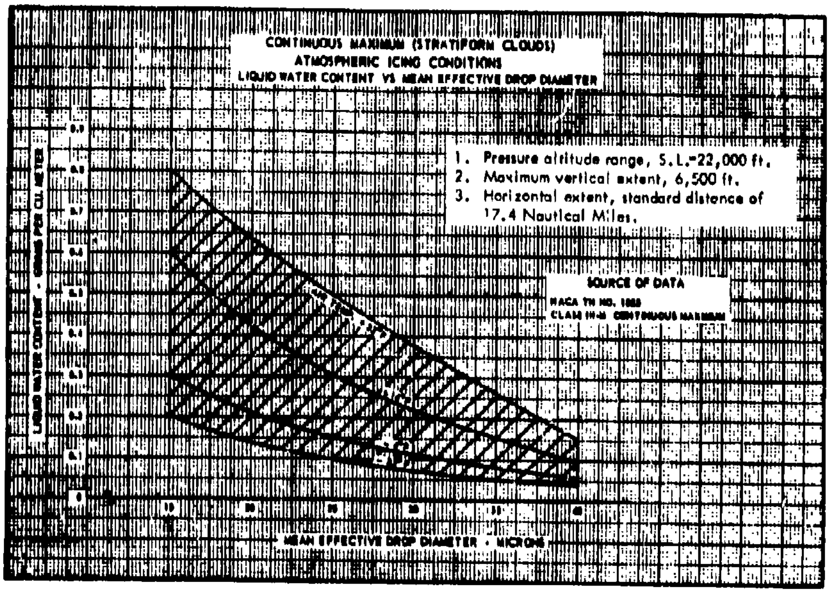

FIGURE 1. CONTINUOUS MAXIMUM ICING ENVELOPE. As promulgated in FAR-25, Appendix C, the maximum continuous intensity of atmospheric icing conditions is defined by the variables of LWC, MVD, and ambient air temperature, and the interrelationships of these variables as shown here.

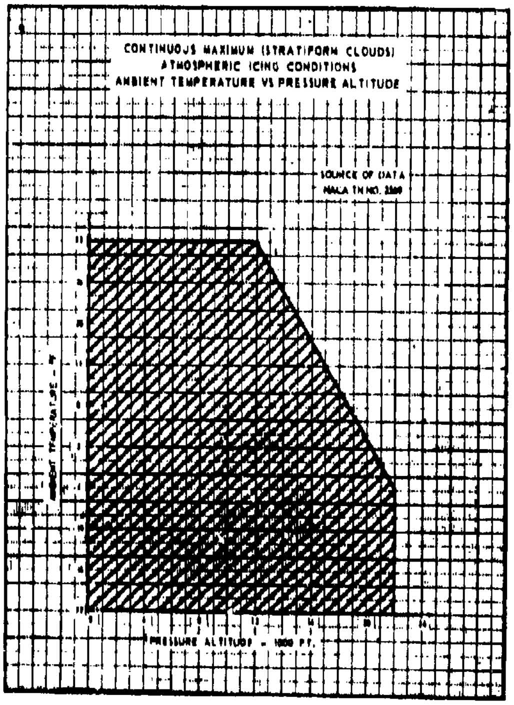

FIGURE 2. CONTINUOUS MAXIMUM ENVELOPE OF TEMPERATURE VS. ALTITUDE (FROM FAR-25, APP. C.)

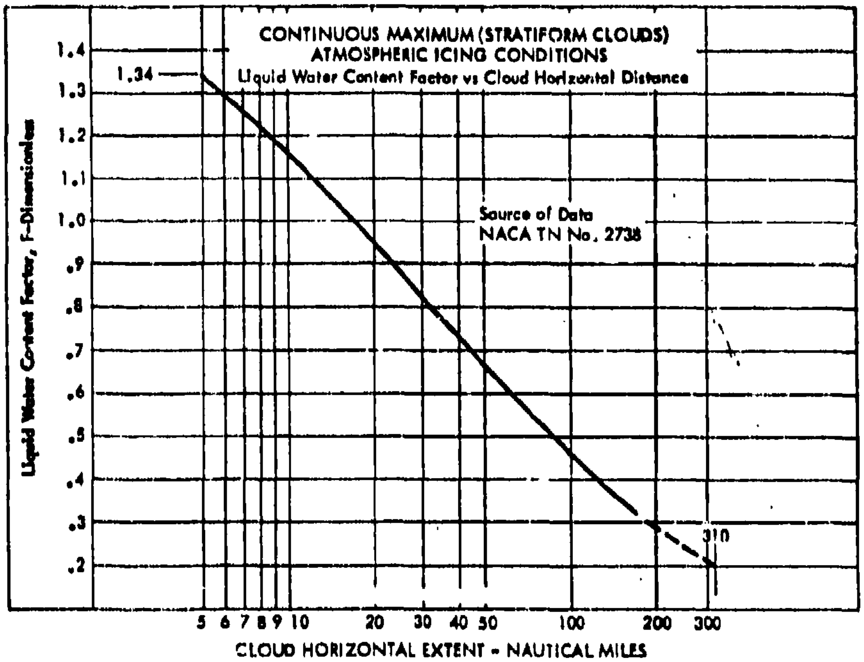

FIGURE 3. ADJUSTMENT FACTOR FOR LWC VS. CLOUD HORIZONTAL EXTENT FOR CONTINUOUS MAXIMUM ICING CONDITIONS (FROM FAR-25, APP. C)

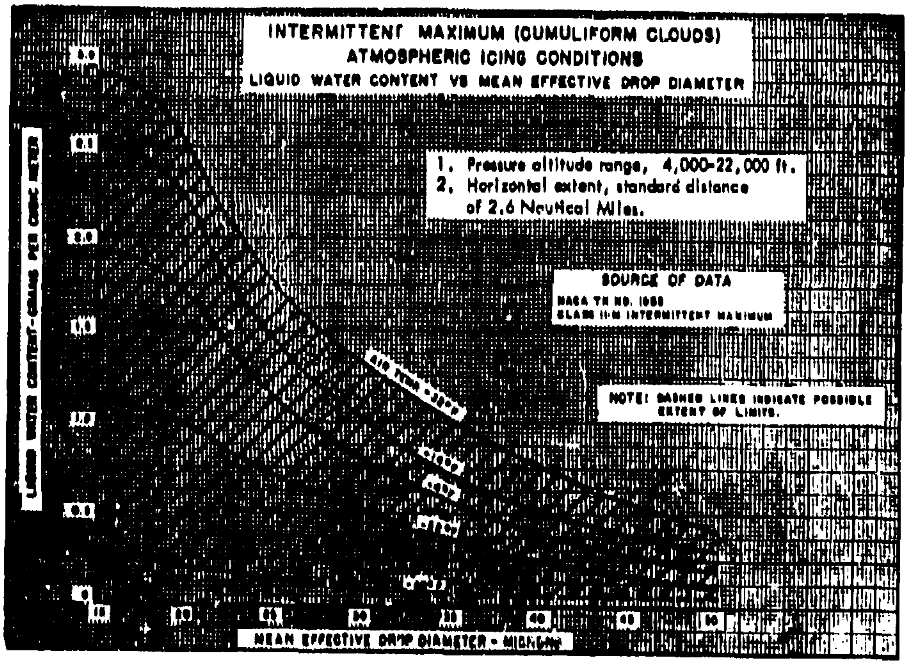

FIGURE 4. INTERMITTENT MAXIMUM ICING ENVELOPE. As promulgated in FAR-25, Appendix C, the intermittent maximum intensity of atmospheric icing conditions is defined by the variables of LWC, MVD, and ambient air temperature, and the interrelationships of these variables as shown here.

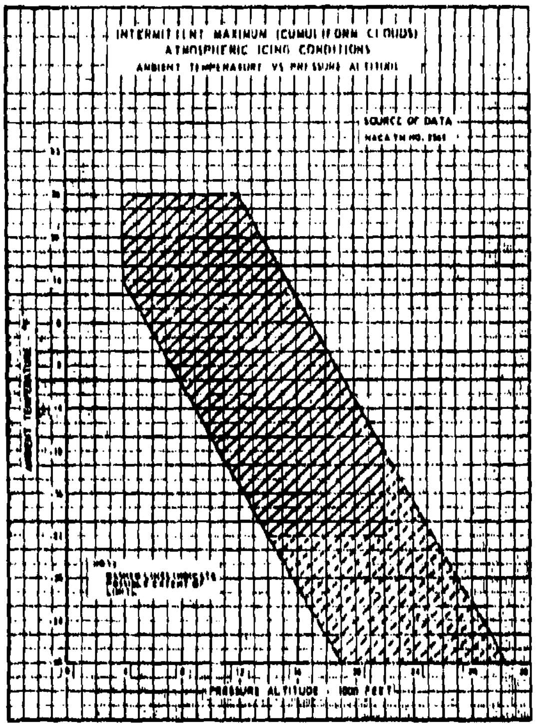

FIGURE 5. INTERMITTENT MAXIMUM ENVELOPE OF TEMPERATURE VS. ALTITUDE (FROM FAR-25, APP. C.)

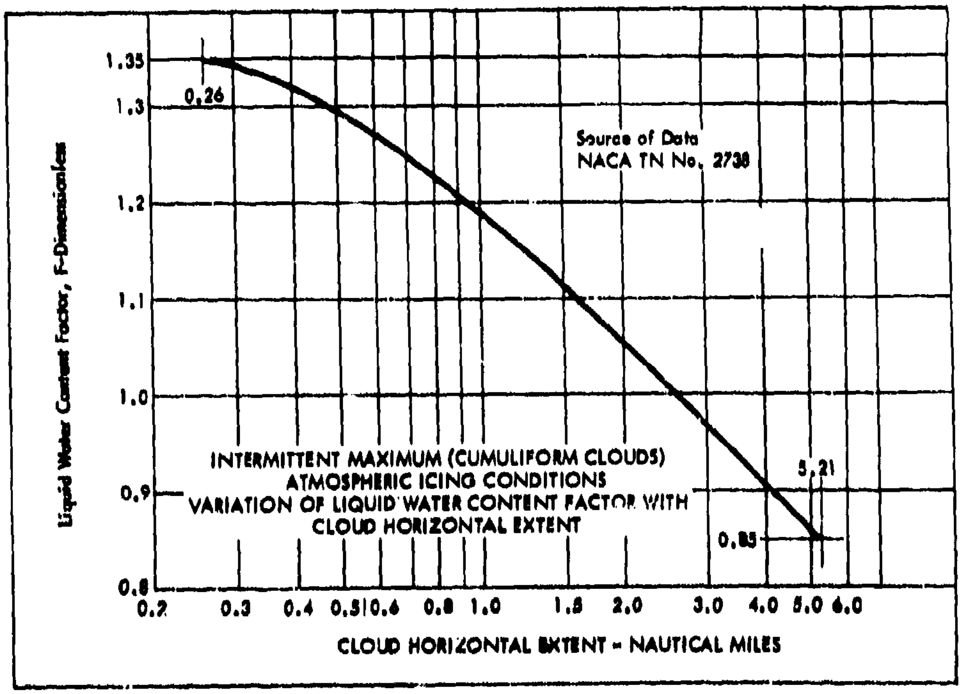

FIGURE 6. ADJUSTMENT FACTOR FOR LWC VS. CLOUD HORIZONTAL EXTENT FOR INTERMITTENT ICING CONDITIONS (FROM FAR-25, APP. C)

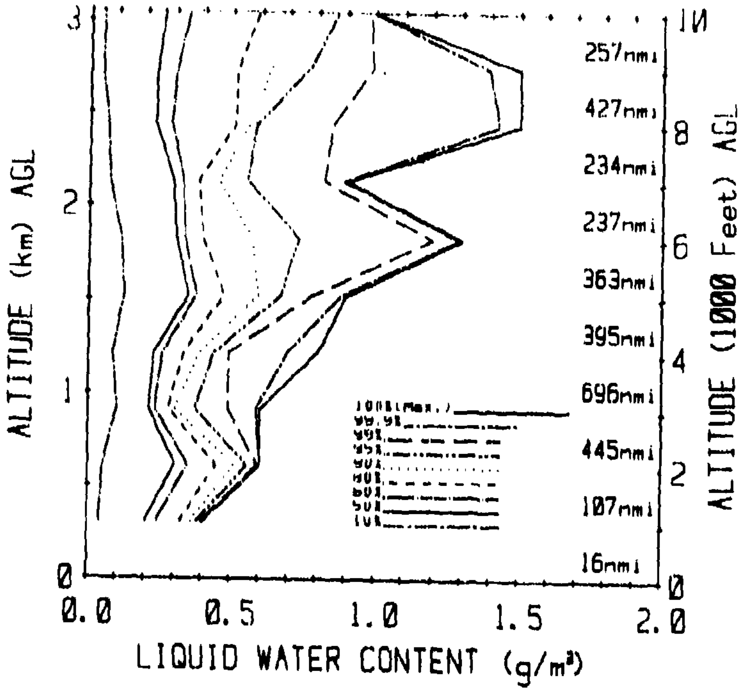

FIGURE 7. ALTITUDE VARIATION OF SUPERCOOLED LWC FOR ALL CLOUD TYPES AS OBSERVED IN THE NACA DATA (1946-1950). At each 1000 ft level the nth percentile curves indicate the value of LWC that was unexceeded in n% of the data miles recorded in supercooled clouds within the 1000 ft altitude interval immediately below. The right-hand column of numbers gives the number of data miles accumulated within each 1000 ft interval. A total of 3170 data miles is represented in this Figure.

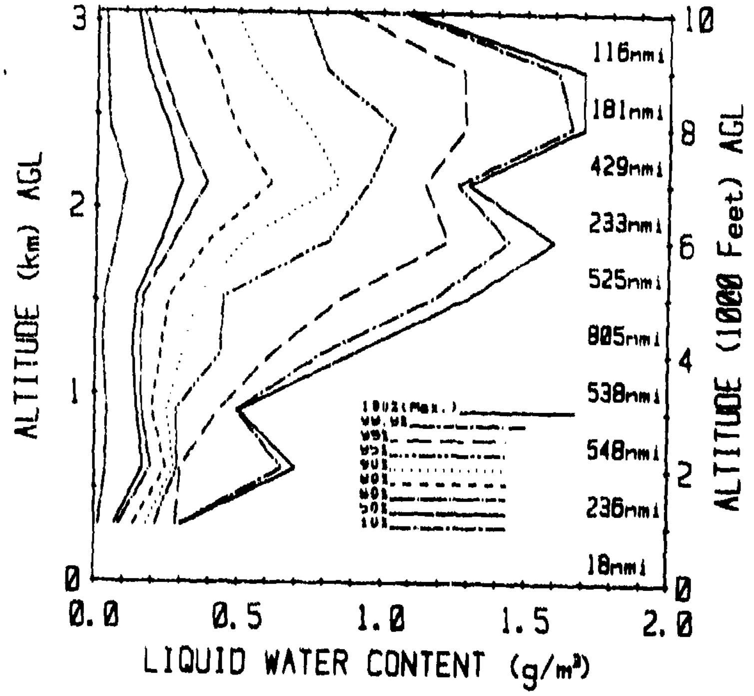

FIGURE 8. ALTITUDE VARIATION OF SUPERCOOLED LWC FOR ALL CLOUD TYPES AS OBSERVED IN THE MODERN DATA. At each 1000 ft level the nth percentile curves indicate the value of LWC that was unexceeded in n% of the data miles recorded in supercooled clouds within the 1000 ft altitude interval immediately below. The right-hand column of numbers gives the number of data miles accumulated within each 1000 ft interval. A total of 3630 data miles is represented in this Figure.

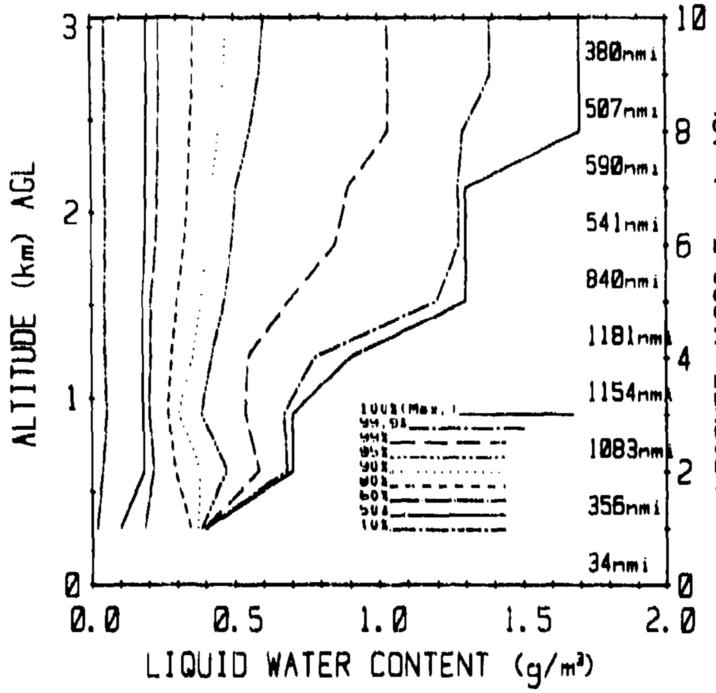

FIGURE 9. CUMULATIVE VARIATION WITH ALTITUDE FOR SUPERCOOLED LWC FROM ALL CLOUD TYPES AS RECORDED IN THE ENTIRE CONUS DATA BASE. At each 1000 ft level the pth percentile curves indicate the value of LWC that was unexceeded in p% of the data miles accumulated at all altitudes below the specified level. The right-hand column of numbers gives the number of data miles recorded within each 1000 ft interval. A total of 6660 data miles is represented in this Figure.

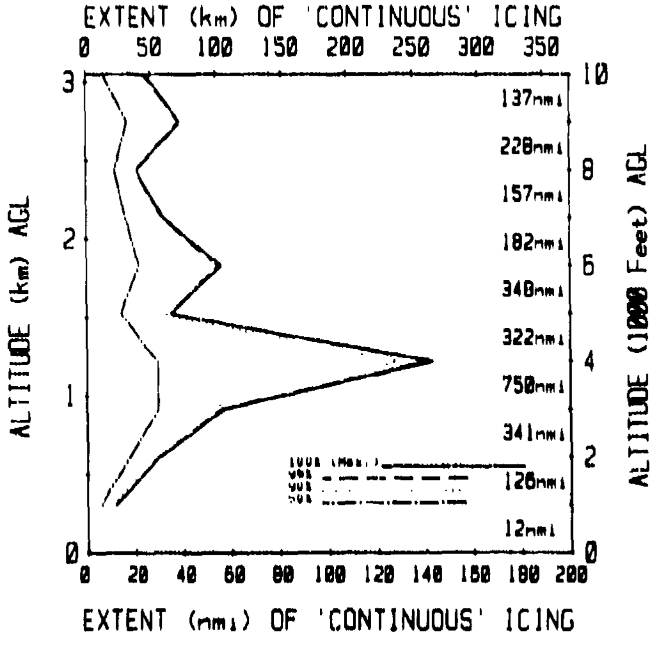

FIGURE 10. ALTITUDE VARIATION OF HORIZONTAL EXTENTS OF EXTENDED ICING ENCOUNTERS IN LAYER CLOUDS (St, Sc, Ns, As, Ac) AS OBSERVED IN THE NACA DATA (1946-1950). An extended encounter is a series of consecutive icing events added together sequentially until a gap of some specified duration (3 nmi for this case) is reached. At each 1000 ft level the pth percentile curves indicate the horizontal extent which was unexceeded in p% of the extended encounters within the 1000 ft altitude interval immediately below. The right-hand column of numbers gives the number of data miles contributing within each 1000 ft interval. A total of 2600 data miles is represented in this Figure.

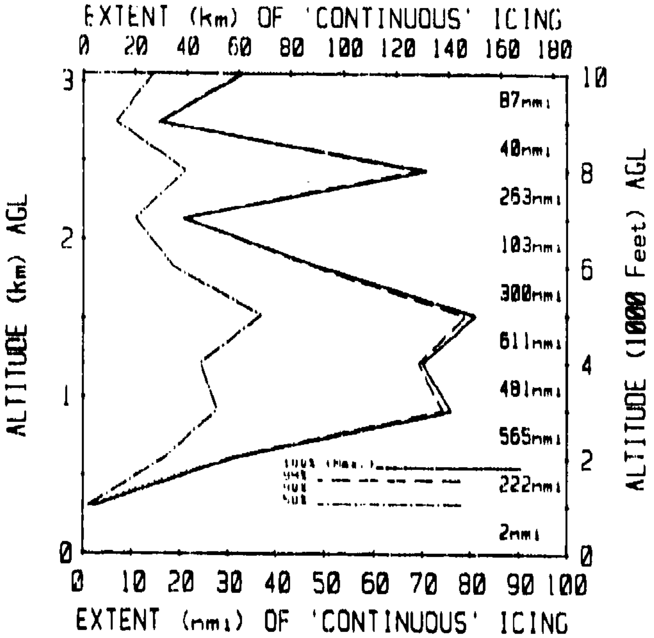

FIGURE 11. ALTITUDE VARIATION OF HORIZONTAL EXTENTS OF EXTENDED ICING ENCOUNTERS IN LAYER CLOUDS (St, Sc, Ns, As, Ac) AS OBSERVED IN THE MODERN DATA. An extended encounter is a series of consecutive icing events added together sequentially until a gap of some specified duration (1 nmi for this case) is reached. At each 1000 ft level the pth percentile curves indicate the horizontal extent which was unexceeded in p% of the extended encounters within the 1000 ft altitude interval immediately below. The right-hand column of numbers give the number of data miles contributing within each 1000 ft interval. A total of 2675 data miles is represented in this Figure.

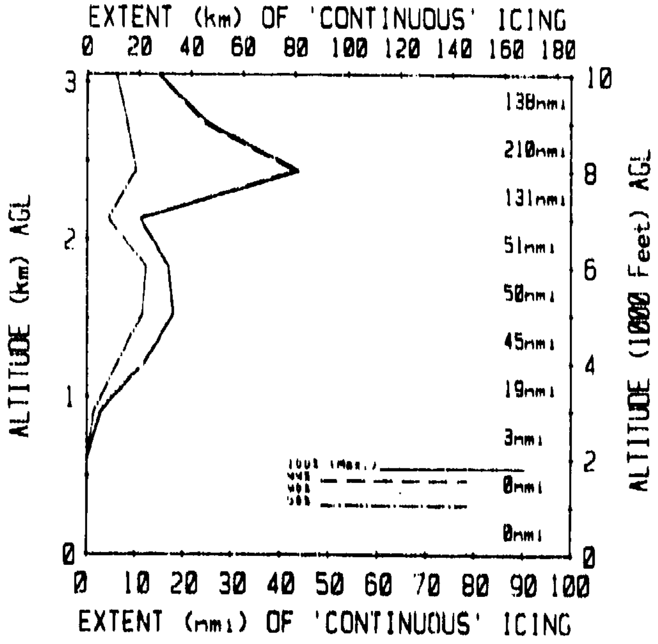

FIGURE 12. ALTITUDE VARIATION OF HORIZONTAL EXTENTS OF EXTENDED ICING ENCOUNTERS IN CONVECTIVE CLOUDS (Cu, Cb) AS OBSERVED IN THE NACA DATA (1946-1950). An extended encounter is a series of consecutive icing events added together sequentially until a gap of some specified duration (1 nmi for this case) is reached. At each 1000 ft level the pth percentile curves indicate the horizontal extent which was unexceeded in p% of the extended encounters within the 1000 ft altitude interval immediately below. The right-hand column of numbers gives the number of data miles contributing within each 1000 ft interval. A total of 650 data miles is represented in this Figure.

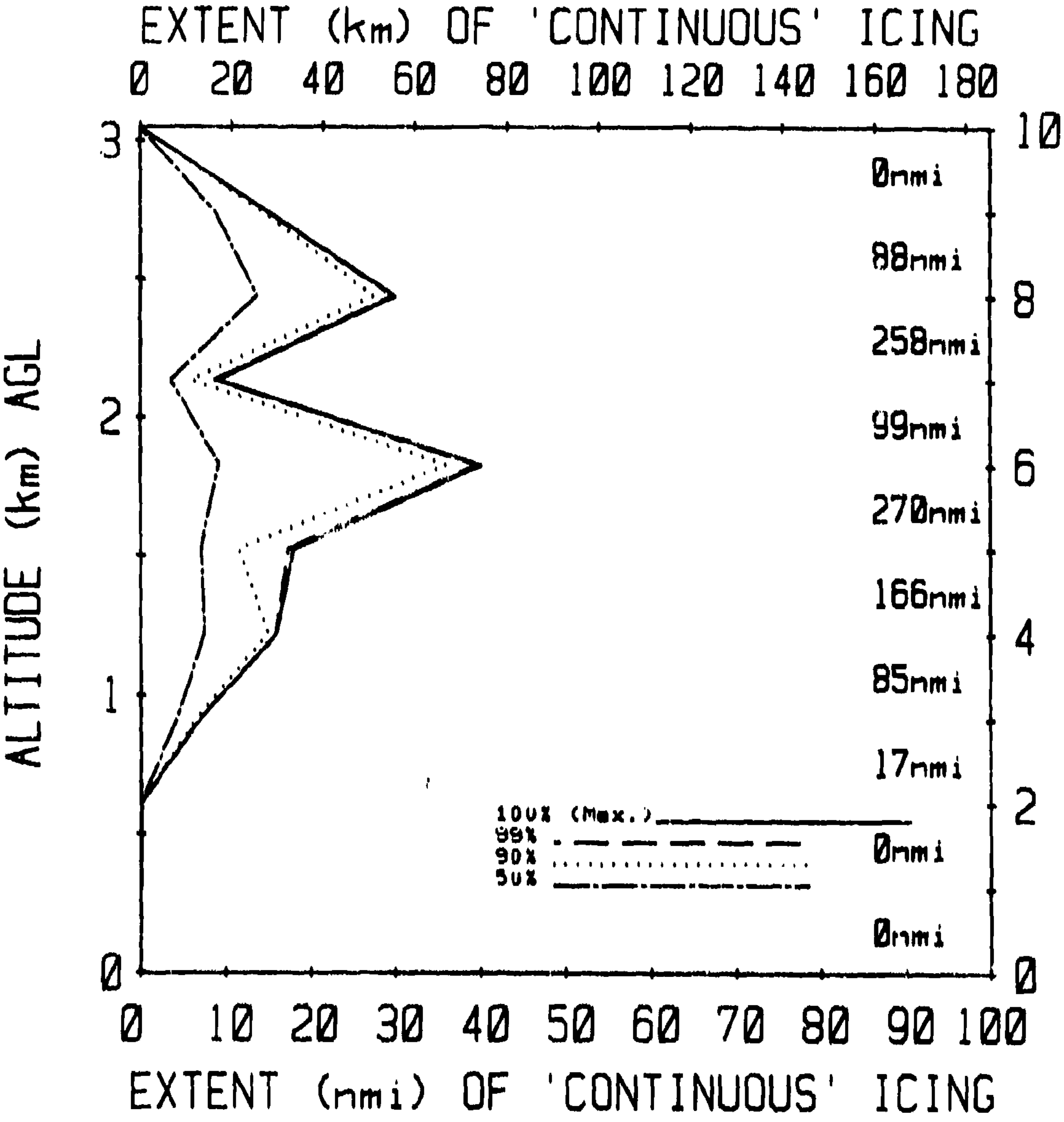

FIGURE 13. ALTITUDE VARIATION OF HORIZONTAL EXTENTS OF EXTENDED ICING ENCOUNTERS IN CONVECTIVE CLOUDS (Cu, Cb), AS OBSERVED IN THE MODERN DATA. An extended encounter is a series of consecutive icing events added together sequentially until a gap of some specified duration (3 nmi for this case) is reached. At each 1000 ft level the nth percentile curves indicate the horizontal extent which was unexceeded in n% of the extended encounters within the 1000 ft altitude interval immediately below. The right-hand column of numbers gives the number of data miles contributing within each 1000 ft interval. A total of 985 data miles is represented in this Figure.

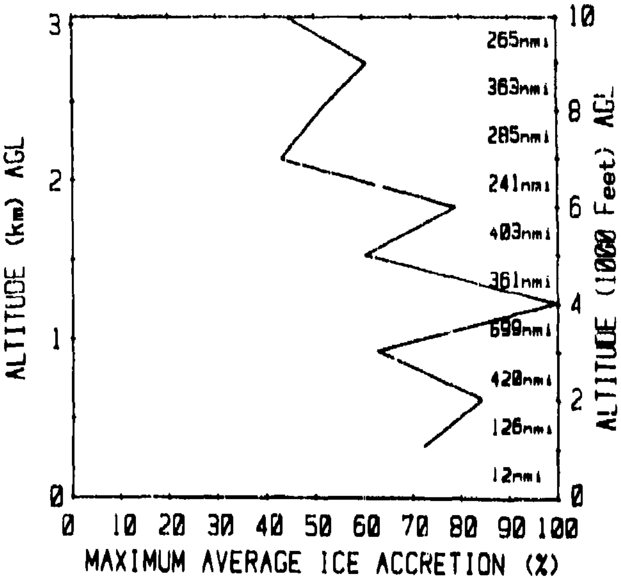

FIGURE 14. ALTITUDE VARIATION OF AVERAGE ICE ACCRETION PER EXTENDED ICING ENCOUNTER AS DETERMINED FROM THE NACA DATA (1946-1950). Ice accretion amounts represented by the product $\bar{W}H$ are computed for all extended icing encounters occurring in each 1000 ft altitude interval. The average value of $\bar{W}H$ for each altitude interval is expressed as a percentage of the largest of these interval-wide averages. At each 1000 ft level the plotted line indicates this percentage value for the 1000 ft altitude interval immediately below. An extended encounter is a series of consecutive icing events added together sequentially until a gap of some specified duration (3 nmi for this case) is reached. $\bar{W}$ is the LWC averaged over the extended encounter (gaps not included) and H is the horizontal extent of the extended encounter (gaps not included). The right-hand column of numbers gives the number of data miles contributing within each 1000 ft interval. A total of 3170 data miles is represented in this Figure.

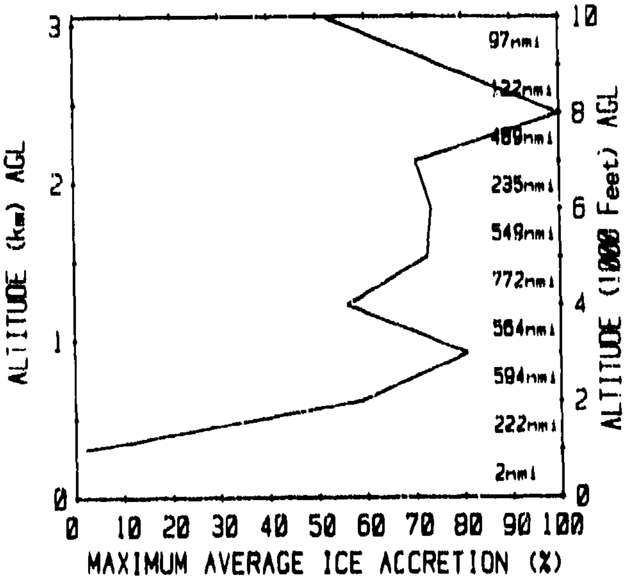

FIGURE 15. ALTITUDE VARIATION OF AVERAGE ICE ACCRETION PER EXTENDED ICING ENCOUNTER AS DETERMINED FROM THE MODERN DATA. Ice accretion amounts represented by the product $\bar{W}H$ are computed for all extended icing encounters occurring in each 1000 ft altitude interval. The average value of $\bar{W}H$ for each altitude interval is expressed as a percentage of the largest of these interval-wide averages. At each 1000 ft level the plotted line indicates this percentage value for the 1000 ft altitude interval immediately below. An extended encounter is a series of consecutive icing events added together sequentially until a gap of some specified duration (3 nmi for this case) is reached. $\bar{W}$ is the LWC averaged over the extended encounter (gaps not included) and H is the horizontal extent of the extended encounter (gaps not included). The right-hand column of numbers gives the number of data miles contributing within each 1000 ft interval. A total of 3645 data miles is represented in this Figure.

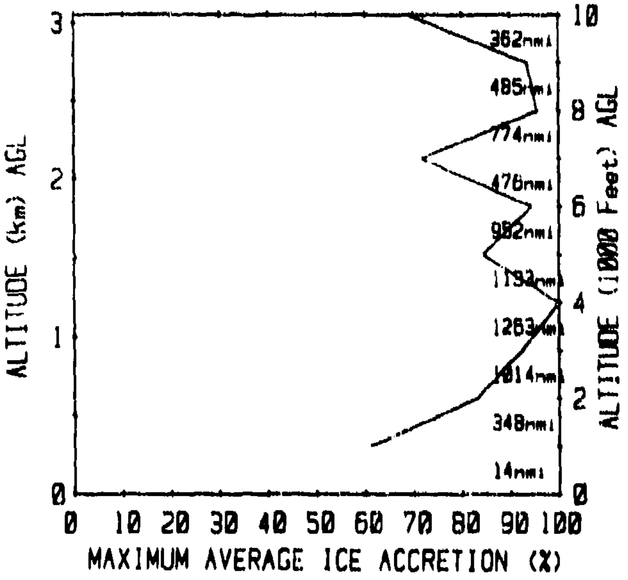

FIGURE 16. ALTITUDE VARIATION OF AVERAGE ICE ACCRETION PER EXTENDED ICING ENCOUNTER AS DETERMINED FROM THE COMBINED NACA AND MODERN DATA. Ice accretion amounts represented by the product $\bar{W}H$ are computed for all extended icing encounters occurring in each 1000 ft altitude interval. The average value of $\bar{W}H$ for each altitude interval is expressed as a percentage of the largest of these interval-wide averages. At each 1000 ft level the plotted line indicates this percentage value for the 1000 ft altitude interval immediately below. An extended encounter is a series of consecutive icing events added together sequentially until a gap of some specified duration (3 nmi for this case) is reached. $\bar{W}$ is the LWC averaged over the extended encounter (gaps not included) and H is the horizontal extent of the extended encounter (gaps not included). The right-hand column of numbers gives the number of data miles contributing within each 1000 ft interval. A total of 6820 data miles is represented in this Figure.

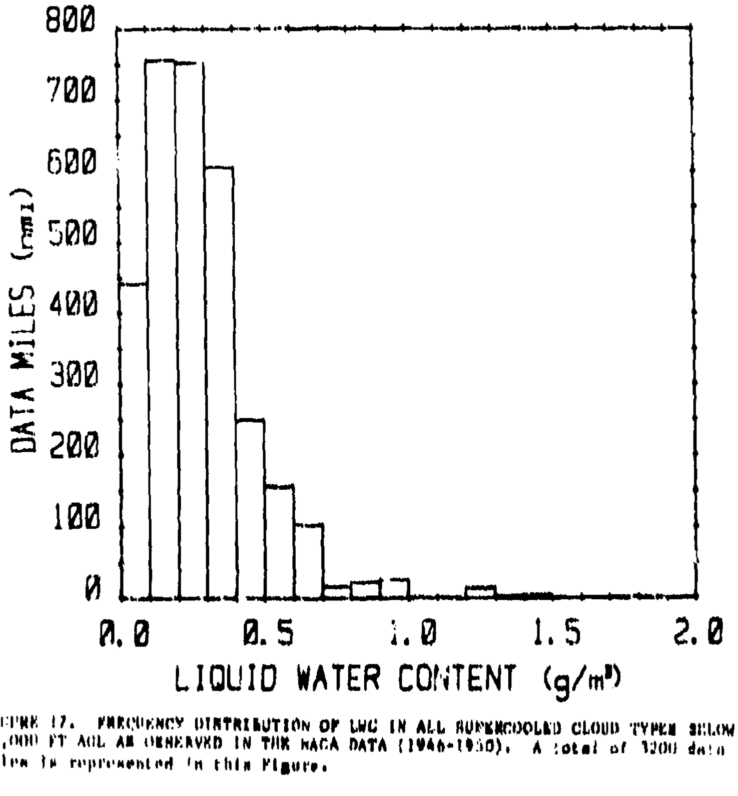

FIGURE 17. FREQUENCY DISTRIBUTION OF LWC IN ALL SUPERCOOLED CLOUD TYPES BELOW 10,000 FT AGL AS OBSERVED IN THE NACA DATA (1946-1950). A total of 3200 data miles is represented in this Figure.

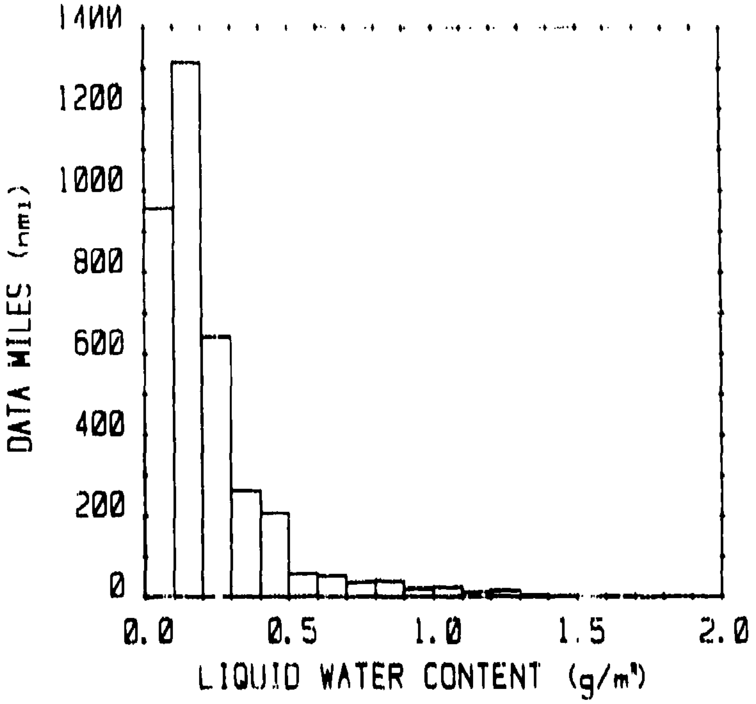

FIGURE 18. FREQUENCY DISTRIBUTION OF LWC IN ALL SUPERCOOLED CLOUD TYPES BELOW 10,000 FT AGL AS OBSERVED IN THE MODERN DATA. A total of 3645 data miles is represented in this Figure.

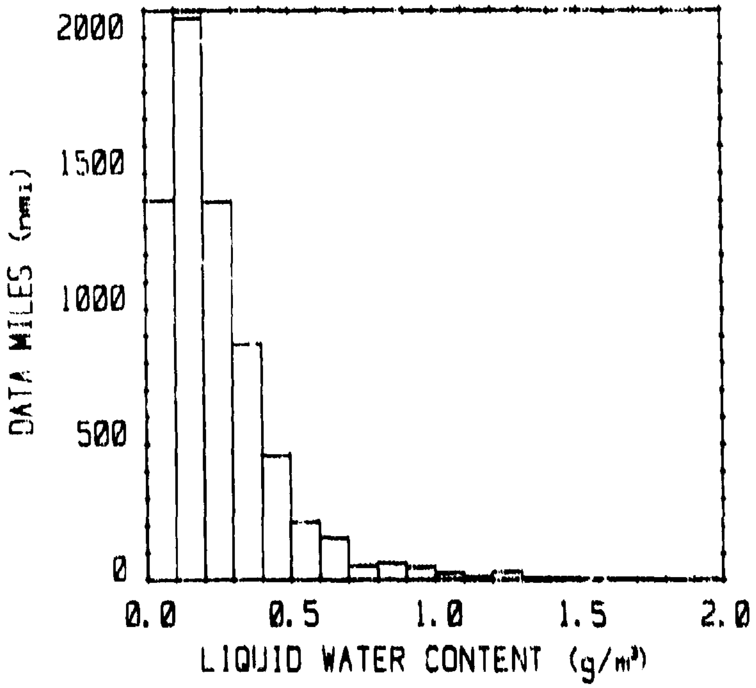

FIGURE 19. FREQUENCY DISTRIBUTION OF LWC IN ALL SUPERCOOLED CLOUD TYPES BELOW 10,000 FT AGL AS OBSERVED IN THE COMBINED NACA AND MODERN DATA. A total of 6850 data miles is represented in this Figure.

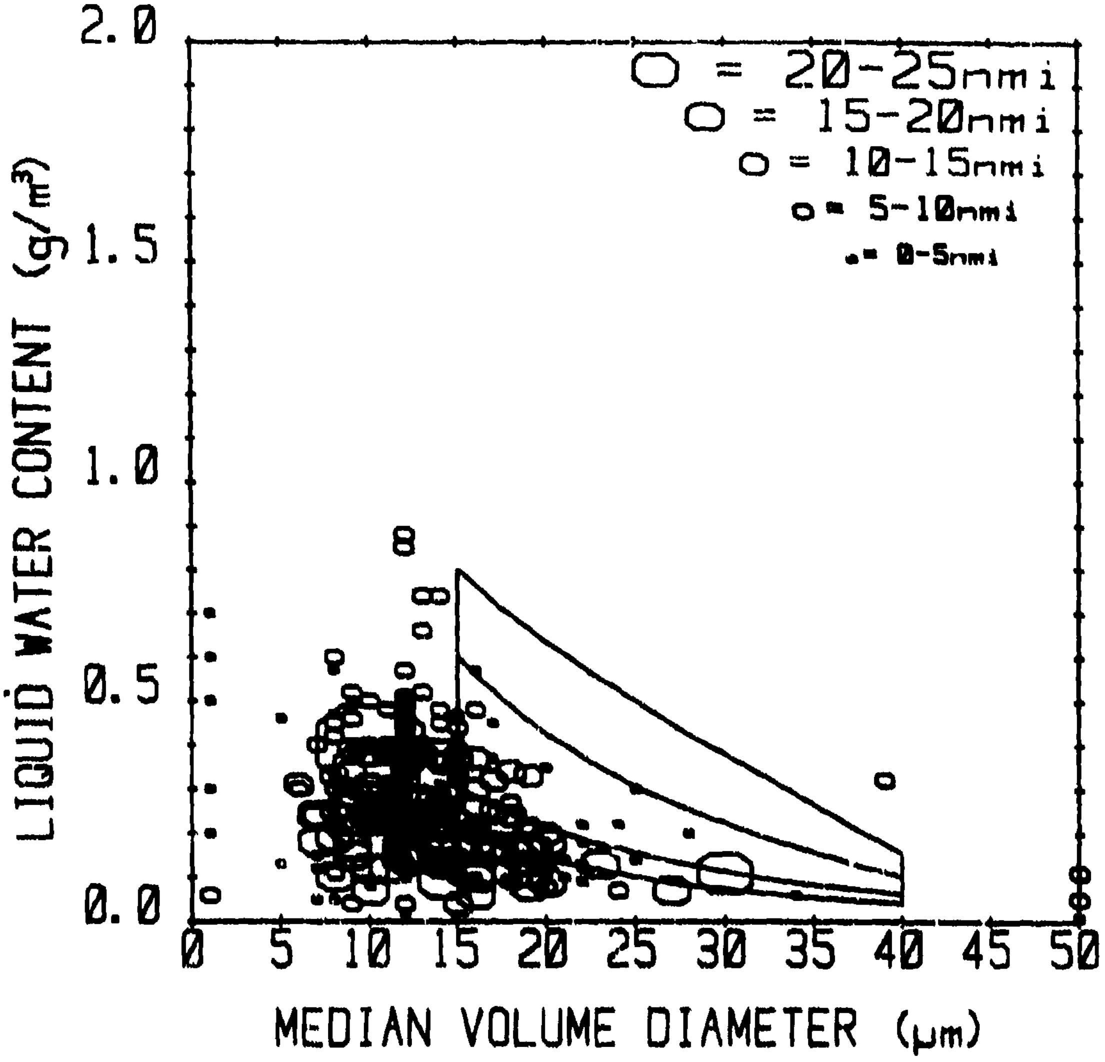

FIGURE 20. SCATTERPLOT OF OBSERVED LWC, MVD COMBINATIONS IN THE NACA DATA FOR LAYER CLOUDS UP TO 10,000 FT AGL AND FOR CLOUD TEMPERATURES FROM -10°C to 0°C. The size of each plotted symbol is proportional to its statistical weight (i.e., the observed horizontal extent of the associated icing event) as shown by the scale above the graph. The center of each plotted symbol corresponds to the average (and approximately constant) value of LWC and MVD observed during the icing event. Values of LWC for which no MVD measurements are available are plotted arbitrarily at 1 µm MVD. A total of 2105 data miles is represented in this graph. The Continuous Maximum envelope from FIG. 1 of FAR-25, App. C, is superimposed for comparison.

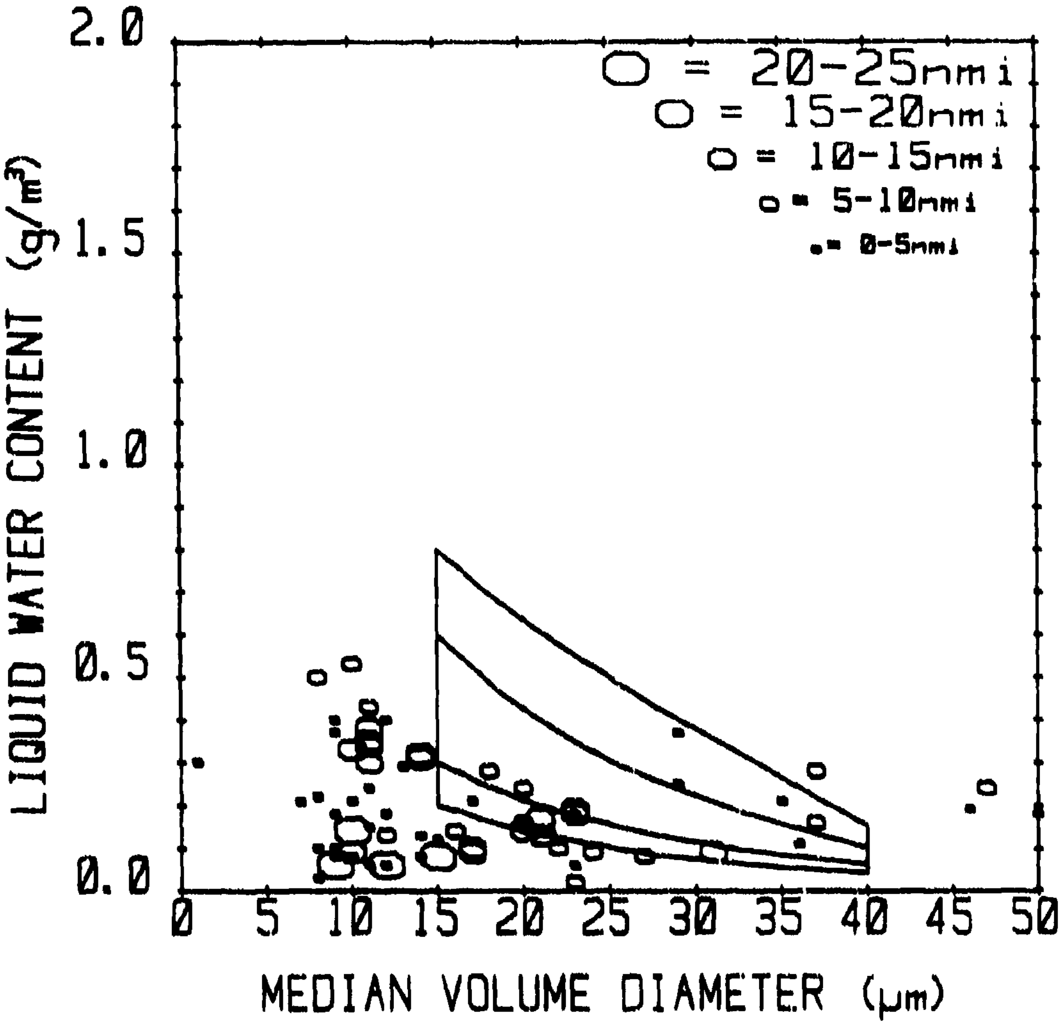

FIGURE 21. SCATTERPLOT OF OBSERVED LWC, MVD COMBINATIONS IN THE NACA DATA FOR LAYER CLOUDS UP TO 10,000 FT AGL AND FOR CLOUD TEMPERATURES FROM -20°C. to -10°C. The size of each plotted symbol is proportional to its statistical weight (i.e., the observed horizontal extent of the associated icing event) as shown by the scale above the graph. The center of each plotted symbol corresponds to the average (and approximately constant) value of LWC and MVD observed during the icing event. Values of LWC for which no MVD measurements are available are plotted arbitrarily at 1 μm MVD. A total of 464 data miles is represented in this graph. The Continuous Maximum envelope from FIG. 1 of FAR-25, App. C, is superimposed for comparison.

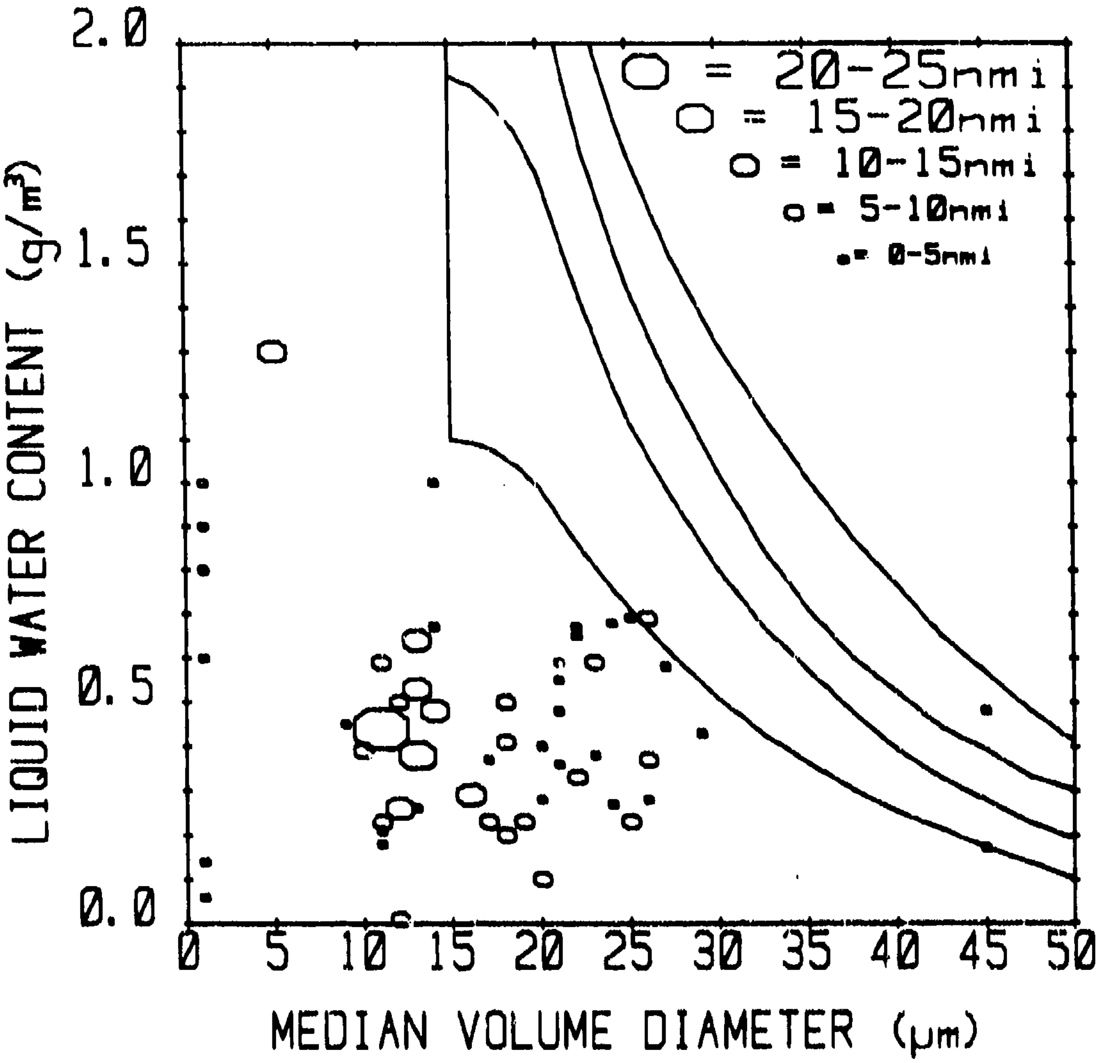

FIGURE 22. SCATTERPLOT OF OBSERVED LWC, MVD COMBINATIONS IN THE NACA DATA FOR CONVECTIVE CLOUDS UP TO 10,000 FT AGL AND FOR CLOUD TEMPERATURES FROM -10°C. to 0°C. The size of each plotted symbol is proportional to its statistical weight (i.e., the observed horizontal extent of the associated icing event) as shown by the scale above the graph. The center of each plotted symbol corresponds to the average (and approximately constant) value of LWC and MVD observed during the icing event. Values of LWC for which no MVD measurements are available are plotted arbitrarily at 1 μm MVD. A total of 320 data miles is represented in this graph. The Intermittent Maximum envelope from FIG. 4 of FAR-25, App. C, is superimposed for comparison.

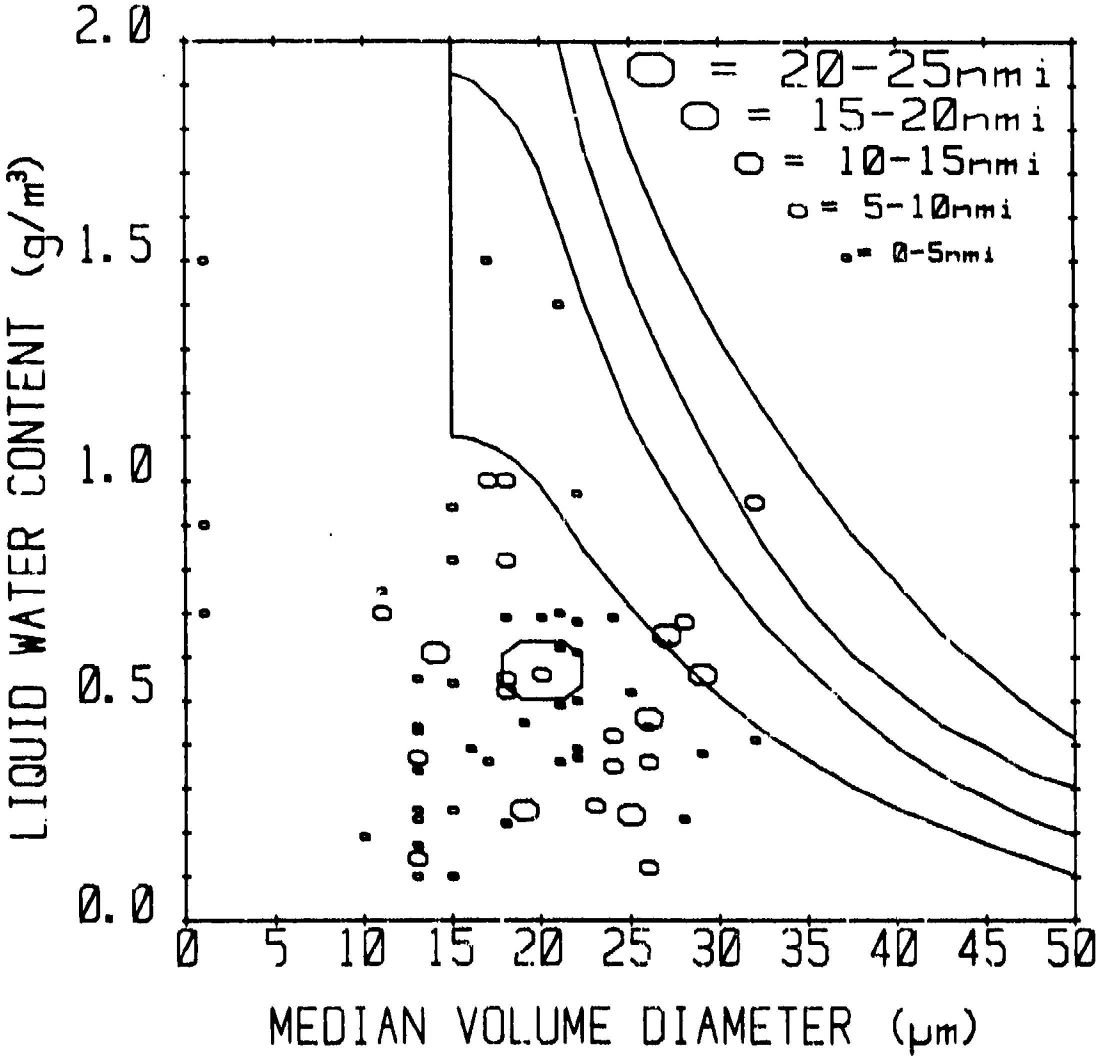

FIGURE 23. SCATTERPLOT OF OBSERVED LWC, MVD COMBINATIONS IN THE NACA DATA FOR CONVECTIVE CLOUDS UP TO 10,000 FT AGL AND FOR CLOUD TEMPERATURES FROM -20°C to -10°C. The size of each plotted symbol is proportional to its statistical weight (i.e., the observed horizontal extent of the associated icing event) as shown by the scale above the graph. The center of each plotted symbol corresponds to the average (and approximately constant) value of LWC and MVD observed during the icing event. Values of LWC for which no MVD measurements are available are plotted arbitrarily at 1 μm MVD. A total of 315 data miles is represented in this graph. The Intermittent Maximum envelope from FIG. 4 of FAR-25, App. C, is superimposed for comparison.

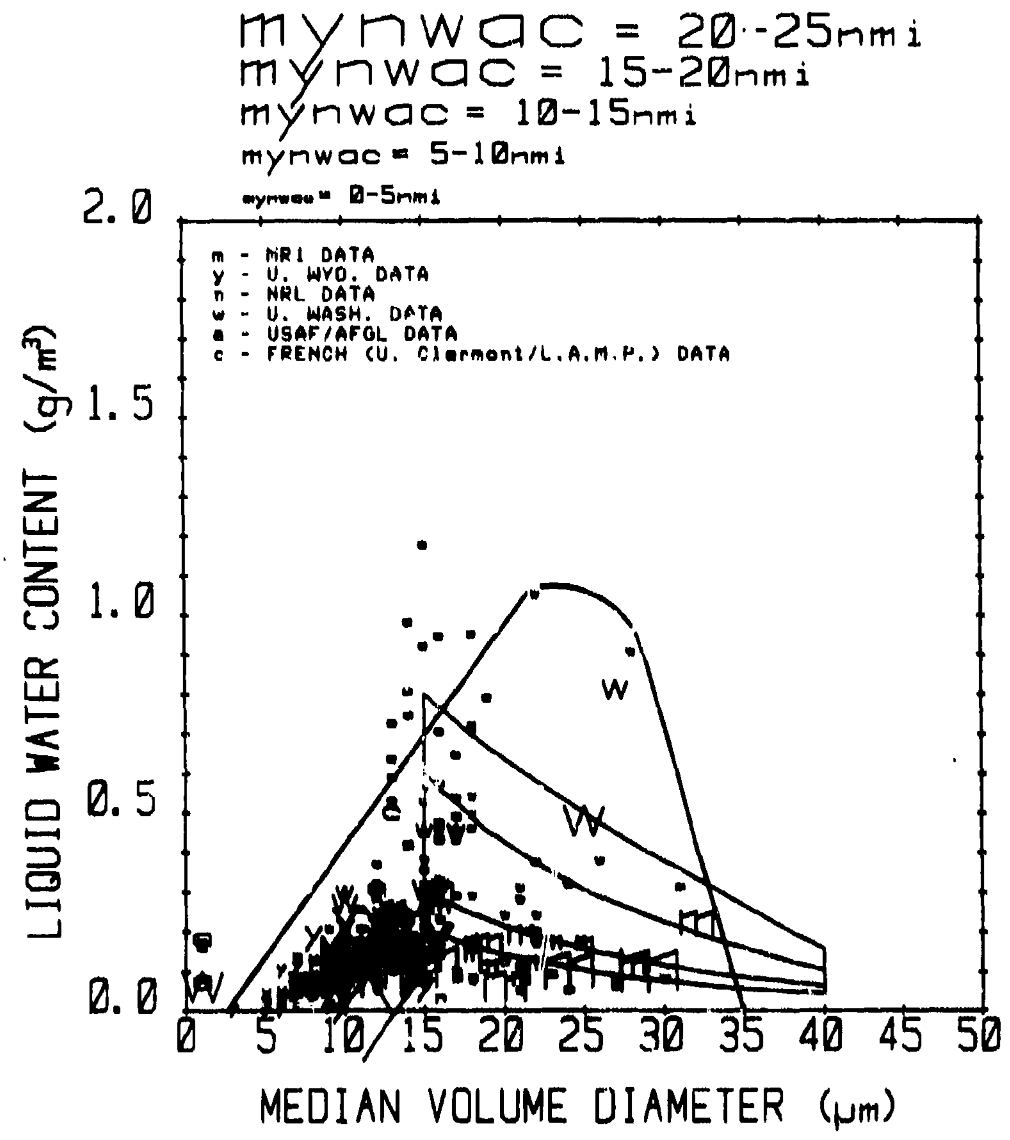

FIGURE 24. SCATTERPLOT OF OBSERVED LWC, MVD COMBINATIONS IN THE MODERN DATA FOR LAYER CLOUDS UP TO 10,000 FT AGL AND FOR CLOUD TEMPERATURES FROM -10°C to 0°C. The various plotting symbols represent different data sources as indicated in the key. The size of each plotted symbol is proportional to its statistical weight (i.e., the observed horizontal extent of the associated icing event) as shown by the scale above the graph. The center of each plotted symbol corresponds to the average (and approximately constant) value of LWC and MVD observed during the icing event. Values of LWC for which no MVD measurements are available are plotted arbitrarily at 1 µm MVD. A total of 1320 data miles is represented in this graph. The Continuous Maximum envelope from FIG. 1 of FAR-25, App. C, is superimposed for comparison. The other smooth curve is the observed, apparent limit to the CONUS data for this temperature interval.

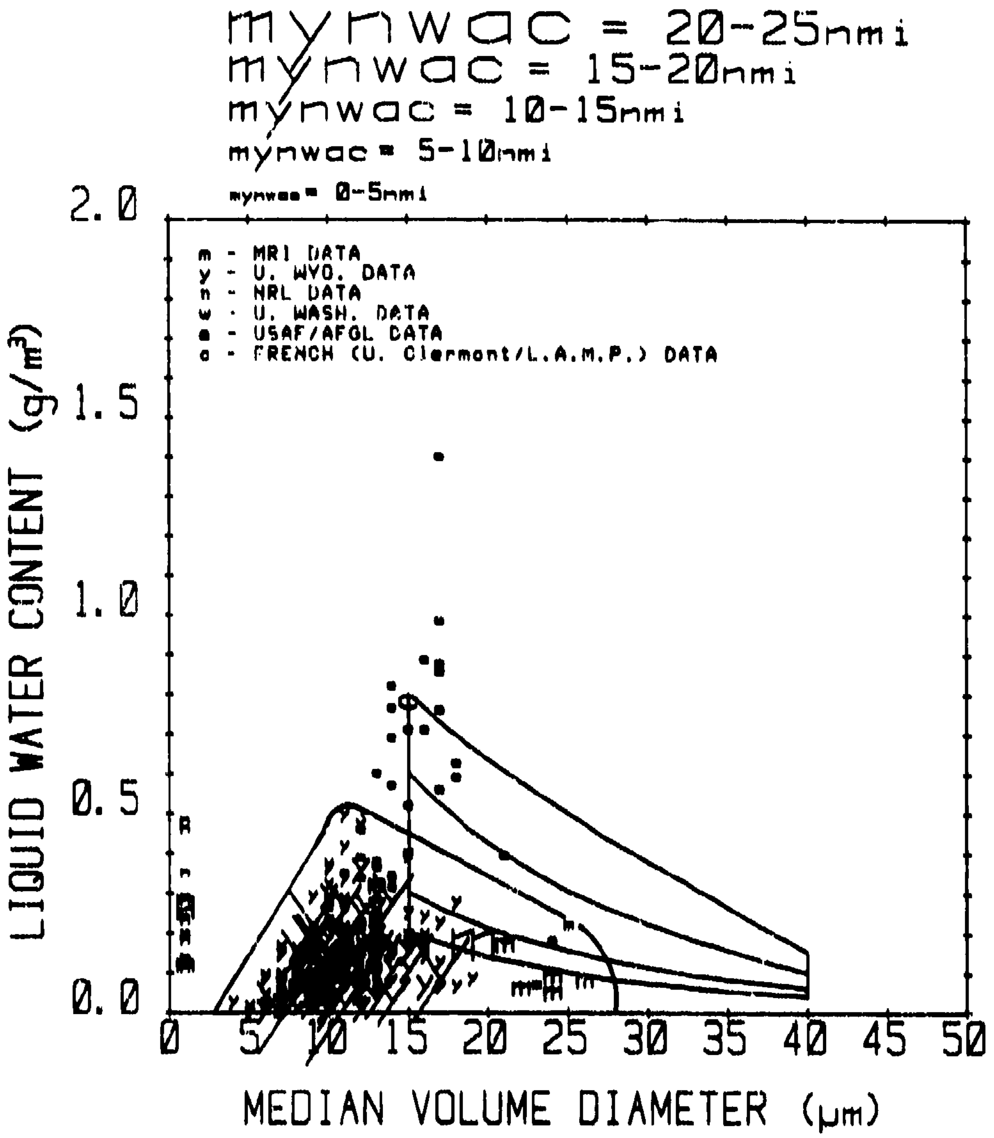

FIGURE 23. SCATTERPLOT OF OBSERVED LWC, MVD COMBINATIONS IN THE MODERN DATA FOR LAYER CLOUDS UP TO 10,000 FT AGL AND FOR CLOUD TEMPERATURES FROM -20°C to -10°C. The various plotting symbols represent different data sources as indicated in the key. The size of each plotted symbol is proportional to its statistical weight (i.e., the observed horizontal extent of the associated icing event) as shown by the scale above the graph. The center of each plotted symbol corresponds to the average (and approximately constant) value of LWC and MVD observed during the icing event. Values of LWC for which no MVD measurements are available are plotted arbitrarily at 1 μm MVD. A total of 1180 data miles is represented in this graph. The Continuous Maximum envelope from FIG. 1 of FAR-25, App. C, is superimposed for comparison. The other smooth curve is the observed, apparent limit to the CONUS data for this temperature interval.

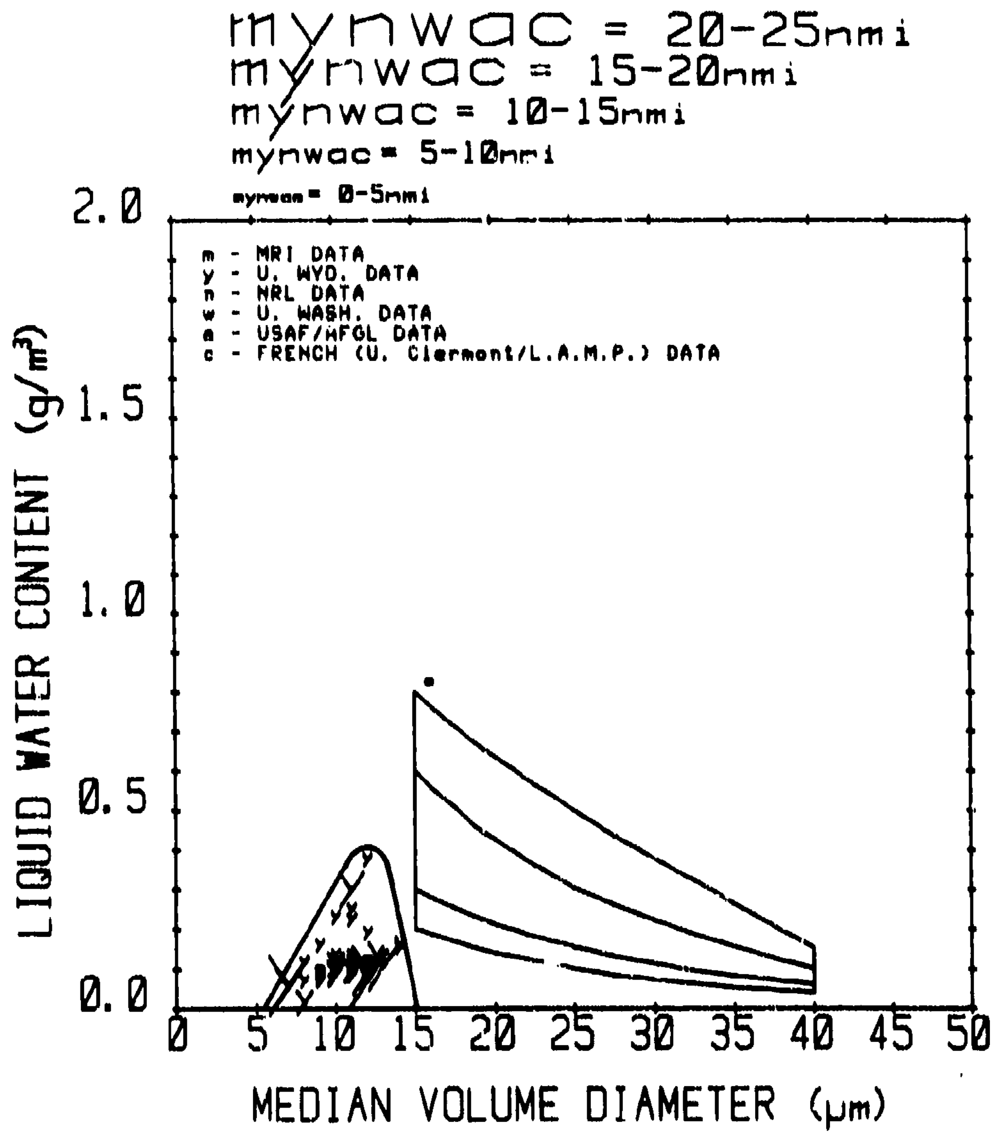

FIGURE 26. SCATTERPLOT OF OBSERVED LWC, MVD COMBINATIONS IN THE MODERN DATA FOR LAYER CLOUDS UP TO 10,000 FT AGL AND FOR CLOUD TEMPERATURES FROM -30°C to -20°C. The various plotting symbols represent different data sources as indicated in the key. The size of each plotted symbol is proportional to its statistical weight (i.e., the observed horizontal extent of the associated icing event) as shown by the scale above the graph. The center of each plotted symbol corresponds to the average (and approximately constant) value of LWC and MVD observed during the icing event. Values of LWC for which no MVD measurements are available are plotted arbitrarily at 1 μm MVD. A total of 174 data miles is represented in this graph. The Continuous Maximum envelope from FIG. 1 of FAR-25, App. C, is superimposed for comparison. The other smooth curve is the observed, apparent limit to the CONUS data for this temperature interval.

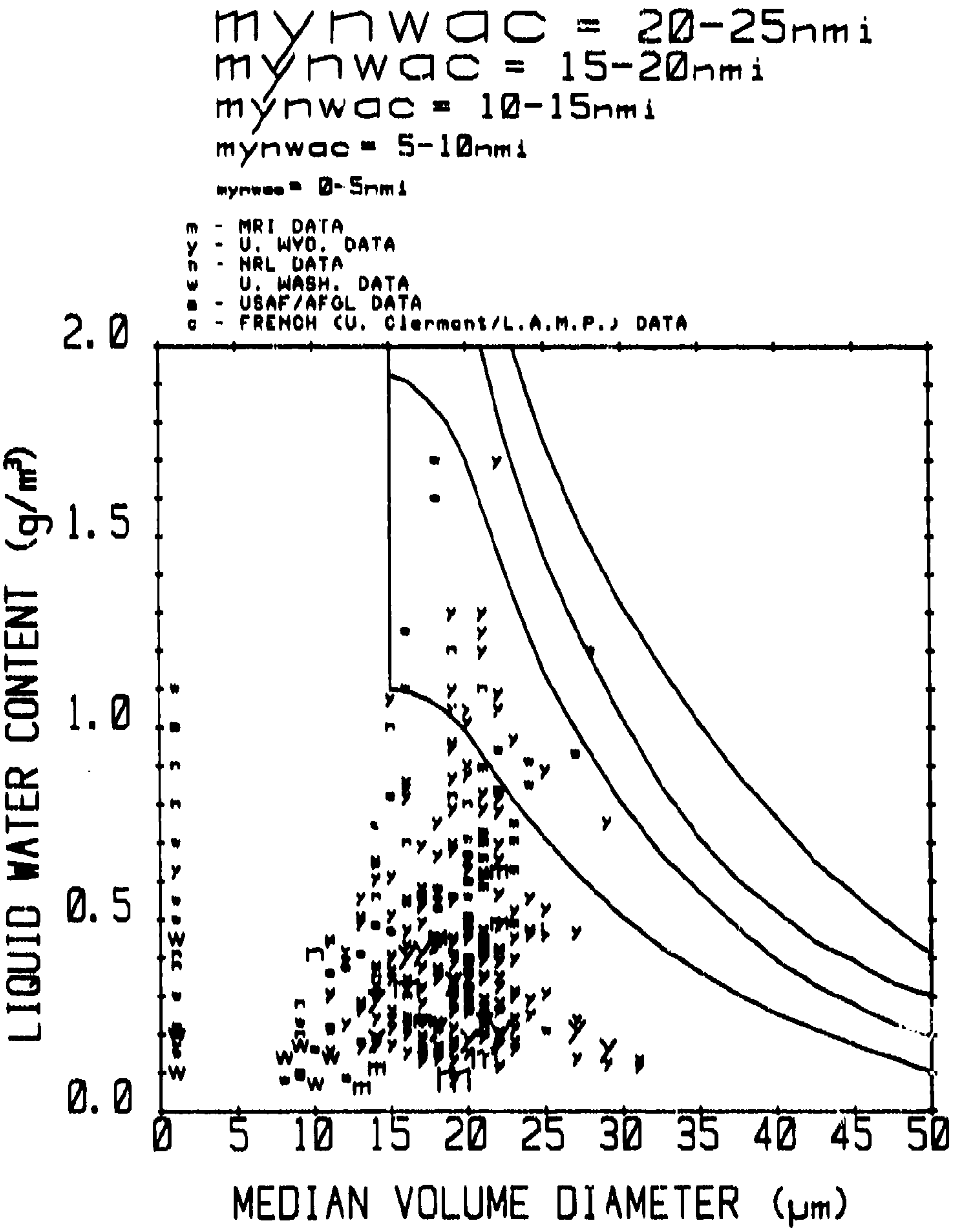

FIGURE 27. SCATTERPLOT OF OBSERVED LWC, MVD COMBINATIONS IN THE MODERN DATA FOR CONVECTIVE CLOUDS UP TO 10,000 FT AGL AND FOR CLOUD TEMPERATURES FROM -10°C to 0°C. The various plotting symbols represent different data sources as indicated by the key. The size of each plotted symbol is proportional to its statistical weight (i.e., the observed horizontal extent of the associated icing event) as shown by the scale above the graph. The center of each plotted symbol corresponds to the average (and approximately constant) value of LWC and MVD observed during the icing event. Values of LWC for which no MVD measurements are available are plotted arbitrarily at 1 μm MVD. A total of 734 data miles is represented in this graph. The Intermittent Maximum envelope from FIG. 4 of FAR-25, App. C, is superimposed for comparison.

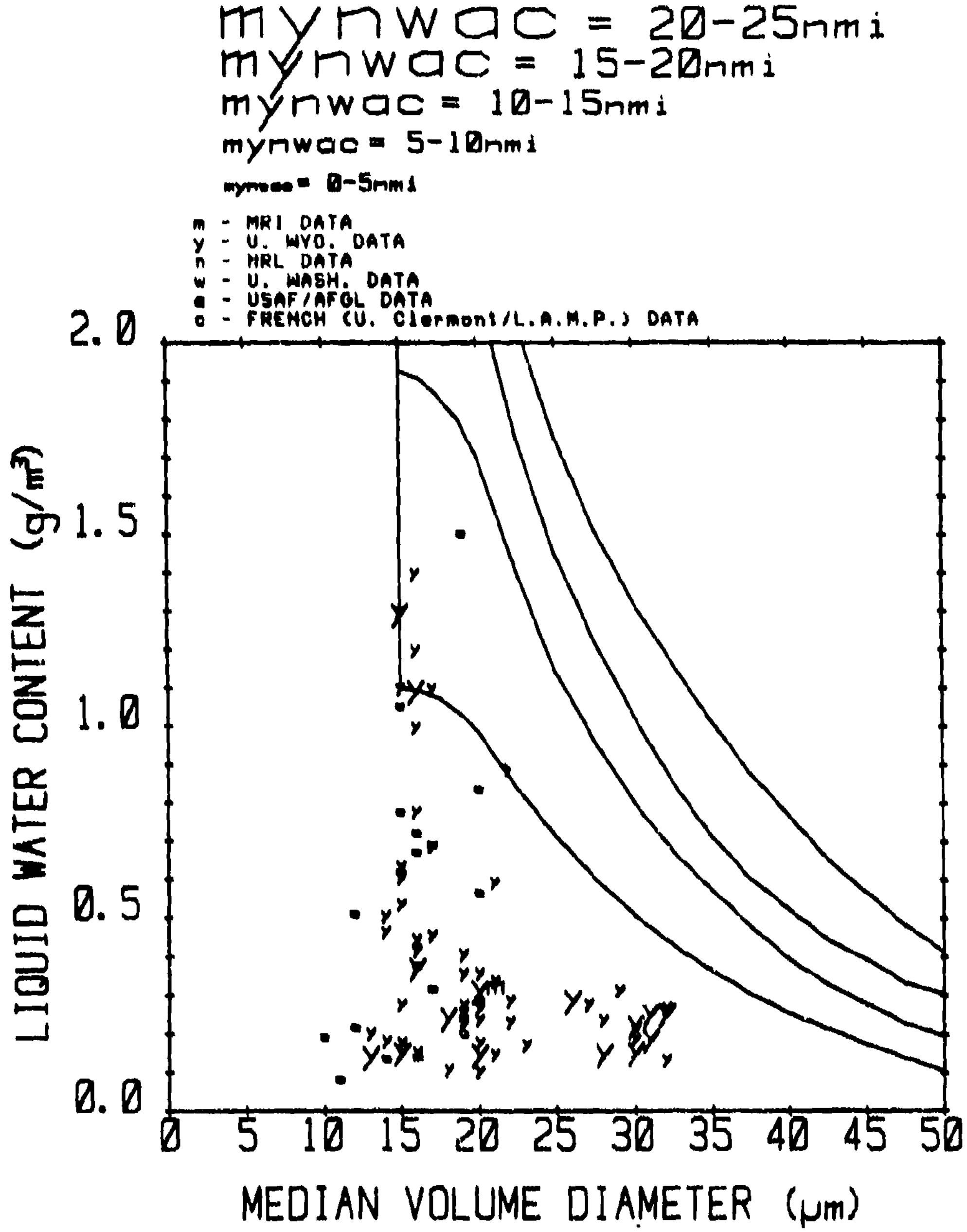

FIGURE 28. SCATTERPLOT OF OBSERVED LWC, MVD COMBINATIONS IN THE MODERN DATA FOR CONVECTIVE CLOUDS UP TO 10,000 FT AGL AND FOR CLOUD TEMPERATURES FROM -20°C to -10°C. The various plotting symbols represent different data sources as indicated by the key. The size of each plotted symbol is proportional to its statistical weight (i.e., the observed horizontal extent of the associated icing event) as shown by the scale above the graph. The center of each plotted symbol corresponds to the average (and approximately constant) value of LWC and MVD observed during the icing event. Values of LWC for which no MVD measurements are available are plotted arbitrarily at 1 μm MVD. A total of 244 data miles is represented in this graph. The Intermittent Maximum envelope from FIG. 4 of FAR-25, App. C, is superimposed for comparison.

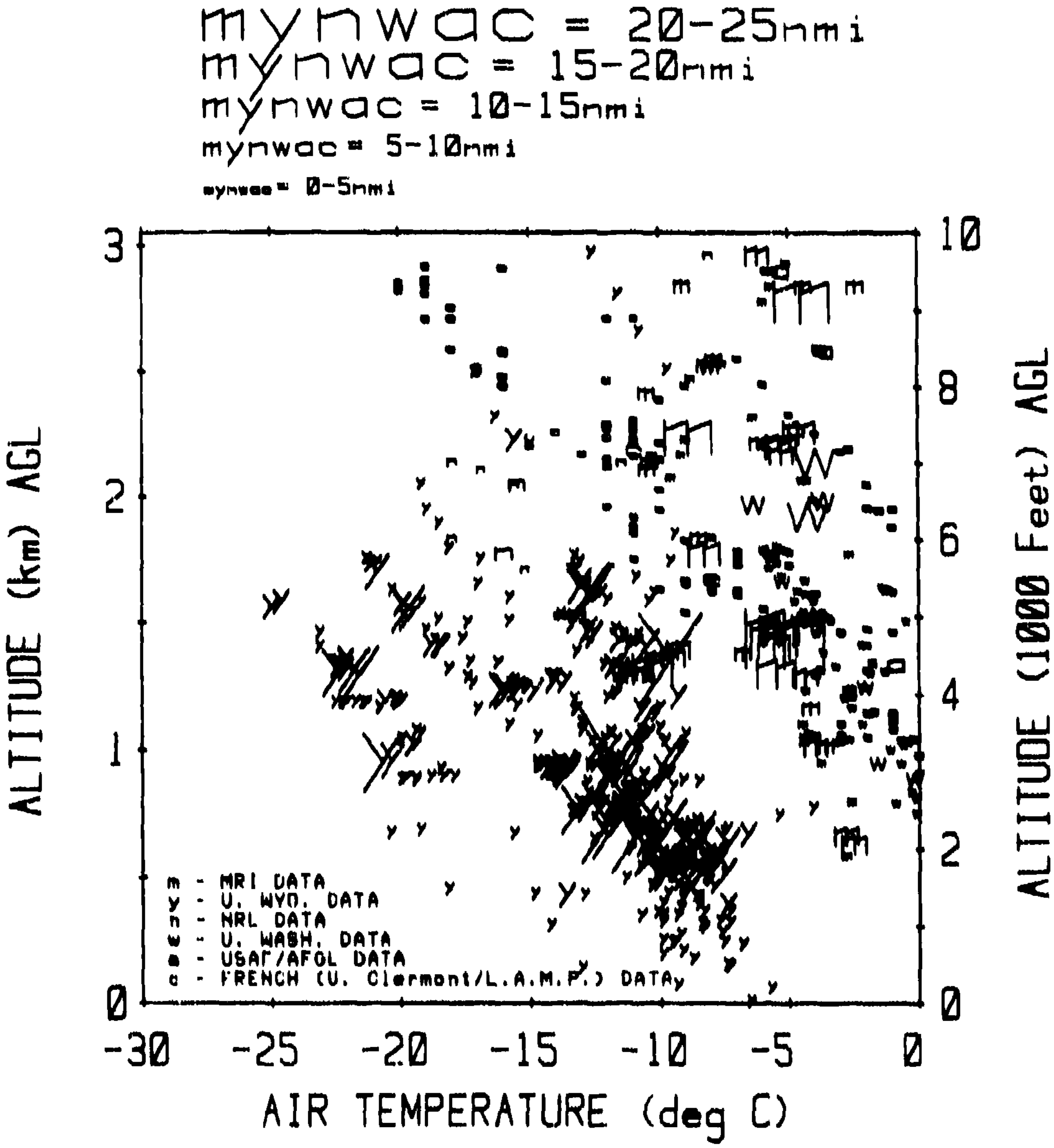

FIGURE 29. SCATTERPLOT OF ICING EVENT TEMPERATURES VS. ALTITUDE FOR MODERN DATA FROM SUPERCOOLED LAYER CLOUDS (St, Sc, Ns, As, Ac) UP TO 10,000 FT AGL. The various plotting symbols represent different data sources as indicated in the key. The size of each symbol is proportional to its statistical weight (i.e., the observed horizontal extent of the associated icing event) as shown by the scale above the graph. The center of each symbol corresponds to the average (and approximately constant) value of altitude and OAT observed during the icing event. A total of 2660 data miles is represented in this graph.

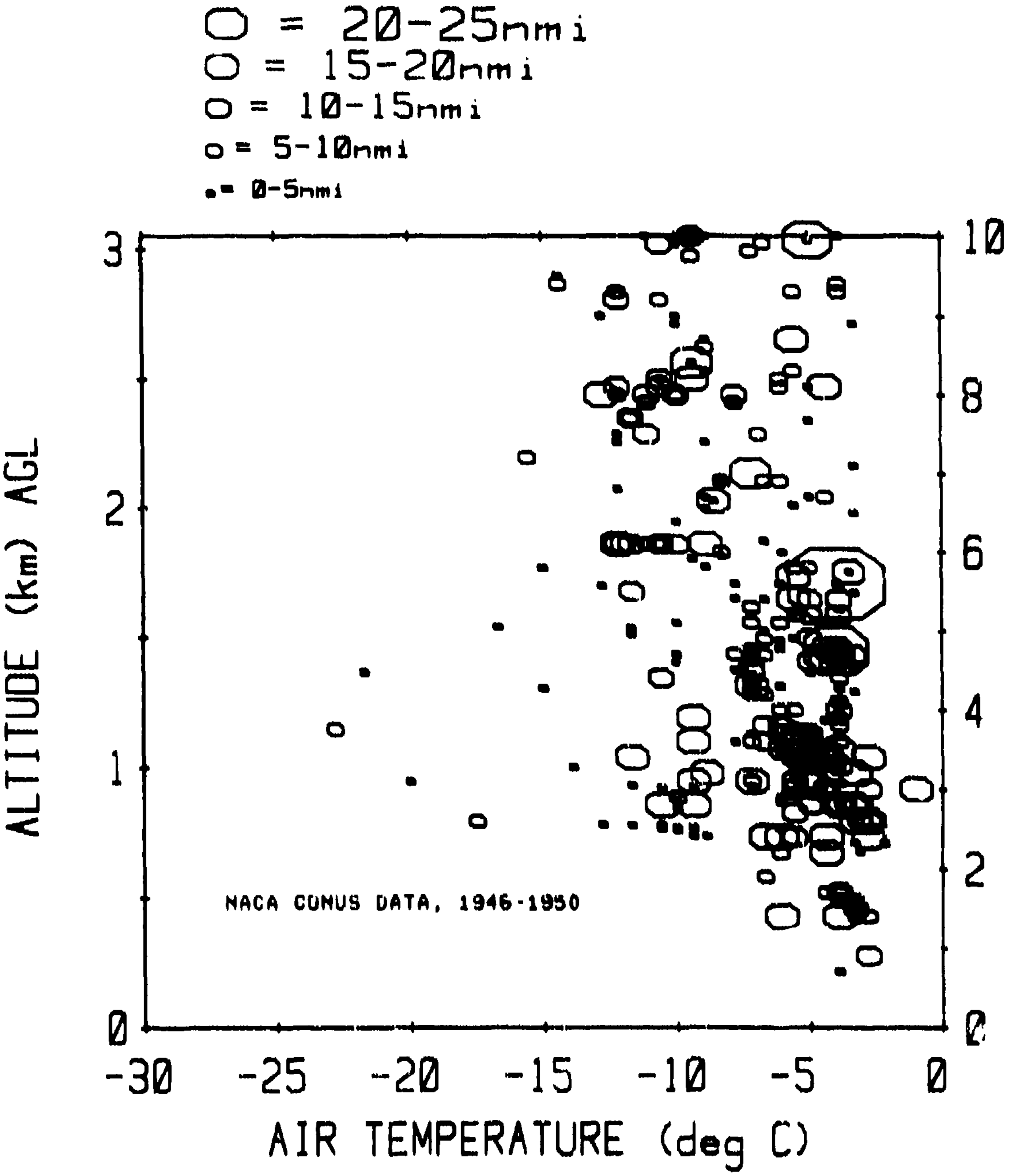

FIGURE 30. SCATTERPLOT OF ICING EVENT TEMPERATURES VS. ALTITUDE FOR NACA DATA FROM SUPERCOOLED LAYER CLOUDS (St, Sc, Ns, As, Ac) UP TO 10,000 FT AGL. The size of each symbol is proportional to its statistical weight (i.e., the observed horizontal extent of the associated icing event) as shown by the scale above the graph. The center of each symbol corresponds to the average (and approximately constant) value of altitude and OAT observed during the icing event. A total of 2610 data miles is represented in this graph.

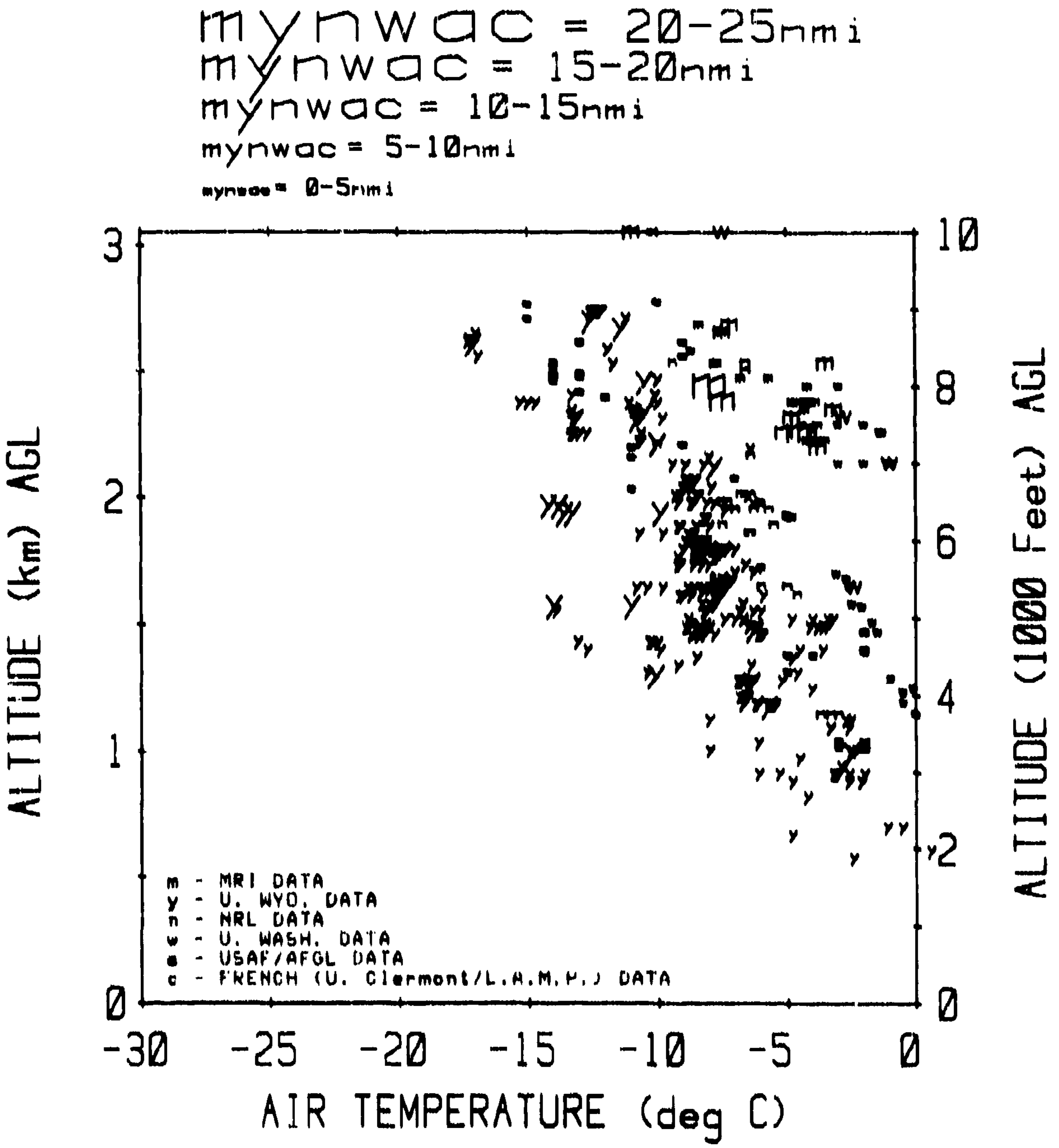

FIGURE 31. SCATTERPLOT OF ICING EVENT TEMPERATURES VS. ALTITUDE FOR MODERN DATA FROM SUPERCOOLED CONVECTIVE CLOUDS (Cu, Cb) UP TO 10,000 FT AGL. The various plotting symbols represent different data sources as indicated in the key. The size of each symbol is proportional to its statistical weight (i.e., the observed horizontal extent of the associated icing event) as shown by the scale above the graph. The center of each symbol corresponds to the average (and approximately constant) value of altitude and OAT observed during the icing event. A total of 980 data miles is represented in this graph.

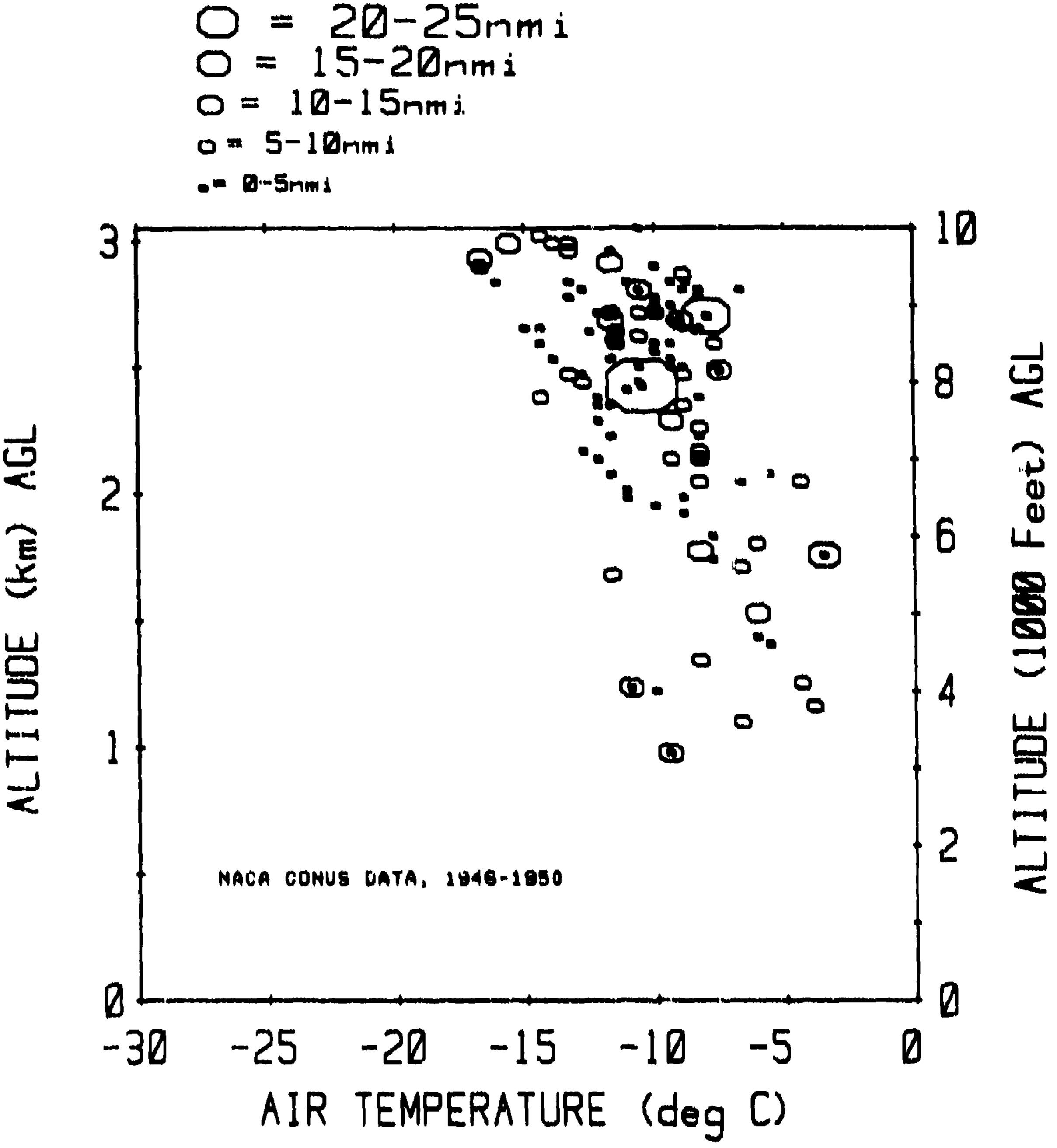

FIGURE 32. SCATTERPLOT OF ICING EVENT TEMPERATURES VS. ALTITUDE FOR NACA DATA FROM SUPERCOOLED CONVECTIVE CLOUDS (Cu, Cb) UP TO 10,000 FT AGL. The size of each symbol is proportional to its statistical weight (i.e., the observed horizontal extent of the associated icing event) as shown by the scale above the graph. The center of each symbol corresponds to the average (and approximately constant) value of altitude and OAT observed during the icing event. A total of 620 data miles is represented in this graph.

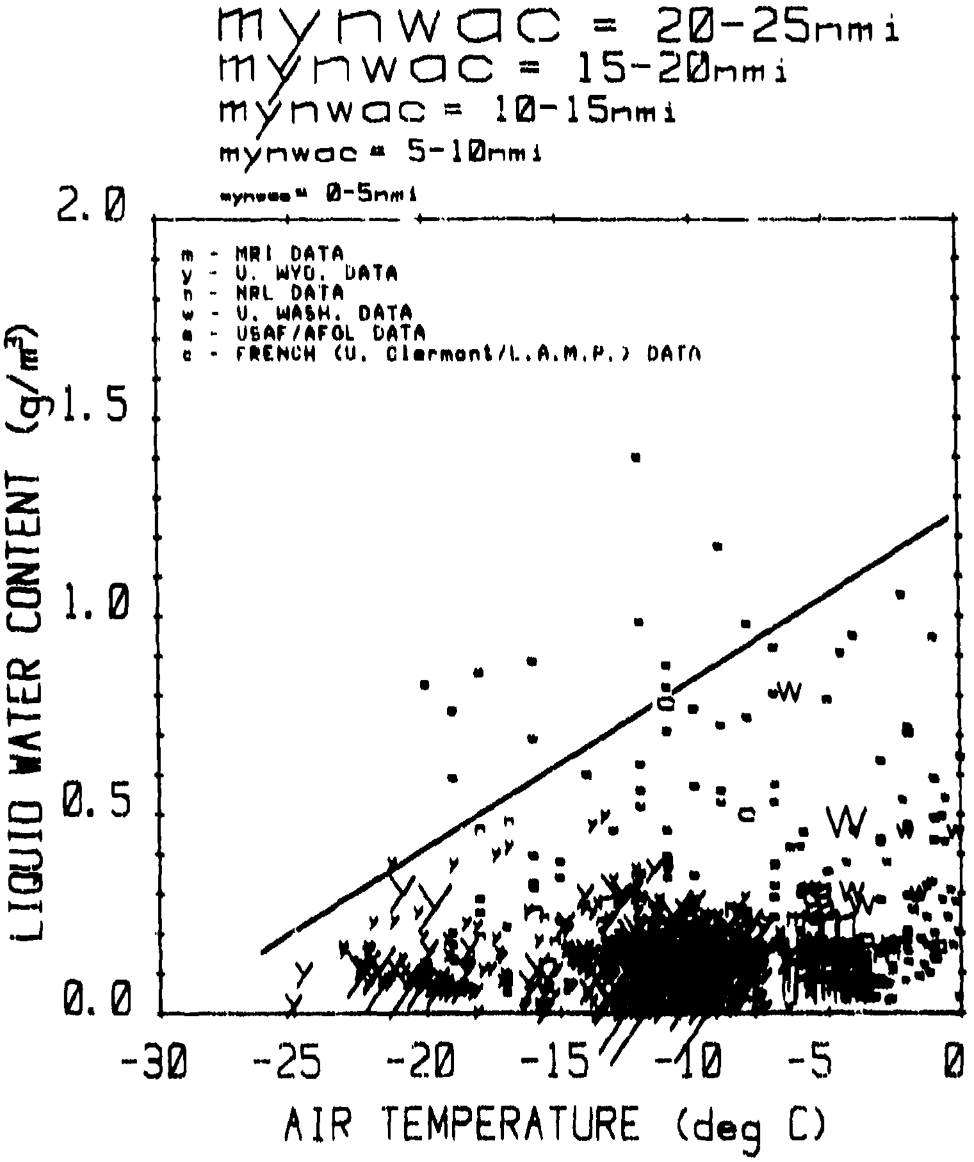

FIGURE 33. SCATTERPLOT OF LWC VS. OAT FOR MODERN DATA FROM SUPERCOOLED LAYER CLOUDS (St, Sc, Ns, As, Ac) UP TO 10,000 FT AGL. The various plotting symbols represent different data sources as indicated in the key. The size of each symbol is proportional to its statistical weight (i.e., the observed horizontal extent of the associated icing event) as shown by the scale above the graph. The center of each symbol corresponds to the average (and approximately constant) value of LWC and OAT observed during the icing event. The solid line represents the apparent upper limit to LWC as a function of temperature for CONUS supercooled layer clouds below 10,000 ft AGL. The position of the line is based on the maximum LWC values in the combined NACA and modern CONUS data sets. A total of 2660 data miles is represented in this graph.

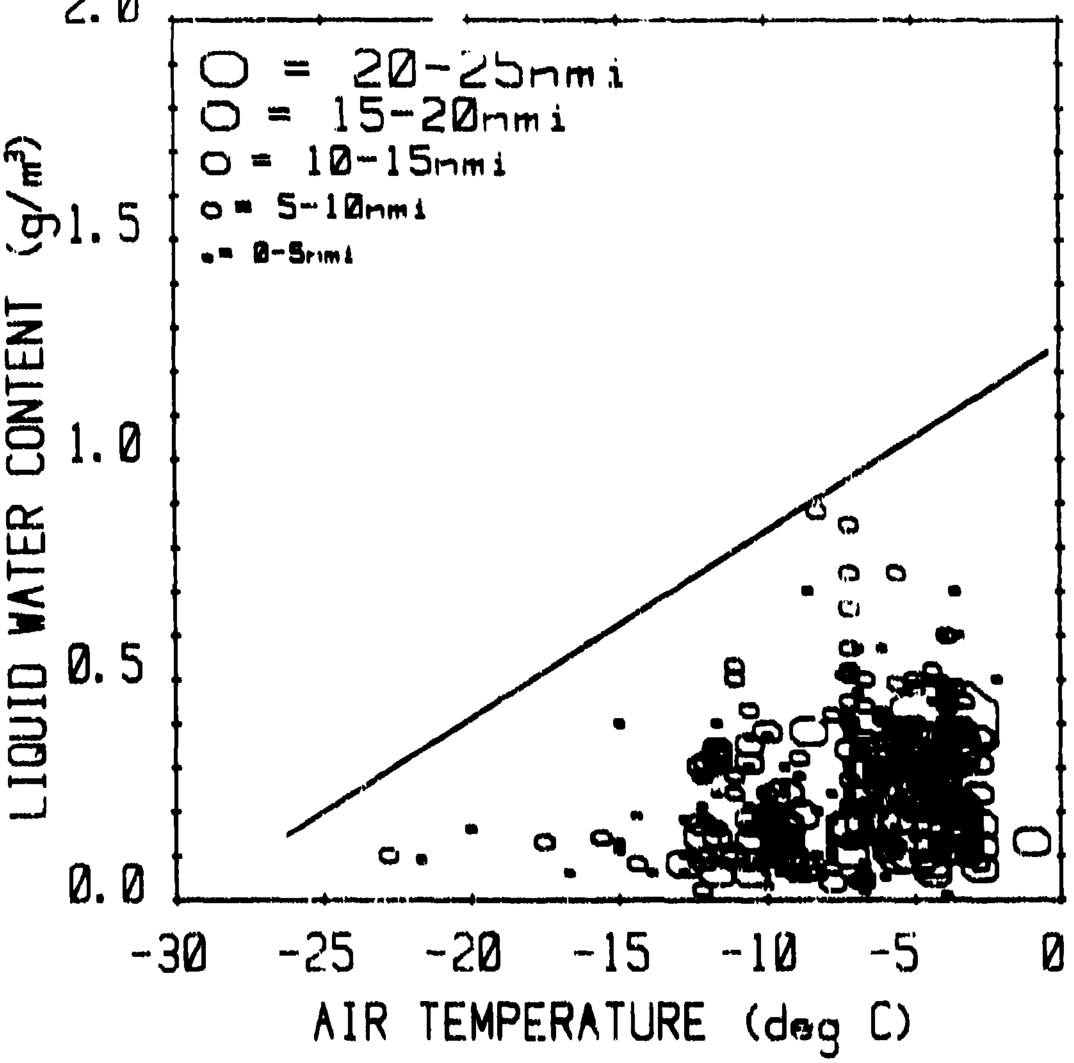

FIGURE 34. SCATTERPLOT OF LWC VS. OAT FOR NACA (1946-1950) DATA FROM SUPERCOOLED LAYER CLOUDS (St, Sc, Ns, As, Ac) UP TO 10,000 FT AGL. The size of each symbol is proportional to its statistical weight (i.e., the observed horizontal extent of the associated icing event) as shown by the scale above the graph. The center of each symbol corresponds to the average (and approximately constant) value of LWC and OAT observed during the icing event. The solid line bounding the data points represents the apparent upper limit to LWC as a function of temperature for CONUS supercooled layer clouds below 10,000 ft AGL. The position of the line is based on the maximum LWC values in the combined NACA and modern data sets. A total of 2610 data miles is represented in this graph.

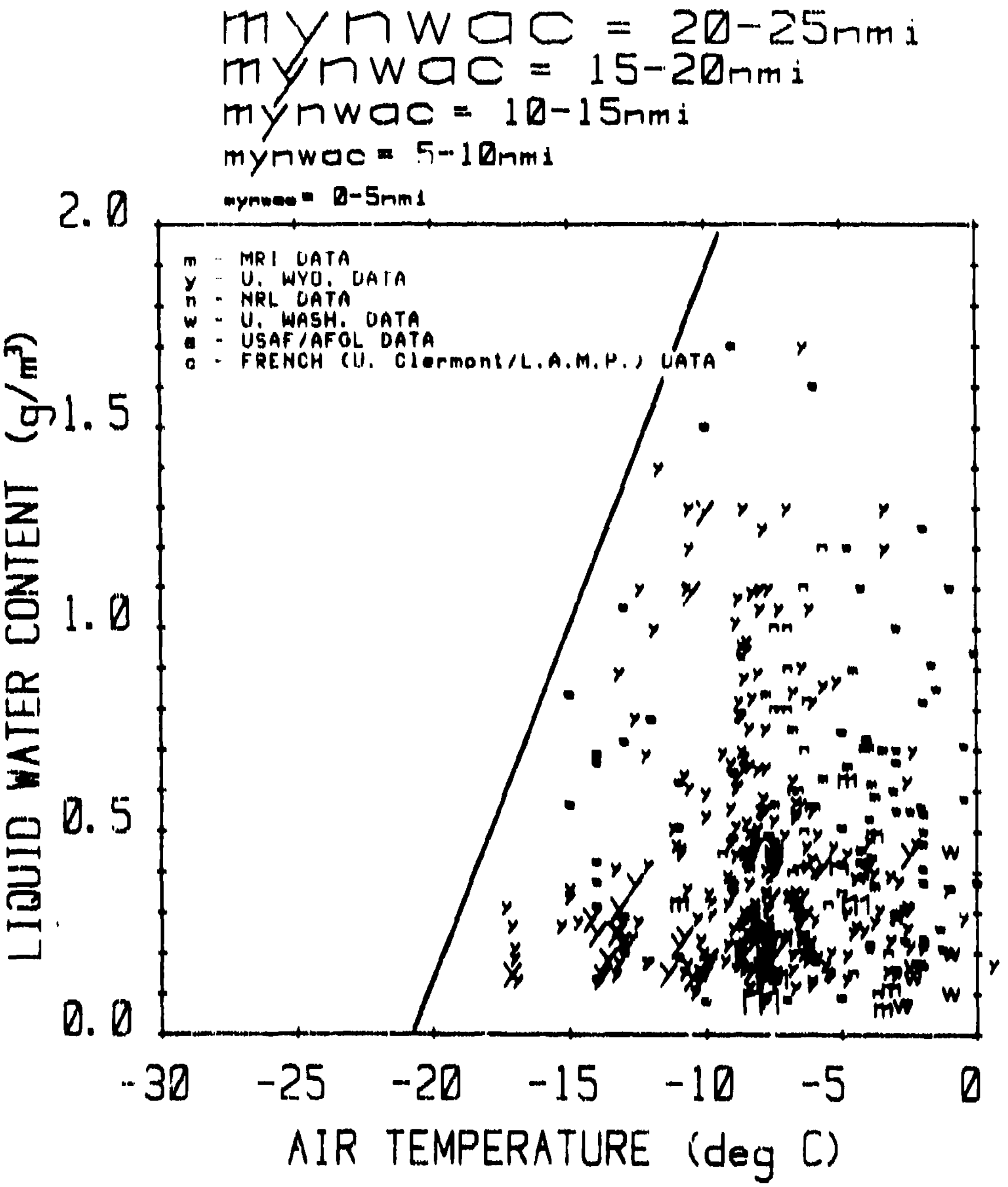

FIGURE 35. SCATTERPLOT OF LWC VS. OAT FOR MODERN DATA FROM SUPERCOOLED CONVECTIVE CLOUDS (Cu, Cb) UP TO 10,000 FT AGL. The various plotting symbols represent different data sources as indicated in the key. The size of each symbol is proportional to its statistical weight (i.e., the observed horizontal extent of the associated icing event) as shown by the scale above the graph. The center of each symbol corresponds to the average (and approximately constant) value of LWC and OAT observed during the icing event. The solid line bounding the data points represents the apparent upper limit to LWC as a function of temperature for CONUS supercooled convective clouds below 10,000 ft AGL. The position of the line is based on the maximum LWC values in the combined NACA and modern data sets. A total of 980 data miles is represented in this graph.

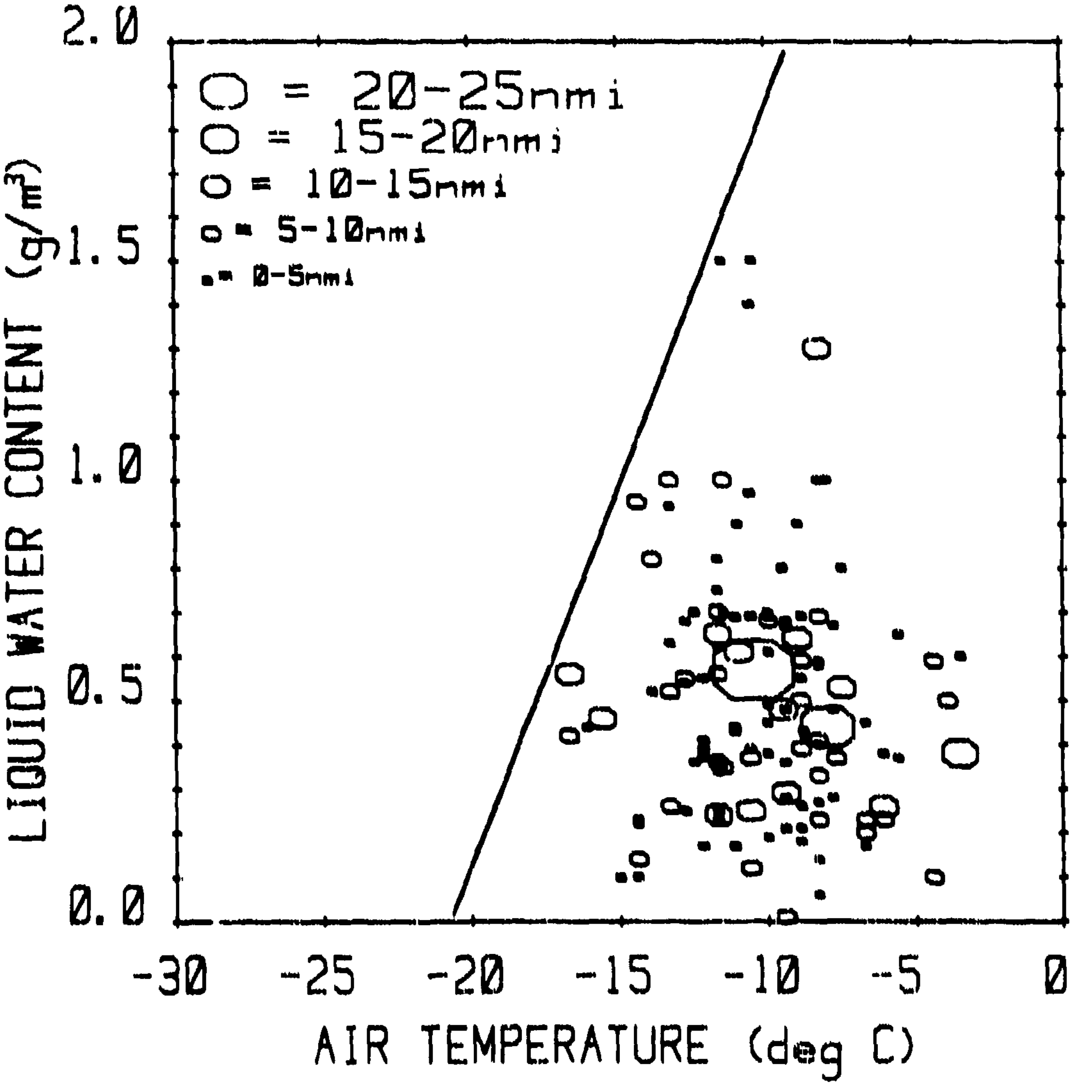

FIGURE 36. SCATTERPLOT OF LWC VS. OAT FOR NACA (1946-1950) DATA FROM SUPERCOOLED CONVECTIVE CLOUDS (Cu, Cb) UP TO 10,000 FT AGL. The size of each symbol is proportional to its statistical weight (i.e., the observed horizontal extent of the associated icing event) as shown by the scale above the graph. The center of each symbol corresponds to the average (and approximately constant) value of LWC and OAT observed during the icing event. The solid line bounding the data points represents the apparent upper limit to LWC as a function of temperature for CONUS supercooled convective clouds below 10,000 ft AGL. The position of the line is based on the maximum LWC values in the combined NACA and modern data sets. A total of 620 data miles is represented in this graph.

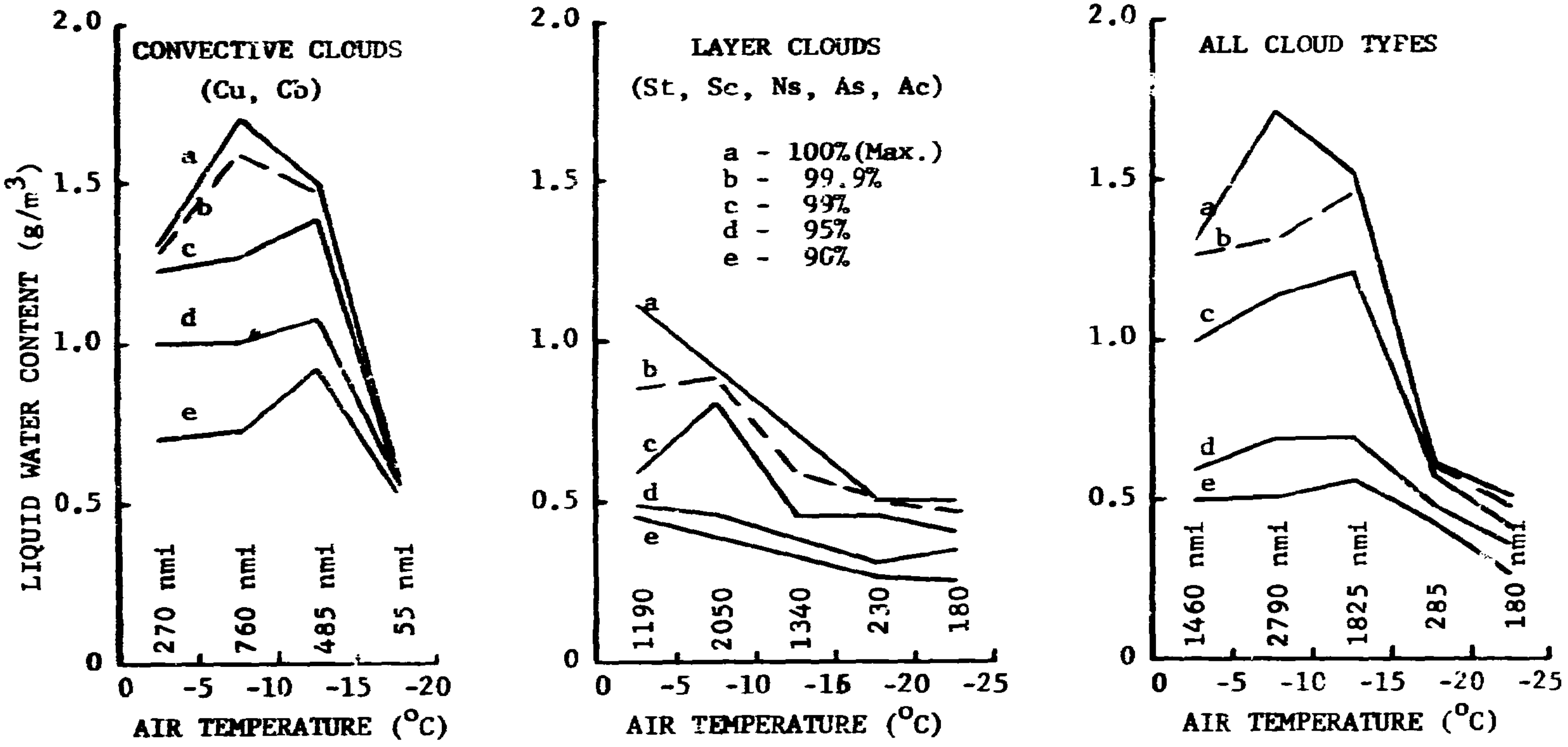

FIGURE 37. SELECTED, CUMULATIVE FREQUENCIES OF OCCURRENCE OF LWC VS. TEMPERATURE FOR THE ENTIRE CONUS DATA BASE. The nth percentile curves indicate the value of LWC that was unexceeded in n% of the data miles recorded for the indicated temperature interval and cloud category. The number of data miles contributing to each 5°C temperature interval is given in each temperature interval.

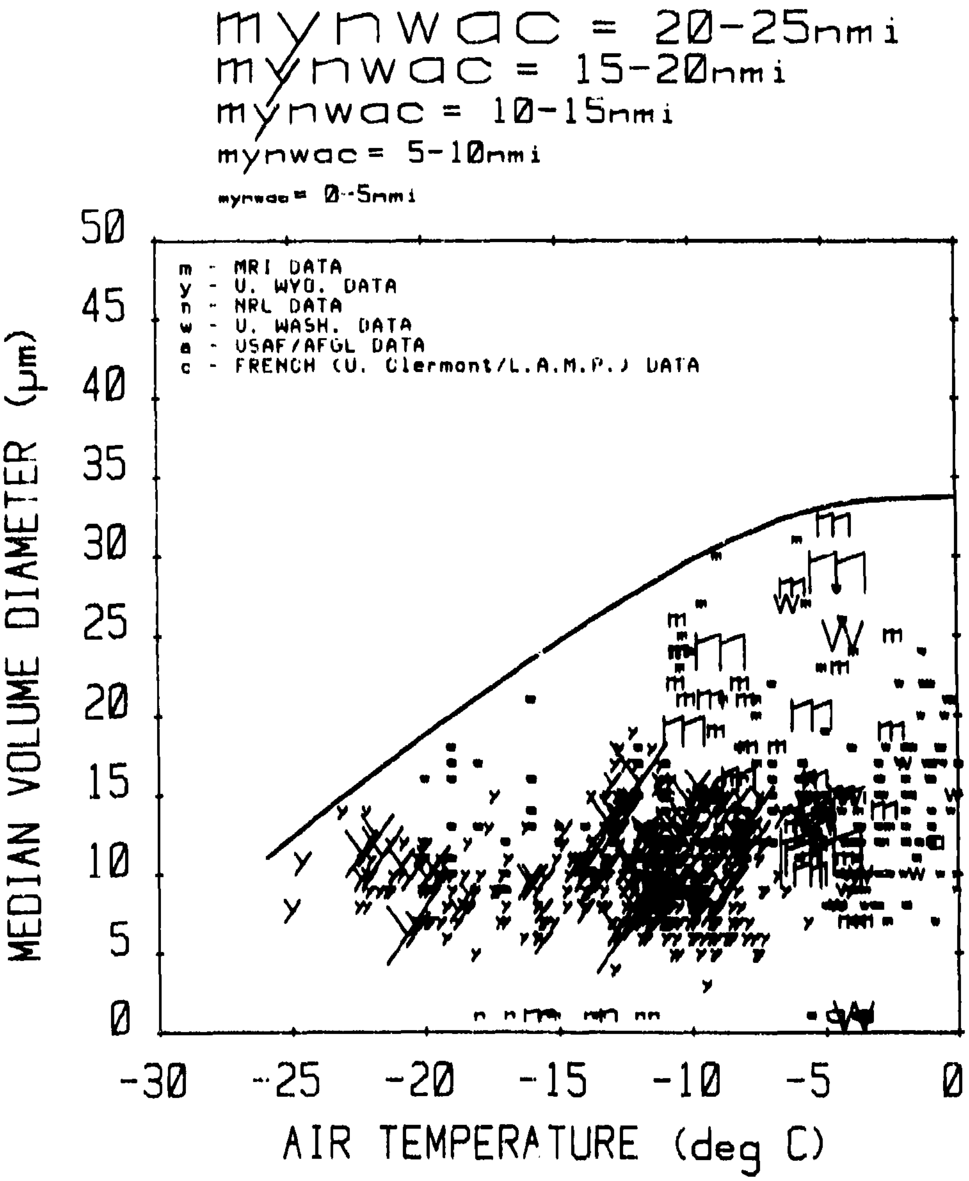

FIGURE 38. SCATTERPLOT OF MVD VS. OAT FOR MODERN DATA FROM SUPERCOOLED LAYER CLOUDS (St, Sc, Ns, As, Ac) UP TO 10,000 FT AGL. The various plotting symbols represent different data sources as indicated in the key. The size of each symbol is proportional to its statistical weight (i.e., the observed horizontal extent of the associated icing event) as shown by the scale above the graph. The center of each symbol corresponds to the average (and approximately constant) value of MVD and OAT observed during the icing event. The solid line bounding the data points represents the apparent upper limit to MVD as a function of temperature for supercooled layer clouds below 10,000 ft AGL. The position of the line at temperatures above −15°C is based on the maximum MVDs in the modern data only, but below −15°C the line is based on maximum MVDs from both the NACA and modern data sets. The data points plotted at 1 μm MVD are those for which the MVD values are actually unknown. A total of 2660 data miles is represented in this graph.

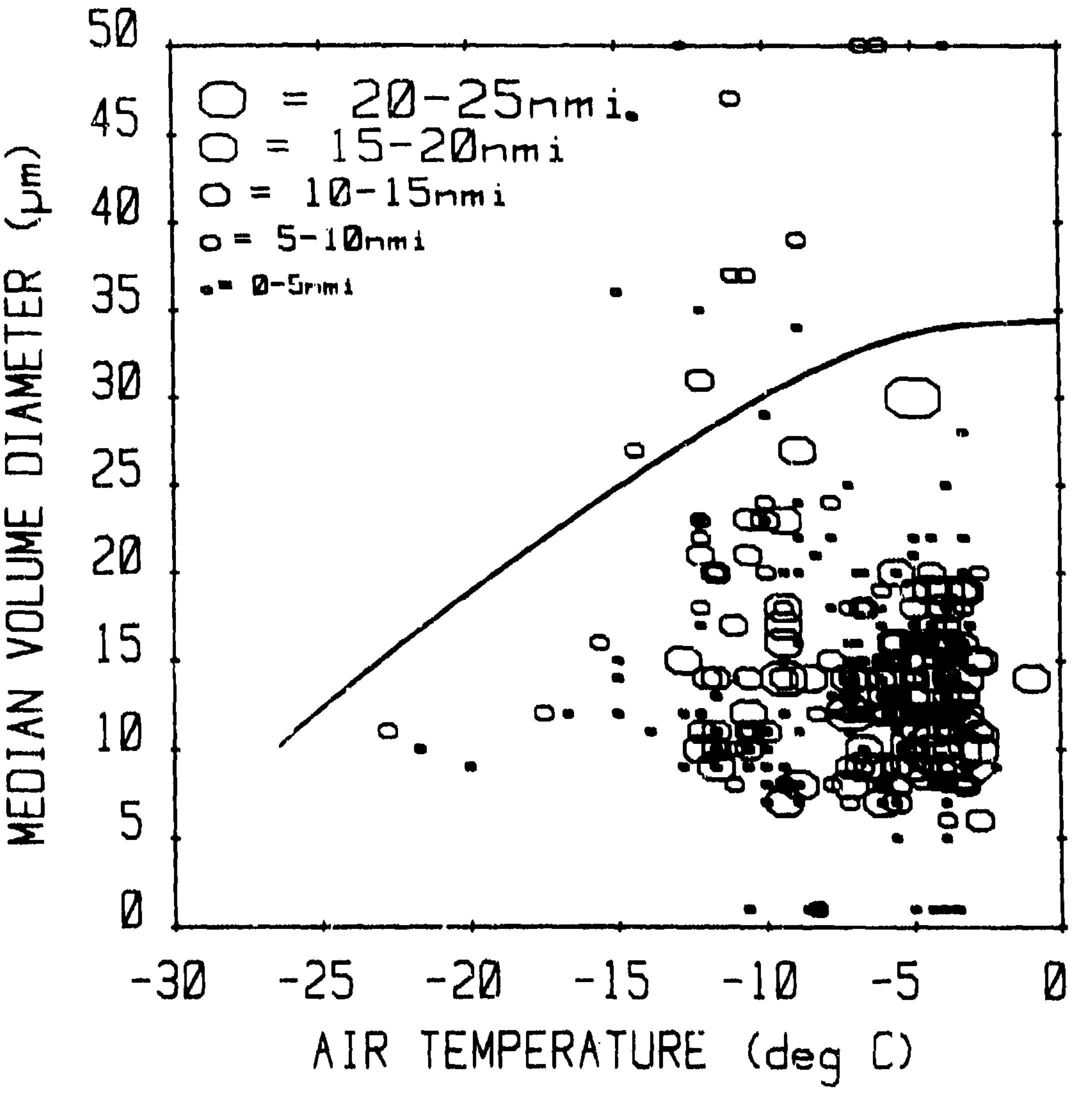

FIGURE 39. SCATTERPLOT OF MVD VS. OAT FOR NACA (1946-1950) DATA FROM SUPERCOOLED LAYER CLOUDS (St, Sc, Ns, As, Ac) UP TO 10,000 FT AGL. The size of each symbol is proportional to its statistical weight (i.e., the observed horizontal extent of the associated icing event) as shown by the scale above the graph. The center of each symbol corresponds to the average (and approximately constant) value of MVD and OAT observed during the icing event. The solid line through the data points represents the apparent upper limit to MVD as a function of temperature for supercooled layer clouds below 10,000 ft AGL. The position of the line at temperatures above -15°C is based on the maximum MVDs in the modern data only, but below -15°C the line is based on maximum MVDs from both the NACA and modern data sets. The data points plotted at 1 μm MVD are those for which the MVD values are actually unknown. A total of 2610 data miles is represented in this graph.

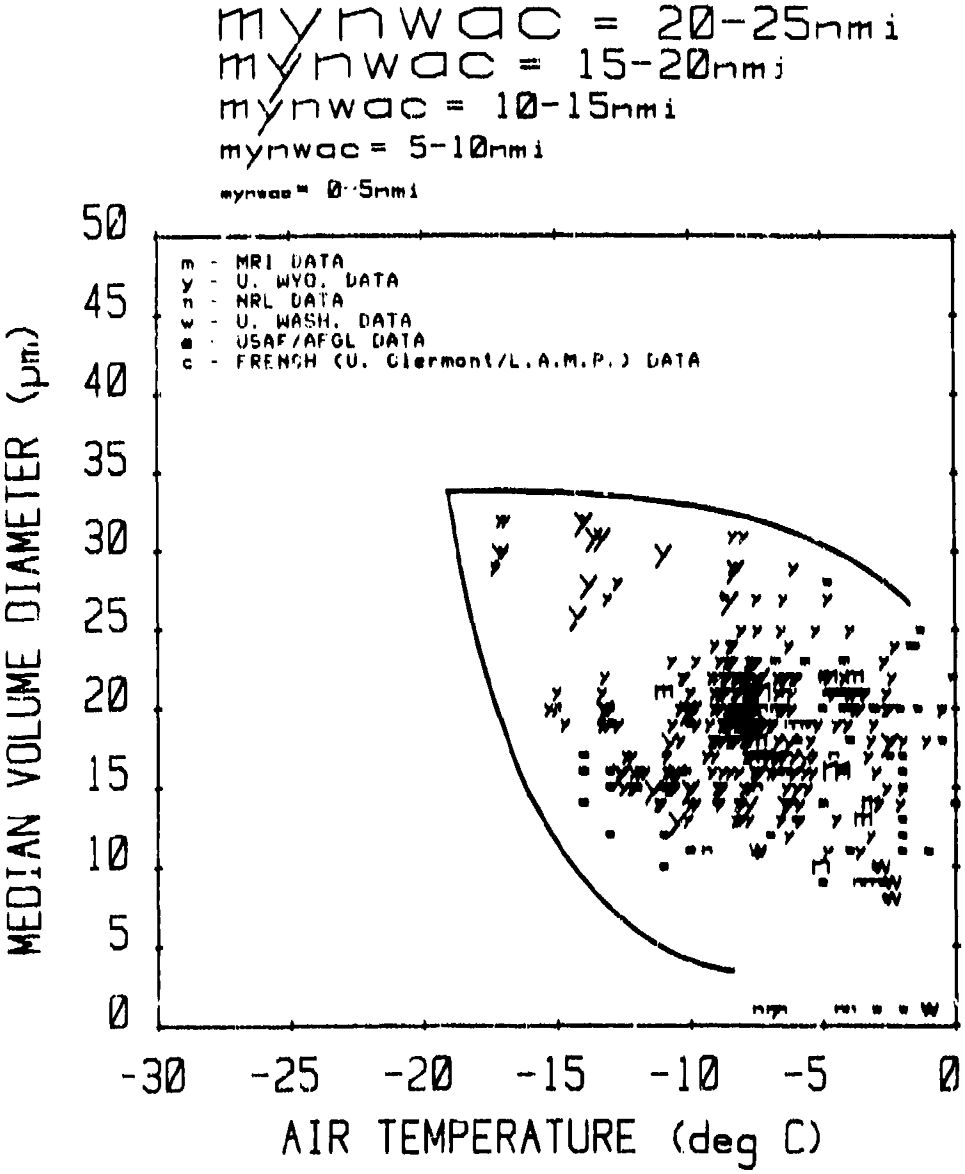

FIGURE 40. SCATTERPLOT OF MVD VS. OAT FOR MODERN DATA FROM SUPERCOOLED CONVECTIVE CLOUDS (Cu, Cb) UP TO 10,000 FT AGL. The various plotting symbols represent different data sources as indicated in the key. The size of each symbol is proportional to its statistical weight (i.e., the observed horizontal extent of the associated icing event) as shown by the scale above the graph. The center of each symbol corresponds to the average (and approximately constant) value of MVD and OAT observed during the icing event. The solid line bounding the data points represents the apparent upper and lower limit to MVD as a function of temperature for supercooled convective clouds below 10,000 ft AGL. The position of the line is based on extreme MVD values in both the NACA and modern data sets. The data points plotted at 1 μm MVD are those for which the MVD values are actually unknown. A total of 980 data miles is represented in this graph.

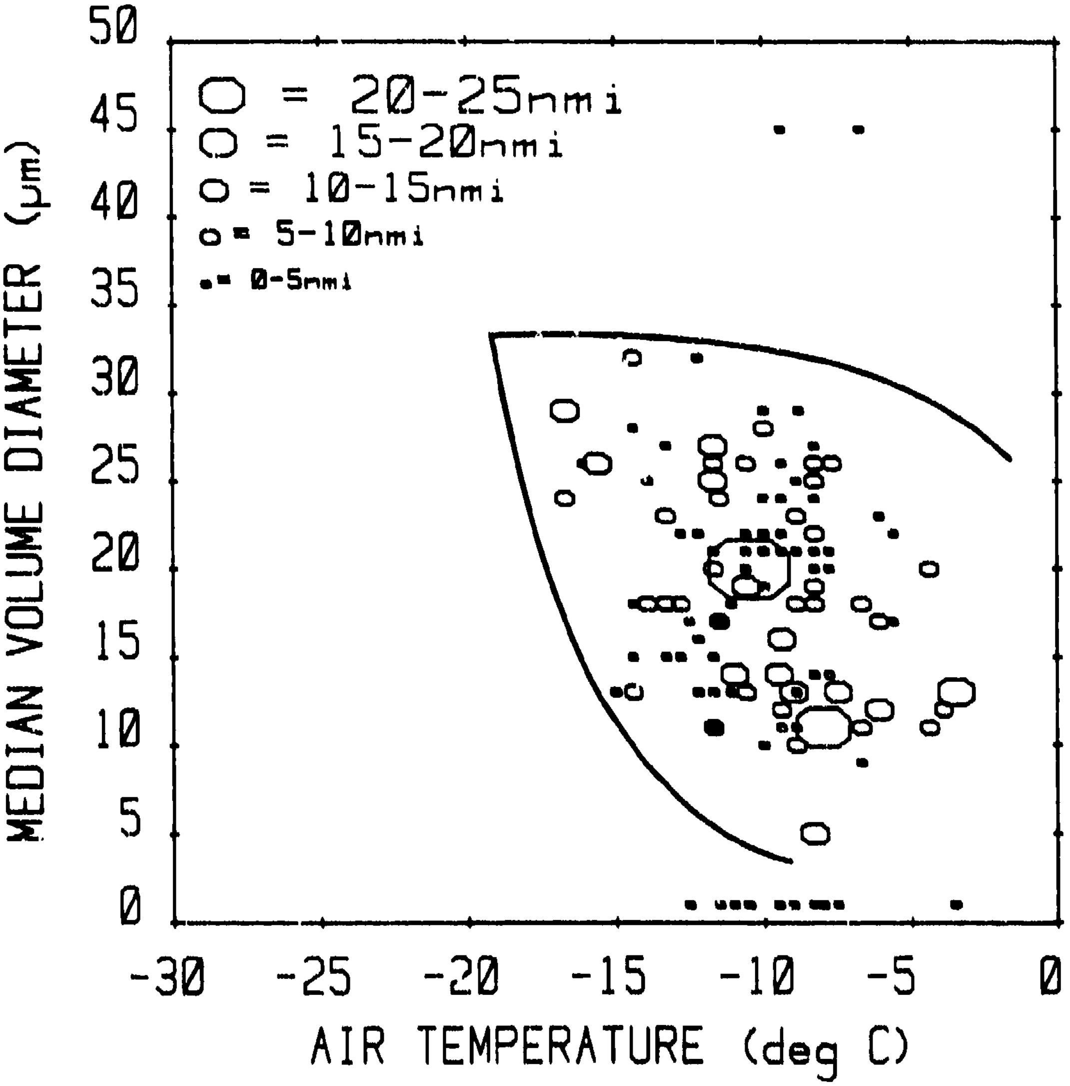

FIGURE 41. SCATTERPLOT OF MVD VS. OAT FOR NACA (1946-1950) DATA FROM SUPERCOOLED CONVECTIVE CLOUDS (Cu, Cb) UP TO 10,000 FT AGL. The size of each symbol is proportional to its statistical weight (i.e., the observed horizontal extent of the associated icing event) as shown by the scale above the graph. The center of each symbol corresponds to the average (and approximately constant) value of MVD and OAT observed during the icing event. The solid line bounding the data points represents the apparent upper and lower limit to MVD as a function of temperature for supercooled convective clouds below 10,000 ft AGL. The position of the line is based on extreme MVD values in both the NACA and modern data sets. The data points plotted at 1 μm MVD are those for which the MVD values are actually unknown. A total of 620 data miles is represented in this graph.

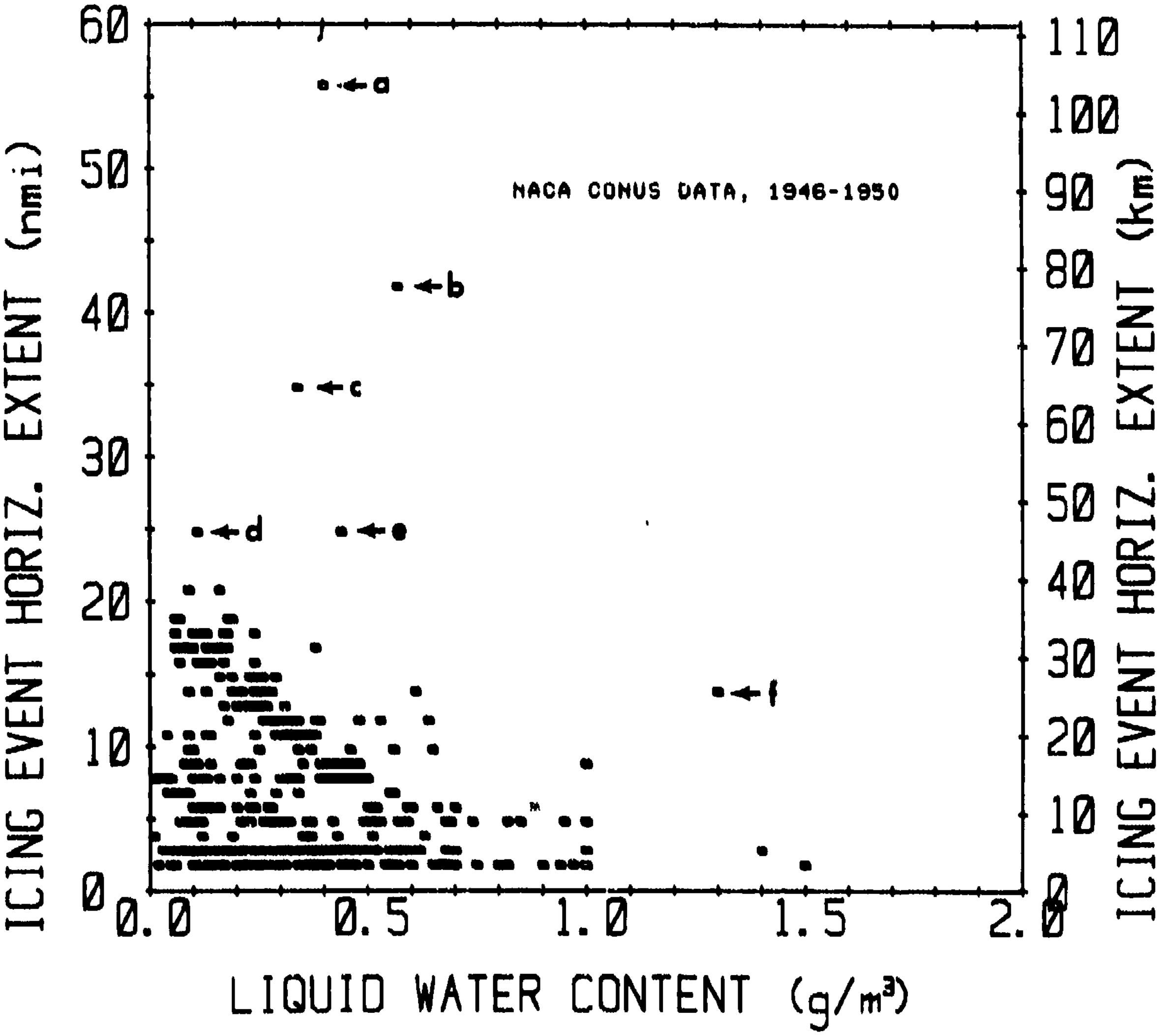

FIGURE 42. SCATTERPLOT OF NACA OBSERVED HORIZONTAL EXTENTS OF INDIVIDUAL ICING EVENTS VS. AVERAGE LWC OVER THE EVENT. Data are from all supercooled cloud types up to 10,000 ft AGL and for all observed cloud temperatures below 0°C. Extreme values, labeled a through f, are analysed individually in the HORIZONTAL EXTENT section of the text. A total of 3200 data miles is represented in this graph.

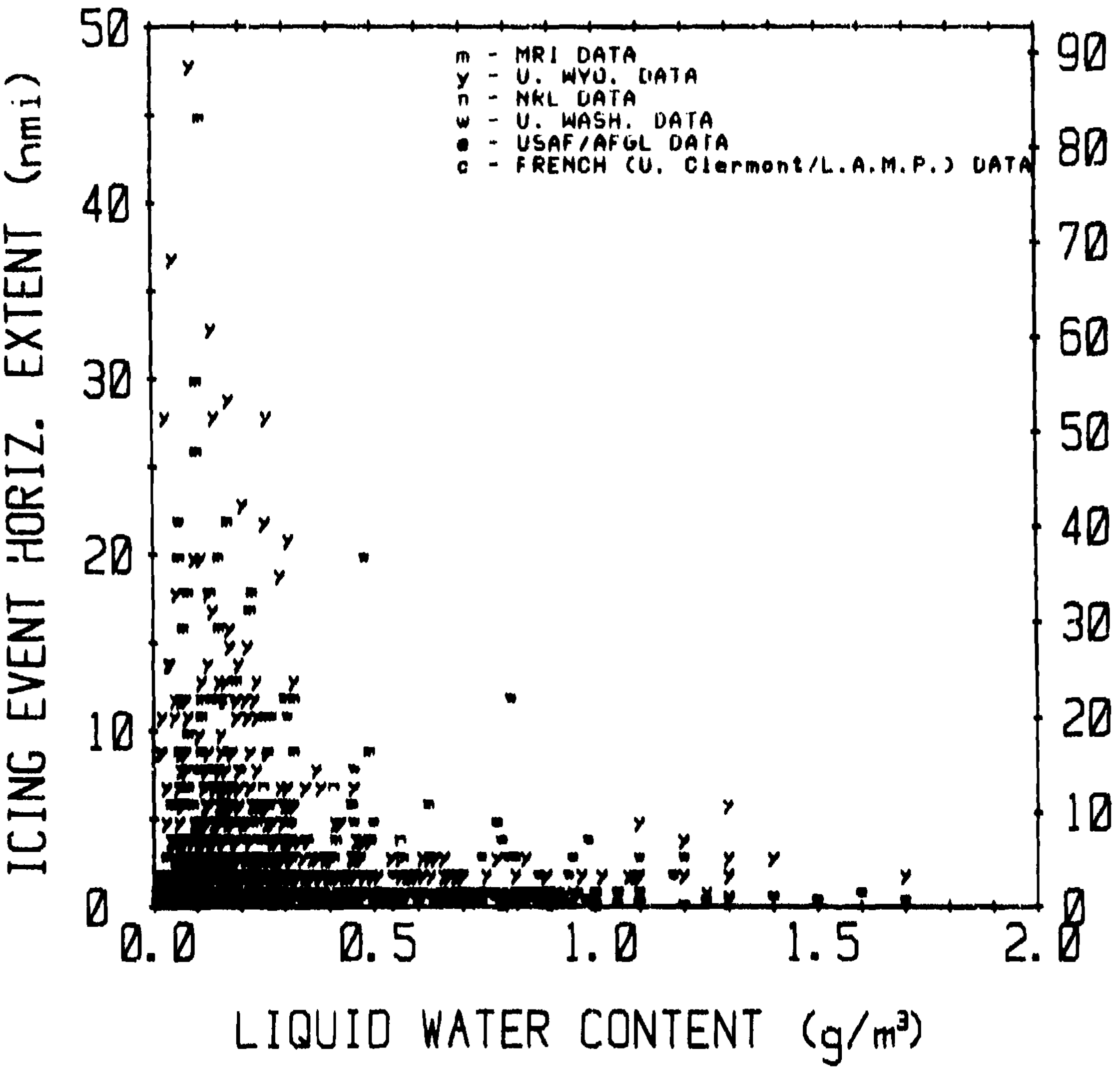

FIGURE 43. SCATTERPLOT OF MODERN OBSERVED HORIZONTAL EXTENTS OF INDIVIDUAL ICING EVENTS VS. AVERAGE LWC OVER THE EVENT. Data are from all supercooled cloud types below 10,000 ft AGL and for all observed cloud temperatures below 0°C. A total of 3645 data miles is represented in this graph. The different plotting symbols represent different data sources as indicated in the key.

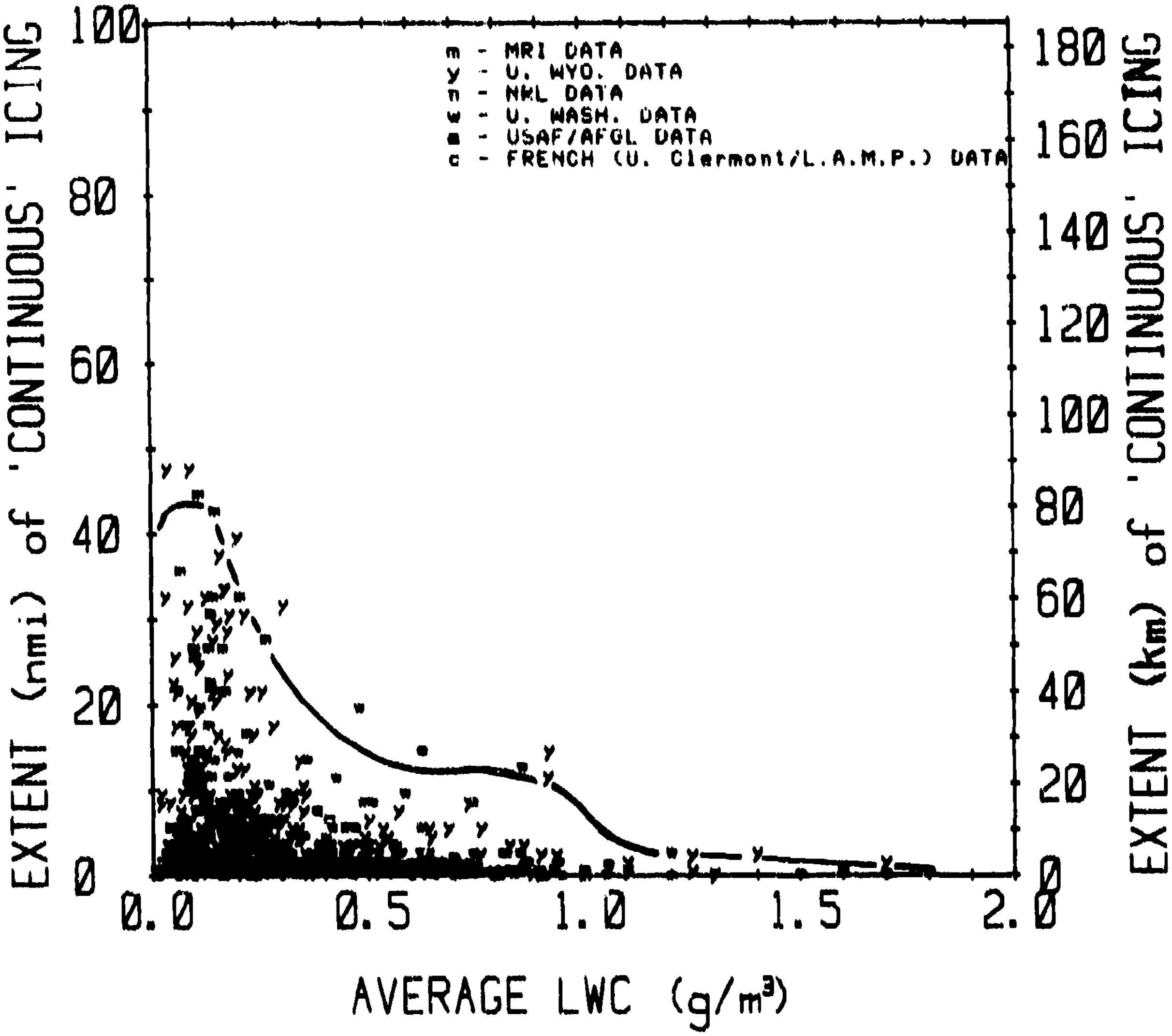

FIGURE 44. SCATTERPLOT OF MODERN OBSERVED HORIZONTAL EXTENTS OF ENTIRE ICING ENCOUNTERS VS. AVERAGE LWC OVER THE ENCOUNTER. In this figure an icing encounter is defined as a series of one or more icing events traversed consecutively until a cloud gap of 1 nmi or more is reached. The horizontal extent of the encounter is the sum of the horizontal extents of the component icing events but does not include the extent of permissible cloud gaps. Data are for all supercooled cloud types at altitudes up to 10,000 ft AGL and for all observed cloud temperatures below 0°C. A total of 3645 data miles is represented in this graph. The different plotting symbols represent different data sources as indicated in the key. The curved line is the 99th percentile of horizontal extent for these encounters as a function of average LWC.

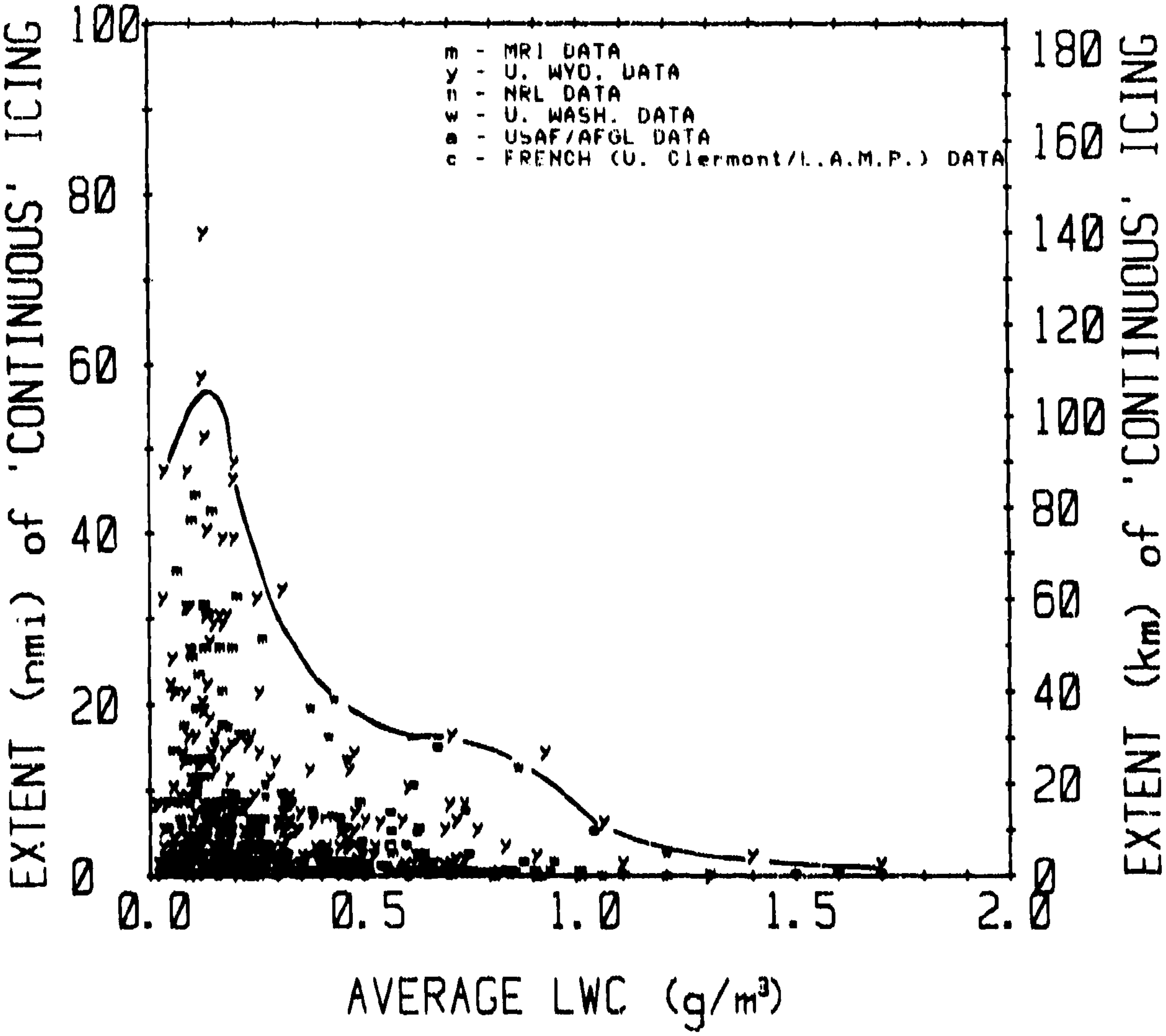

FIGURE 45. SCATTERPLOT OF MODERN OBSERVED HORIZONTAL EXTENTS OF ENTIRE ICING ENCOUNTERS VS. AVERAGE LWC OVER THE ENCOUNTER. In this figure an icing encounter is defined as a series of one or more icing events traversed consecutively until a cloud gap of 3 nmi or more is reached. The horizontal extent of the encounter is the sum of the horizontal extents of the component icing events but does not include the extent of permissible cloud gaps. Data are for all supercooled cloud types at altitudes up to 10,000 ft AGL and for all observed cloud temperatures below 0°C. A total of 3645 data miles is represented in this graph. The different plotting symbols represent different data sources as indicated in the key. The curved line is the 99th percentile of horizontal extent for these encounters as a function of average LWC.

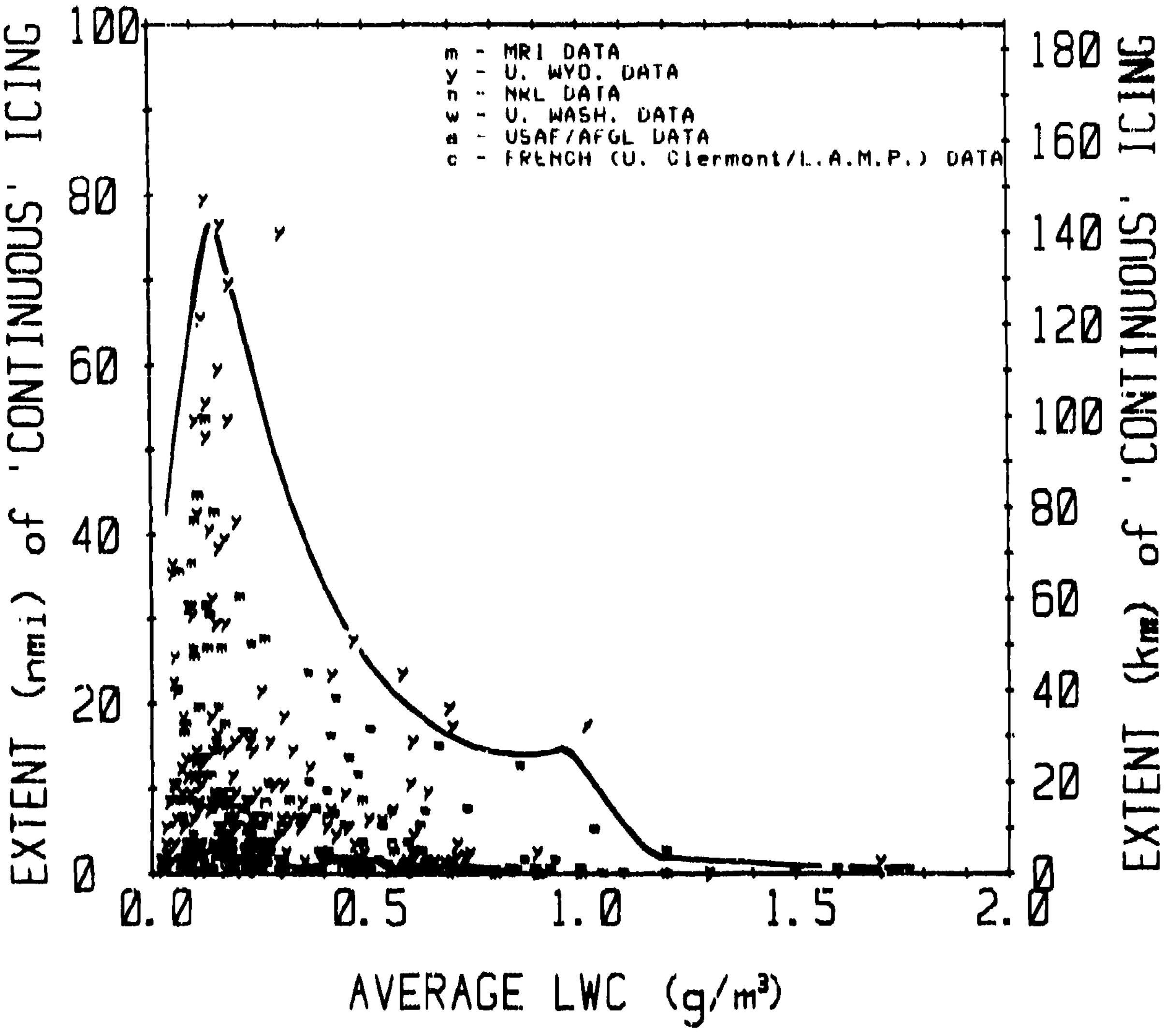

FIGURE 46. SCATTERPLOT OF MODERN OBSERVED HORIZONTAL EXTENTS OF ENTIRE ICING ENCOUNTERS VS. AVERAGE LWC OVER THE ENCOUNTER. In this figure an icing encounter is defined as a series of one or more icing events traversed consecutively until a cloud gap of 10 nmi or more is reached. The horizontal extent of the encounter is the sum of the horizontal extents of the component icing events but does not include the extent of permissible cloud gaps. Data are for all supercooled cloud types at altitudes up to 10,000 ft AGL and for all observed cloud temperatures below 0°C. A total of 3645 data miles is represented in this graph. The different plotting symbols represent different data sources as indicated in the key. The curved line is the 99th percentile of horizontal extent for these encounters as a function of average LWC.

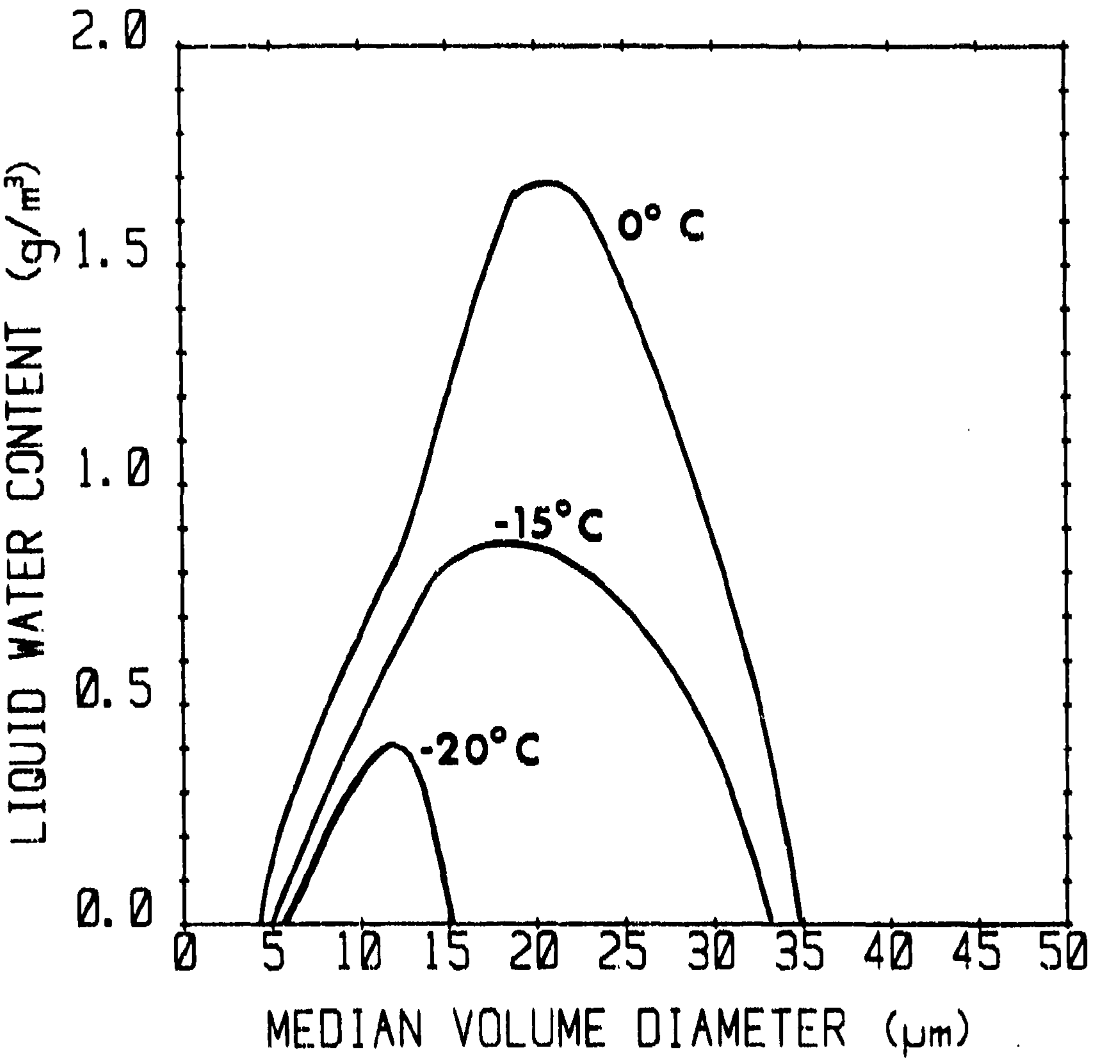

FIGURE 47. APPROXIMATE EXTREME VALUES OF LWC AND MVD COMBINATIONS OBSERVED IN SUPERCOOLED CLOUDS AT ALTITUDES UP TO 10,000 FT AGL. The curved lines here represent the approximate extreme values of LWC and MVD observed in any supercooled cloud icing event up to 10,000 ft AGL and up to the temperatures indicated.

APPENDIX A

THE NEW DATA BASE FOR SUPERCOOLED CLOUDS UP TO 10,000 FT AGL

This appendix contains the following information.

1. The DATA CODING SCHEME (Table A-1) -- a list of the items included in the Data Base and their arrangement on an 80-column punched card format. Each icing event requires two 80-column records (i.e., two punched cards, or their equivalent on digital magnetic tape). The first card or leading card, contains general information about the flight, the cloud or cloud system in which the measurements took place, and the associated weather situation. The second or "type 2" card contains specific data such as LWC, MVD, etc., averaged over a specific icing event defined by the "Rules for Defining Uniform Cloud Intervals" given in Table 1 of the text. Usually there is more than one identifiable icing event in a given cloud (or cloud system) in which case there are several "type 2" data cards following a common leading card. This group of cards, consisting of a leading card followed by one or more "type 2" data cards is referred to as a <u>data suite</u>.

2. The CODE SYMBOL EXPLANATION (Table A-2) -- an item-by-item explanation of the data entries, the selection of alphanumeric symbols that are allowable for coding the data into the card columns, and the format for entering the symbols into the assigned card columns. Examples are given in many cases for purposes of illustration.

3. The LIST OF CODE SYMBOLS (Table A-3).

4. The NEW SUPERCOOLED CLOUD DATA BASE (Table A-4) -- a complete listing of the coded Data Base as it exists at this writing. Additions are anticipated in the near future as more data, already in existence, are made available. These additions are expected to include data from clouds along cold fronts and in cyclonic storms, orographic clouds, Mt. Washington (New Hampshire) Observatory measurements, and some modern European airborne measurements.

TABLE A-1. DATA CODING SCHEME

First Card of each Data Suite

Item	Code	Card Columns
Mission Identifier (Flight No. or Cloud No.)	XXXXXXX	1-7
Date of Measurement	MMDDYY	8-13
Geographic Location	GG or GGG	14-16
Source of Data:		
Agency	LLL or LLLL	17-20
Reference (Publication ID or Report No.)	ZZ ------ ZZ	21-36
Altitude Reporting Convention:		
Scale used for data in this suite	A	37
Elevation of local surface (hundreds of feet, ASL)	FF or M	38-39
Cloud Information:		
Cloud type	CC or CCCc	40-43
Uniformity	G	44
Cloud base altitude (hundreds of feet)	BBB	45-47
Cloud base temperature (°C)	+WW.W	48-52
Cloud top altitude (hundreds of feet)	HHH	53-55
Cloud top temperature (°C)	-YY.Y	56-60
Weather Factors:		
Airmass type	aAa or Ma	61-63
Weather description	cc --- cc	64-79
Card 1 indicator	1	80

Second and Following Cards of each Data Suite

Item	Code	Card Columns
Time of Day for Event	hhmm+h	1-6
Icing Event Information:		
Event No	ee	7-8
Defining criterion	f	9
Duration (min.)	mm or .m	10-11
Distance in cloud (nmi)	dd or .d	12-13
Aircraft State during Event:		
Sampling maneuver	s	14
Airspeed (kt)	vvv	15-17
Altitude (ft)	aaaaa	18-22
Outside Air temperature (°C)	+tt.t	23-27
LWC Meter Data:		
LWC (g/m^3)	w.w or .ww	28-30
Probe ID	pp	31-32

TABLE A-1. DATA CODING SCHEME (Continued)

Item	Code	Card Columns
Droplet Probe Data:		
LWC (g/m^3)	w.w or .ww	33-35
MVD (μm)	uu	36-37
Max droplet diameter (μm)	zz	38-39
N (no/cc)	nnn	40-42
Probe ID	pp	43-44
Precipitation or Other Large Particle Probe Data:		
PMS 2D-C Probe concentration (Particles per liter)	n.n or .nn	45-47
PMS 2D-P Probe " " " " "	n.n or .nn	48-50
PMS 1D (OAP) Probe " " "	nn or .n	51-52
Other Ice Particle Counter "	nn or .n	53-54
Probe ID	p	55
Ice Meter Data:		
LWC (g/m^3)	w.w or .ww	56-58
Icing rate (g cm^{-2} $hour^{-1}$ or cm/hour)	i.ir or .iir	59-62
Probe ID	pp	63-64
Ice Meter Data (2nd probe, if used)		
LWC (g/m^3)	w.w or .ww	65-67
Icing rate (g cm^{-2} $hour^{-1}$ or cm/hour)	i.ir or .iir	68-71
Probe ID	pp	72-73
Weather Factors:		
Precip. during measurements (type & intensity)	q+ or qq	74-75
State of cloud particles	ssss	76-79
Card 2 Indicator	2	80

TABLE A-2. CODE SYMBOL EXPLANATION

CARD 1 --- COMMON INFORMATION

Mission Identifier (Flight No. or Cloud No.)

Up to 7 symbols are allowed to name or number the flight or cloud.

Date of Measurement

MM = month, DD = day, YY = year

Geographic Location

Use standard 2-letter symbols for states (e.g. KS = Kansas, IL = Illinois), preceded by a regional identifier (w = western, n = northern, s = southern, e = eastern, c = central, o = ocean or shoreline area). For more localized flights use standard 3-letter symbols for the nearest airfield (e.g. BUF = Buffalo, MKG = Muskegon, etc.). For flights localized over or along major lakes, use 2-letter symbols (e.g., LE = Lake Erie, LH = Lake Huron, etc.).

Source of Data: Agency

Use 3 or 4-letter symbols (e.g., NRL, NACA, UWY, MRI, etc.).

Source of Data: Reference

Up to 16 symbols are allowed for report numbers, literature citations.

Altitude Reporting Convention

Scale Used for Data in this Suite

This one letter symbol (P, S, or G) indicates whether the altitudes on this lead card and on the data cards associated with it are all given in terms of pressure altitude (P), altitude above sea level (S), or altitude above the local surface or ground level (G).

Elevation of Local Surface

This information is important for use in later data analyses where altitudes reported variously in pressure altitude, above ground level, etc. must be converted to a common scale. Elevations up to 9900 ft ASL may be reported.

TABLE A-2. CODE SYMBOL EXPLANATION (Continued)

For data from above mountainous terrain where elevation is variable or ambiguous, enter the letter "M" instead of a numerical value.

Cloud Information

Cloud Type

Up to 4 symbols are allowed to describe cloud types. Conventional notation (e.g., St for stratus, Sc for Strato Cumulus, etc.) may be used as well as unconventional notation such as NCSt for non-cyclonic stratus, or CySt for cyclonic stratus, for example, and OR = orographic, Ln = lenticular.

Cloud Uniformity

C = continuous, I = intermittent (scattered), B = broken, V = variable (Only continuous cloud parcels of about 1 nmi or more in horizontal extent are considered. Cloud parcels separated by short breaks constitute a "broken" cloud, but the cloud parcels selected for use as data are themselves continuous.)

Cloud Base/Top Altitudes

Expressed in hundreds of feet pressure altitude, above ground level or other as specified in column 37 of the first card of the suite.

Airmass Type

Use standard 2 or 3 letter designators such as cP, mPk, etc., or Mm for modified maritime, Mc for modified continental.

Weather Description

Up to 16 symbols are allowed to indicate the relevant weather conditions and the distance and direction of the sampled clouds from a particular feature such as a low pressure center, cold front, etc. (See Table A-3 for one- and two-letter code symbols).

TABLE A-2. CODE SYMBOL EXPLANATION (Continued)

CARD 2 - ICING EVENT DATA

Time of Day for Event

Enter the hour and minute at which the event began. For some of the old NACA data where measurements were conducted over an extended time period, it is necessary to use +h in columns 5-6 to indicate that the measurements occurred for h hours after the indicated starting time. The letter "Z" following an entry indicates Greenwich Mean Time; otherwise, the entry is in local standard time.

Event No.

A 1 or 2 digit number assigned by a data analyst to identify each icing event as a separate entity.

Defining Criterion

Individual icing events are identified and delimited according to the rules for defining uniform cloud intervals given in Table 1 of the text. A code letter is entered in column 9 for icing events defined by one of the level flight criteria, (e.g., "C" indicates that the icing event in question occurred in level flight from the end of the previous event or from the time the aircraft entered the cloud until the outside air temperature rose above 0°C). For vertical profile flights, the code letter "P" specifies that rules for profile data are used to define the icing event in question.

Duration

The time (to the nearest tenth or whole minute) the event lasted. Applies only to events occurring during level flight. For profile flights enter "N" in column 11.

Distance in Cloud

The approximate distance (in nautical miles) traveled by the aircraft during the icing event. Note that the approximate airspeed is required to compute this value. Enter "N" in column 13 for profile flights. Use only for distance flown during actual measurements, not for estimated overall cloud horizontal extent.

TABLE A-2. CODE SYMBOL EXPLANATION (Continued)

Aircraft State during Event

Sampling Maneuver

L = level flight, S = spiral profile, P = slant profile, V = variable

Airspeed

Enter at least an approximate, average, true airspeed (in knots).

Altitude

Expressed in feet pressure altitude, above ground level, or other as specified in column 37 of the first card of the suite, during the event. For use in salvaging NACA data where altitude range extended more than ±500 ft, enter llluu to indicate that altitude was greatly variable between lower (lll) and upper (uu) limits expressed in hundreds and thousands of feet, respectively. E.g., data ranging over altitudes from 11,800 to 14,600 ft would be entered as 11815.

Outside Air Temperature

Enter average temperature during event, including the + or - sign and the decimal. To salvage variable altitude (and temperature) NACA data, enter Vlluu in columns 23-27 where V indicates a variable altitude case, and ll and uu are the min and max temperatures (both assumed negative) to the nearest whole degrees Celsius.

LWC Meter Data

This section would normally be used for data obtained from a Johnson-Williams or similar hot wire type of LWC sensor, or from a heated sample dewpoint sensor measurement where no droplet size information is available and an accretion of icing is not necessary for the measurement. Decimal point must be included.

Probe ID

JW = Johnson-Williams, CS = C.S.I.R.O., DP = dewpoint, or others as needed.

Droplet Probe Data

This section is normally used for data from PMS probes, the rotating multicylinders, or other probes which yield droplet or ice particle size information. LWC data is entered as specified above for LWC meters.

TABLE A-2. CODE SYMBOL EXPLANATION (Continued)

MVD (μm)

Enter the indicated median volume diameter (mass median diameter) in microns.

Maximum Droplet Diameter

For the icing cylinder technique this information usually comes from the fixed diameter cylinder covered with sensitized blueprint paper. For droplet counter probes the maximum droplet diameter is defined to be that diameter which includes 95% of all LWC indicated, assuming that the probe(s) in use are sensitive to the largest droplets actually present in the cloud. Rain, drizzle, snow and other frozen particles are not included in this category.

Droplet Number Concentration, N

Enter the indicated number (per cm^3) of droplets in all measured sizes. For the precipitation or large particle probes the entries are in number of particles per liter to the nearest tenth or whole number. For the PMS-ID (OAP) probe, if the concentration exceeds 100 per liter, then use "1c," "2c," etc., to indicate the concentration to the nearest 100, 200, etc., per liter.

Probe ID

A = ASSP, F = FSSP, R = rotating multicylinders, FC = fixed diameter cylinder with sensitized blueprint paper, RF = combination of R and FC. RI = rotating multicylinder data adjusted for exposure for indicated by recording ice rate meters. W = University of Washington (Turner-Radke) Optical Ice Particle Counter.

Ice Meter Data

This section is normally used for data from ice accretion sensors without droplet size information. LWC, if deducible from the probe, is entered as specified above for LWC meters.

Icing Rate

This information is not often included in the data reports but it is a desirable piece of information. Enter the rate to the nearest tenth, accuracy permitting. Following the numerical entry, enter the letter "G" if rate is in g cm^{-2}/hour, or "C" if rate is in cm/hour, or "I" if the rate is in inches/hour.

Probe ID

RO = Rosemount model 871, 10 = Leigh (Mark 10), 12 = Leigh (Mark 12), RM = rotating multicylinders, RD = rotating disk, PA = probe based on pressure sensitive array of holes.

Weather Factors

Precipitation During Measurements

This item refers to the occurrence of precipitation in or from the cloud, preferably as observed from the aircraft. Observations from the ground are allowable only if precipitation is observed. Absence of precipitation at the ground is no indicator that precipitation is lacking in, or just below the cloud, since the precipitation may be evaporating before it reaches the ground. Conventional reporting symbols are to be used, such as S- = light snow, S = moderate snow, S+ = heavy snow, etc.

State of Cloud Particles

Columns 76-79 may be used for qualitative observations on the state (liquid or frozen) of the cloud. Symbols may be mS = mostly snow, mW = mostly water, mI = mostly ice, mW+I = mostly water with some ice, etc.

General Information

For all cases, enter the letter "U" when the value for an entry is unknown. If the entry category does not apply, e.g., columns 10-11 and 12-13 for profile flights, enter "N" for not applicable. An asterisk (*) preceding an entry denotes an estimated entry. The letter "X" indicates that a value was supplied for the entry but that it was obviously an incorrect value due to miscalculation or to instrument mal-performance. The lower case letter "m" indicates a missing value, usually because the required computations or averages have not yet been performed even though the data are available to the analyst.

TABLE A-3. LIST OF CODE SYMBOLS
(Use separately or in combination)

A = Ahead of
Bt = Between
C = Convergence
Cf = Cold front
Cl = Cloud(s)
Cv = Convection
Cy = Cyclone, cyclonic flow
D = Dense
Dy = Dry
d = Due to
E = East
Ey = Easterly
F = Following
Fl = Flight level
Fm = Fast moving
Fw = Fair weather
g = General(ly)
Hc = High pressure center
Hp = High pressure region
I = Inversion
Inn = Inversion at flight level nn
L = Layer
Lc = Low pressure center
Lp = Low pressure region
Le = Lake effect
M = Moderate, medium
N = North
Ny = Northerly
O = Over
Oc = Occluded
Of = Occluded front
Or = Orographic
Ot = Outside of
P = Precipitation
Pg = Pressure gradient
P = Possibly, possible
R = Ridge
Rb = Rainband
S = South
Sf = Stationary front
Sm = Slow moving
Sr = Strong, deep
St = Stationary
Su = Surface
Sy = Southerly
s = Some
T = Thin
Tb = Turbulence
Tr = Trough
Ua = Unstable air
Ud = Updraft
Uf = Upslope flow
Up = Upper, upper level, upper part
u = Usually
W = West
Wf = Warm front
Wi = Wind(s)
Wk = Weak
Wv = Wave
Wy = Westerly
* = Estimated value follows
→ = To, moving toward
? = Amount or type uncertain
.5, 1, 2,... = Numeral indicating distance in hundreds of nmi

PRECIPITATION CODE SYMBOLS

R = Rain
S = Snow
ZR = Freezing Rain
L = Drizzle
ZL = Freezing Drizzle
E = Sleet
A = Hail
SP = Snow Pellets
T = Thunderstorm

CLOUD NAMES

St = Stratus
Sc = Stratocumulus
Ns = Nimbostratus
As = Altostratus
Ac = Altocumulus
Cu = Cumulus
Cb = Cumulonimbus

TABLE A-3. LIST OF CODE SYMBOLS (Continued)

LOCATION IDENTIFIER CODE

Symbol	Location
AZ	Arizona
AKO	Akron, CO
AOO	Altoona, PA
AST	Astoria, OR
BLU	Blue Canyon, CA
CA	California
CO	Colorado
CAK	Akron, OH
CDR	Chadron, NE
CLE	Cleveland, OH
CYS	Cheyenne, WY
DDC	Dodge City, KS
DEN	Denver, CO
DET	Detroit, MI
DHT	Dalhart, TX
DLH	Duluth, MN
EAU	Eau Claire, WI
FLG	Flagstaff, AZ
GCK	Garden City, KS
GLD	Goodland, KS
GLL	Greeley, CO
GSH	Goshen, IN
HGR	Hagerstown, MD
HQM	Hoquiam, WA
HTS	Huntington, WV
IA	Iowa
ID	Idaho
IL	Illinois
IN	Indiana
IAD	Dulles Int'l Airport, VA
JST	Johnstown, PA
KS	Kansas
LA	Louisiana
LE	Lake Erie
LH	Lake Huron
LM	Lake Michigan
LS	Lake Superior
LAN	Lansing, MI
LBF	North Platte, NE
LTA	Lake Tahoe, CA
LHX	La Junta, CO
MA	Massachusetts
MD	Maryland
ME	Maine
MI	Michigan
MN	Minnesota
MO	Missouri
MT	Montana
MCC	McClellan AFB, CA
MCK	McCook, NE
MEM	Memphis, TN
MFD	Mansfield, OH
MFR	Medford, OR
MKG	Muskegon, MI
MRY	Monterey, CA
MSP	Minneapolis-St. Paul, MN
NC	North Carolina
NE, NB	Nebraska
NJ	New Jersey
NM	New Mexico
NV	Nevada
NY	New York
OH	Ohio
OR	Oregon
OLM	Olympia, WA
OMA	Omaha, NE
ORF	Norfolk, VA
PA	Pennsylvania
PAE	Everett Paine Field, WA
PDX	Portland, OR
PIH	Pocatello, ID
QUE	Quebec, Canada
RDD	Redding, CA
ROA	Roanoke, VA
RWL	Rawlins, WY

TABLE A-3. LIST OF CODE SYMBOLS (Continued)

LOCATION IDENTIFIER CODE

Symbol	Location	Symbol	Location
SP	Spain	VA	Virginia
SCQ	Santiago, Spain	VLL	Valladolid, Spain
SEA	Seattle, WA	VWV	Waterville, OH
SMF	Sacramento, CA		
SNY	Sidney, NE	WA	Washington
SYR	Syracuse, NY	WI	Wisconsin
		WV	West Virginia
TN	Tennessee	WY	Wyoming
TX	Texas	W72	(offshore, VA,NC)
TVC	Traverse City, MI		
		237	(offshore, WA)
UT	Utah		

TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE
Data File No. 1

```
     ---------------------------Card Column No.-------------------------------------------
              11111111112222222222333333333344444444445555555555666666666677777777778
     12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                              Card (Record) Contents
  1 F26     032146wNVNACANACA TN-1393     P40Ac  BU  U      U  U     #cPWklp          1
  2 1600+16 H 717L13910650-8.6 N  N .3814U U  R  N  N N N N N   N  N N    N N SWmW    2
  3 1700-1 6H 1 2L13910650 -8.6N  N .7 U U U  R  N  N N N N N   N  N N    N N SWmW    2
  4 F27A    03224GuORNACA NACA TN-1393    PU Cu  BU  U      U  U     MmP#0-3FFmCf     1
  5 14:30+ 7H 2 4L1398650 -12.5N  N .3617U U  R  N  N N N N N   N  N N   # N N W      2
  6 14:45- 7H 1 2L1398650 -12.5N  N .7 U U U  R  N  N N N N N   N  N N   # N N W      2
  7 F27B    032246uORNACA NACA TN-1393    PU Su  BU  U      U  U     MmP#0-3FFmCf     1
  8 15:15+ 8H 3 7L1396900  -8.3N  N .06U U U  R  N  N N N N N   N  N N    N N S mS    2
  9 15:35- 8H 1 2L1396900  -8.3N  N .2 U U U  R  N  N N N N N   N  N N    N N S mS    2
 10 F28A    032446cURNACA NACA TN-1393    P40CuCbBU  U      U  U     MmP#3AHc         1
 11 11:15+ 9H 512V139 6678V0811N  N .4814U U  R  N  N N N N N   N  N N    N N U mW    2
 12 12:00- 9H 1 2V139 6678V0811N  N .8 U U U  R  N  N N N N N   N  N N    N N U mW    2
 13 F28B    032446uIDNACA NACA TN-1393    PU CuCbB9U U      U  U     MmP3-5FFmCf      1
 14 12:55 10H 3 7L13910900-16.4N  N .2 16U U  R  N  N N N N N   N  N N    N N S WS    2
 15 F28C    032446uIDNACA NACA TN-1393    PU Cb  IU  U      U  U     MmP3-5FFmCf      1
 16 15:30 11H 3 7L13913200-21. N  N .4 U U U  R  N  N N N N N   N  N N    N N S WS    2
 17 F30     032746eURNACA NACA TN-1393    P40A#AcCU  U      U  U     MmP0SmCf         1
 18 16:00 13H1 2 V139 8012V0309N  N .0508U U  R  N  N N N N N   N  N N    N N S mS    2
 19 F31A    032946oURNACA NACA TN-1393    P40Cu  UU  U      U  U     MmP4FSmCf        1
 20 1030+114H 614V139 7190V0913N  N .6114U U  R  N  N N N N N   N  N N    N N U mW    2
 21 1130-114H1 2 V139 7190V0913N  N .9 U U U  R  N  N N N N N   N  N N    N N U mW    2
 22 F31B    032946uIDNACA NACA TN-1393    PU CbA#UU  U      U  U     MmP#1-2FSmCf     1
 23 1550+215H 3 7V139 9013V1019N  N .1811U U  R  N  N N N N N   N  N N    N N S mS    2
 24 1800-215H1 2 V139 9013V1019N  N .5 U U U  R  N  N N N N N   N  N N    N N S mS    2
 25 F32A    033046uUTNACA NACA TN-1393    PU Cb  UU  U      U  U     MmP#0-1ASmCf     1
 26 11:03 16H1 2 L13912500-9.4 N  N .6 28U U  R  N  N N N N N   N  N N    N N U mW    2
 27 F32B    033046eCANACA NACA TN-1393    PM Cb  UU  U      U  U     MmP#0-2FSmCf     1
 28 13:17 17H1 2 L13911100-13.9N  N .3 45U U  R  N  N N N N N   N  N N    N N S mS    2
 29 F32C    033046oCANACA NACA TN-1393    PU CuCbBU  U      U  U     mP #1-2FSmCf     1
 30 1340+118H 512V139 7898V0711N  N .6413U U  R  N  N N N N N   N  N N    N N U mW    2
 31 1430-118H1 2 V139 7898V0711N  N .9 U U U  R  N  N N N N N   N  N N    N N U mW    2
 32 F33     033146oCANACA NACA TN-1393    P0 CuCbVU  U      U  U     mP WkHp          1
 33 1100+319H1125V139 5712V0214N  N .4411U U  R  N  N N N N N   N  N N    N N S WS    2
 34 1345-319H1 2 V139 5712V0214N  N 1.0U U U  R  N  N N N N N   N  N N    N N S WS    2
 35 F34     040146oCANACA NACA TN-1393    P 0CuCb142 +1.5 U  U     mP WkPg in Hp    1
 36 1510+220H 512V139 6310V0312 N N .5313 U U R  N  N  NN N  N   N  N  N  N N S WS    2
 37 1640-220H 1 2V139 6310V0312 N N .8  U U U R  N  N  NN N  N   N  N  N  N N S WS    2
 38 F35     040346nCANACA NACA TN-1393    P MAc  U U U      U  U     mP WkPg in Hp    1
 39 16:22+21H 3 7V139 9112V0913 N N .1313 U U R  N  N  NN N  N   N  N  N  N N S WS    2
 40 16:47-21H 1 2V139 9112V0913 N N .3  U U U R  N  N  NN N  N   N  N  N  N N S WS    2
 41 F36     040546wURNACA NACA TN-1393    P 0S1bcC U U      U  U     mP #0-2FWkCf     1
 42 17:25+22H 4 9L139 4750 -3.6 N N .4812 U U R  N  N  NN N  N   N  N  N  N N U W     2
 43 17:57-22H 1 2L139 4750 -3.6 N N .7  U U U R  N  N  NN N  N   N  N  N  N N U W     2
 44 F37     040646wORNACA NACA TN-1393    P 0Sc  BU  U      U  U     mP Hp            1
 45 1243+123H4 8 V139 4658V0407 N N .2213 U U R  N  N  NN N  N   N  N  N  N N U  U    2
 46 1330-123H 1 2V139 4658V0407 N N .4 13 U U R  N  N  NN N  N   N  N  N  N N U W     2
 47 F38A    040740nNVNACA NACA TN-1393    P UCu  I U U      U  U     MmPWkLp,0Pg      1
 48 1200+524H9 21V13911815V0816 N N .6117 U U R  N  N  NN N  N   N  N  N  N N U mW    2
 49 1650-524H 1 2V13911815V0816 N N 1.1 U U U R  N  N  NN N  N   N  N  N  N N U mW    2
 50 F38B    040746sWYNACA NACA TN-1393    P MCbA#I U U      U  U     oP 0Pg#3FFmCf    1
 51 1200+525H1023V13911815V0816 N N .1112 U U R  N  N  NN N  N   N  N  N  N N S mS    2
 52 1650-525H 1 2V13911815V0816 N N .2  U U U R  N  N  NN N  N   N  N  N  N N S mS    2
 53 F39     040846CYSNACANACA TN-1393     P50btBcC U U      U  U     oP Uf#1FSf       1
 54 1256+326H1535V139 8511V0305 N N .3410 U U R  N  N  NN N  N   N  N  N  N N U W     2
 55 1540-326H 1 2V139 8511V0305 N N .5  U U U R  N  N  NN N  N   N  N  N  N N U W     2
 56 F40     040946wNENACA NACA TN-1393    P45bt  C U U      U  U     oP #2-3AWkCf     1
 57 0945+127H 717L139 9150 -4.4 N N .0819 U U R  N  N  NN N  N   N  N  N  N N S WS    2
 58 1055-127H 1 2L139 9150 -4.4 N N .2  U U U R  N  N  NN N  N   N  N  N  N N S WS    2

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     12345678901234567890123456789012345678901234567890123456789012345678901234567890
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TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 2

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Rec.
No.                                   Card (Record) Contents
  1 F43A   041446nUTNACA NACA TN-1393   P MSc  B U U     U   U     cP #1-3NW#FLc       1
  2 1040+230H 3 7L13910700 -3.0 N N .1508 U U R  N   N   NN N N   N   N   N   N   N U W   2
  3 1222-230H 1 2L13910700 -3.0 N N .3 08 U U R  N   N   NN N N   N   N   N   N   N U W   2
  4 F43B   041446CYSNACA NACA TN-1393   P50St  C U U     U   U     cP #2-3FFmCf        1
  5 1222+231H2456L13910600 -4.0 N N .4010 U U R  N   N   NN N N   N   N   N   N   N U W   2
  6 1430-231H 1 2L13910600 -4.0 N N .6  U U U R  N   N   NN N N   N   N   N   N   N U W   2
  7 F44A   041546eCONACA NACA TN-1393   P40AcAsl U U     U   U     cP Hp               1
  8 10:00+32H 1 2V139 9912V0506 N N .0520 U U R  N   N   NN N N   N   N   N   N   N S WS  2
  9 10:20-32H 1 2V139 9912V0506 N N .1 20 U U R  N   N   NN N N   N   N   N   N   N S WS  2
 10 F46    042546oURNACA NACA TN-1393   P 0As  C U U     U   U     mP #0-2FCf          1
 11 1600+134H1125V139 8911V0208 N N .1130 U U R  N   N   NN N N   N   N   N   N   N L mW  2
 12 1723-134H 1 2V139 8911V0208 N N .3  U U U R  N   N   NN N N   N   N   N   N   N L mW  2
 13 F47    042646wURNACA NACA TN-1393   P 0CuScB U U     U   U     mP  Hp              1
 14 1230+235H 717V139 5065V0205 N N .3813 U U R  N   N   NN N N   N   N   N   N   N U mW  2
 15 1430-235H 1 2V139 5065V0205 N N .6  U U U R  N   N   NN N N   N   N   N   N   N U mW  2
 16 F48A   042846wURNACA NACA TN-1393   P 0As  C U U     U   U     mP Hp               1
 17 1050+336H 717V139 8313V0107 N N .0510 U U R  N   N   NN N N   N   N   N   N   N S mS  2
 18 1400-336H 1 2V139 8313V0107 N N .2 10 U U R  N   N   NN N N   N   N   N   N   N S mS  2
 19 F48B   042846wURNACA NACA TN-1393   P 0AsAcB U U     U   U     mP Hp               1
 20 1620+237H1228V13910213V0409 N N .1513 U U R  N   N   NN N N   N   N   N   N   N S SW  2
 21 1800-237H 1 2V13910213V0409 N N .4  U U U R  N   N   NN N N   N   N   N   N   N S SW  2
 22 F49A   042946wURNACA NACA TN-1393   P 0CuCbl U U     U   U     mP #2-3FFmCf        1
 23 1105+138H 4 8V139 7694V0814 N N .3524 U U R  N   N   NN N N   N   N   N   N   N S WS  2
 24 1145-138H 1 2V139 7694V0814 N N .7  U U U R  N   N   NN N N   N   N   N   N   N S WS  2
 25 11:53 39P 1 2S13910400-15.0 N N 1.817 U U R  N   N   NN N N   N   N   N   N   N S WS  2
 26 11:54 39P 1 2S13910800-15.6 N N 1.419 U U R  N   N   NN N N   N   N   N   N   N S WS  2
 27 11:58 39P 1 2S13911000-16.1 N N 1.020 U U R  N   N   NN N N   N   N   N   N   N S WS  2
 28 12:04 39P 2 4S13911600-17.5 N N .7 21 U U R  N   N   NN N N   N   N   N   N   N S WS  2
 29 12:05 39P 1 2S13912500-18.9 N N .2 18 U U R  N   N   NN N N   N   N   N   N   N S WS  2
 30 13:15+41H 4 9V139 7994V1013 N N 1.017 U U R  N   N   NN N N   N   N   N   N     S WS  2
 31 13:45-41H 1 2V139 7994V1013 N N 1.517 U U R  N   N   NN N N   N   N   N   N   N S WS  2
 32 1555+242H1842V139 6495V0714 N N .5720 U U R  N   N   NN N N   N   N   N   N   N S WS  2
 33 1800-242H 1 2V139 6495V0714 N N 1.5  U U U R  N   N   NN N N   N   N   N   N   N S WS  2
 34 F49B   042946wURNACA NACA TN-1393   P 0Sc  C U U     U   U     mP #2-3FFmCf        1
 35 12:45+40H 512L139 8200-10.6 N N .1823 U U R  N   N   NN N N   N   N   N   N   N S WS  2
 36 13:15-40H 1 2L139 8200-10.6 N N .3  U U U R  N   N   NN N N   N   N   N   N   N S WS  2
 37 F72     011847SEANACANACA TN-1424     P0UNs   UU  U     U   U    mP C1UGuCf          1
 38 14:15 1 H 1 2L1477100 -3.3  N N .2028U U   R  N   N   NN N N   N   N   N   N     N U U  2
 39 14:20 1 H 1 3L1517100 -3.3  N N .1222U U   R  N   N   NN N N   N   N   N   N     N U U  2
 40 F78     020247SEANACANACA TN-1424     P00 Cu UU   U     U   U    mP Us#3FLc          1
 41 10:53 2 H 1 2L1436800 -11.7 N N .3413U U   R  N   N   NN N N   N   N   N   N     N U U  2
 42 10:57 2 H 1 2L1387000 -12.2 N N .1713U U   R  N   N   NN N N   N   N   N   N     N U U  2
 43 11:01 2 H 1 2L1407100 -12.8 N N .2515U U   R  N   N   NN N N   N   N   N   N     N U U  2
 44 11:07 2 H 1 2L1446600 -11.1 N N .4413U U   R  N   N   NN N N   N   N   N   N     N U U  2
 45 11:12 2 H 1 2L1406500 -11.1 N N .1713U U   R  N   N   NN N N   N   N   N   N     N U U  2
 46 F79     020247FDXNACANACA TN-1424     PU0Se   UU  U     U   U    mP Us#3FLc          1
 47 15:36 3 H 1 2L1437400 -12.2 N N .2117U U   R  N   N   NN N N   N   N   N   N     N U U  2
 48 15:43 3 H 1 3L1537400 -12.2 N N .1823U U   R  N   N   NN N N   N   N   N   N     N U U  2
 49 15:53 3 H 1 2L1477500 -12.2 N N .2135U U   R  N   N   NN N N   N   N   N   N     N U U  2
 50 F95     031047SMFNACANACA TN-1424     P1 UuCbUU   U     U   U    mP Us#0-1FCf        1
 51 16:22 5 H 1 2L14711300-5.0  N N .5716U U   R  N   N   NN N N   N   N   N   N     N U U  2
 52 16:30 5 H 1 2L14711500-5.6  N N .6417U U   R  N   N   NN N N   N   N   N  N      N U U  2
 53 16:40 5 H 1 2L14811000-4.4  N N .4415U U   R  N   N   NN N N   N   N   N   N     N U U  2
 54 F99A    031547PIHNACANACA TN-1424     P44Ac  8116 -6.7124-7.8 cP TCIL,#1W5f       1
 55 14:59 6 H 1 3L15812300-7.8  N N .101213 U RF N   N   NN N N   N   N   N   N     N U U  2
 56 15:08 6 H 3 8L15411900-6.9  N N .041214 U RF N   N   NN N N   N   N   N   N     N U U  2
 57 F99B    031547RWLNACA  NACA TN-1424  P MSt  U  U  U    U    U  cP #1ESf           1
 58 17:12 7 H 1 3L15210700-8.9  N N .0821 U U R  N   N   NN N N   N   N   N   N     N U U  2

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    12345678901234567890123456789012345678901234567890123456789012345678901234567890
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                TABLE A-4.  THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
                                    Data File No. 3

   ------------------------------------Card Column No.---------------------------------------
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Rec.
No.                                Card (Record) Contents
 1 F100A  031647CYSNACA  NACA TN-1424  P60 St U  U  U   U   U  cP LpUf*3ACf       1
 2 11:09 8 H 2 6L15611100-6.1  N N .121215 U RF  N  N  NN N N  N  N  N  N   N U U 2
 3 11:15 8 H 1 2L14710900-5.6  N N .37130  U R   N  N  NN N N  N  N  N  N   N U U 2
 4 11:21 8 H 3 8L15710700-6.7  N N .201214 U RF  N  N  NN N N  N  N  N  N   N U U 2
 5 F100B  031647CYSNACA  NACA TN-1424  P60 St U  U  U   U   U  cP LpUf*3ACf       1
 6 15:10 9 H 2 5L15110750-7.2  N N .211216 U RF  N  N  NN N N  N  N  N  N   N U U 2
 7 15:21 9 H 1 2L13310800-7.2  N N .411315 U RF  N  N  NN N N  N  N  N  N   N U U 2
 8 15:28 9 H 1 2L14810750-7.2  N N .201316 U RF  N  N  NN N N  N  N  N  N   N U U 2
 9 15:37 9 H 1 2L14610600-7.2  N N .391316 U RF  N  N  NN N N  N  N  N  N   N U U 2
10 F100C  031647DMANACA  NACA TN-1424  P15 Sc U  U  U   U   U  cP *2-3AWf&Lc      1
11 18:07 10H 1 2P142 6000-7.8  N N .241313 U RF  N  N  NN N N  N  N  N  N   N U U 2
12 18:10 10H 1 2P142 5100-7.8  N N .1112 U U RF  N  N  NN N N  N  N  N  N   N U U 2
13 F101A  031747eMUNACA  NACA TN-1424  P 5 Sc B  U  U    U  U  cP TCIL;?          1
14 11:13 11H 1 2L148 5200-10.0 N N .10 8 8 U RF  N  N  NN N N  N  N  N  N   N U U 2
15 F101B  031747MEMNACA  NACA TN-1424  P 4 Sc U  U  U    U  U  cP Ua*1-2FCf       1
16 11:33 12H 1 2L148 3600 -5.6 N N .12 7 7 U RF  N  N  NN N N  N  N  N  N   N U U 2
17 12:22 12H 1 2L137 3300 -3.9 N N .15 7 8 U RF  N  N  NN N N  N  N  N  N   N U U 2
18 13:01 12H 2 5L144 3850 -5.3 N N .371013 U RF  N  N  NN N N  N  N  N  N   N U U 2
19 13:30 12H 1 2L134 3500 -4.4 N N .22 812 U RF  N  N  NN N N  N  N  N  N   N U U 2
20 F102   031847LA NACA  NACA TN-1424  P 1 Am U  U  U    U  U  mT C*4NELc         1
21 12:37 13H 1 2L14811800 -4.4 N N .341730 U RF  N  N  NN N N  N  N  N  N   N UmW 2
22 12:42 13H 2 5L14411600 -4.2 N N .151530 U RF  N  N  NN N N  N  N  N  N   N UmW 2
23 13:05 13H 1 3L15411400 -3.9 N N .161416 U RF  N  N  NN N N  N  N  N  N   N UmW 2
24 13:12 13H 1 2L14711400 -3.9 N N .081112 U RF  N  N  NN N N  N  N  N  N   N UmW 2
25 13:21 13H 2 5L14611400 -3.9 N N .311720 U RF  N  N  NN N N  N  N  N  N   N UmW 2
26 14:56 14H 1 2L14411400 -3.3 N N .012021 U RF  N  N  NN N N  N  N  N  N   N UmW 2
27 15:10 14H 1 2L14011300 -1.7 N N .162029 U RF  N  N  NN N N  N  N  N  N   N UmW 2
28 F103A  031947eTNNACA NACA TN-1424    P M Sc U  U  U    U  U  u  OP*2-3NLc      1
29 11:00 15H 1 2L15010000 -3.9 N N .142544 U RF  N  N  NN N N  N  N  N  N   N 0 U 2
30 11:34 15H 1 2L148 8900 -3.3 N N .101617 U RF  N  N  NN N N  N  N  N  N   N 0 U 2
31 11:49 15H 1 2L15110000 -3.9 N N .171829 U RF  N  N  NN N N  N  N  N  N   N 0 U 2
32 F103B  031947NC NACA  NACA TN-1424  P U As    U  U    U  U   u OP*2-3NLc      1
33 12:53 16E 1 2L14211000  8.3 N N .10180  U R   N  N  NN N N  N  N  N  N   N 0 U 2
34 F104A  032047sOHNACA  NACA TN-1424  P 7 Am U  U  U    U  U  cP *2NWkLc         1
35 14:36 17H 1 3L156 8100  8.9 N N .06340  U R   N  N  NN N N  N  N  N  N   N 0 U 2
36 F104B  032047nOHNACA  NACA TN-1424  P 7 Sc U  U  U    U  U  cP *2NWkLc         1
37 15:03 18H 1 3L156 6100  6.7 N N .221022 U RF  N  N  NN N N  N  N  N  N   N U U 2
38 15:07 18H 1 2L144 6100  6.7 N N .021226 U RF  N  N  NN N N  N  N  N  N   N U U 2
39 F105A  032147wINNACA  NACA TN-1424  P 7 Sc U  U  U    U  U  cP Uf39WLc         1
40 11:02 19H 2 4L135 5000 -7.2 N N .371317 U RF  N  N  NN N N  N  N  N  N   N U U 2
41 11:18 19H 1 2L128 4900 -7.2 N N .241316 U RF  N  N  NN N N  N  N  N  N   N U U 2
42 11:38 19H 2 4L130 5200 -7.5 N N .5112 U U RF  N  N  NN N N  N  N  N  N   N U U 2
43 14:13 20H 1 2L135 5100 -6.9 N N .471518 U RF  N  N  NN N N  N  N  N  N   N U U 2
44 14:19 20H 1 2L137 5100  6.9 N N .571618 U RF  N  N  NN N N  N  N  N  N   N U U 2
45 14:34 20H 1 2L132 5000 -6.1 N N .371720 U RF  N  N  NN N N  N  N  N  N   N U U 2
46 F105B  032147IN NACA  NACA TN-1424  P 7 Sc U  U  U    U  U  cP Of35WLc         1
47 15:07 20H 2 4L137 5100 -6.9 N N .3520 U U R   N  N  NN N N  N  N  N  N   N U U 2
48 15:20 20H 1 2L143 5300 -6.9 N N .131715 U RF  N  N  NN N N  N  N  N  N   N U U 2
49 15:29 20H 1 2L137 4500 -5.6 N N .261118 U RF  N  N  NN N N  N  N  N  N   N U U 2
50 F111A  041547nNMNACA  NACA TN-1424  P M Sc U  U  U    U  U  cP *0-1A&FCf       1
51 12:25 22H 1 3L15712400 -8.3 N N .03 611 U RF  N  N  NN N N  N  N  N  N   N U U 2
52 12:34 22H 1 3L15712400 -8.9 N N .0815 U U R   N  N  NN N N  N  N  N  N   N U U 2
53 F111B  041547UENNACA  NACA TN-1424  P45 Sc U  U  U    U  U  cP *0-1FCf         1
54 13:10 22P 1 3P157 9600-10.0 N N .2529 U U R   N  N  NN N N  N  N  N  N   N U U 2
55 13:16 22P 1 2P139 9100-10.0 N N .3729 U U R   N  N  NN N N  N  N  N  N   N U U 2
56 F112   041647KS NACA  NACA TN-1424  P28 Cu U  U  U    U  U  cP FwC1*1+FCf      1
57 11:06 23E 1 3L15711500-15.0 N N .101316 U RF  N  N  NN N N  N  N  N  N   N 0 U 2
58 11:50 23E 3 9L16310600-14.4 N N .141315 U RF  N  N  NN N N  N  N  N  N   N 0 U 2
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             TABLE A-4.  THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
                         Data File No.  4

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Rec.
No.                        Card (Record) Contents
 1 F113    041747OMANACA  NACA TN-1424  P11 Ac U  U  U     U  U  c  *2SWAFmCf       1
 2 10:27 24E 1 3L17011500-10.6 N N .121012 U RF N  N   NN N N  N  N  N  N   N U U  2
 3 10:49 24E 1 3L16011600-11.1 N N .25 910 U RF N  N   NN N N  N  N  N  N   N U U  2
 4 10:59 24E 1 3L15711600-11.1 N N .12 8 9 U RF N  N   NN N N  N  N  N  N   N U U  2
 5 11:05 24E 1 3L16011300-10.6 N N .3311 U U R  N  N   NN N N  N  N  N  N   N U U  2
 6 11:12 24E 1 3L16411000-10.0 N N .21 710 U RF N  N   NN N N  N  N  N  N   N U U  2
 7 11:21 24E 2 6L16110850 -9.4 N N .11 8 U U  R N  N   NN N N  N  N  N  N   N U U  2
 8 F119    042347wNBNACA  NACA TN-1424  P33 Sa U  U  U     U  U  cP *4FCf5WLc       1
 9 11:45+27H 616L142 5500 -4.4 N N .241112 U RF N  N   NN N N  N  N  N  N   N U U  2
10 F120    042547NB NACA  NACA TN-1424  P33 Cu U  U  U     U  U  cP Ua,Hp           1
11 12:31 28P 1 3P167 9800 -8.9 N N .261316 U RF N  N   NN N N  N  N  N  N   N U U  2
12 12:34 28P 1 2P14011600-11.7 N N .231314 U RF N  N   NN N N  N  N  N  N   N U U  2
13 12:40 28E 2 4L13111200-11.1 N N .4313 U U R  N  N   NN N N  N  N  N  N   N U U  2
14 12:49 28F 1 2L15111000-11.7 N N .251316 U RF N  N   NN N N  N  N  N  N   N U U  2
15 13:21 28E 1 2L16012400-13.3 N N .8415 U U R  N  N   NN N N  N  N  N  N   N U U  2
16 F122    042747nUTNACA  NACA TN-1424  P42 Cu U  U  U     U  U  Mm Hp,UaUpCy       1
17 11:38 30E 2 6L16514750-12.5 N N .461216 U RF N  N   NN N N  N  N  N  N   N U U  2
18 11:51 30E 1 3L16215200-12.8 N N .531424 U RF N  N   NN N N  N  N  N  N   N U U  2
19 F10     122646nUHNACA  NACA TN-1424  P 6 Sa U  U  U     U  U  cP Hp,WkNyCy?      1
20 1300+2   H 1 3L156 5070-21.7 N N .0910 U U R  N  N   NN N N  N  N  N  N   N U U  2
21 F11     123046 LENACA  NACA TN-1424  P 6 Sa U  U  U     U  U  cP Ua,Hp           1
22 0930+2   H 1 3L158 4870-15.0 N N .1314 U U R  N  N   NN N N  N  N  N  N   N U U  2
23          H 1 2L138 3160-12.8 N N .0612 U U R  N  N   NN N N  N  N  N  N   N U U  2
24 1130-2   H 1 3L182 3880-13.9 N N .0611 U U R  N  N   NN N N  N  N  N  N   N U U  2
25 F14     010747nUHNACA  NACA TN-1424  P 6StSaU  U  U     U  U  c  *0-JACf         1
26 1430+1   H 2 4L132 2820 -3.1 N N .1917 U U R  N  N   NN N N  N  N  N  N   N U U  2
27          H 1 2L135 3985 -4.4 N N .4517 U U R  N  N   NN N N 4.1CRD N  N   N U U  2
28 1540-1   H 1 2L141 3405 -3.9 N N .3114 U U R  N  N   NN N N 6.4CRD N  N   N U U  2
29 F13     010647CAKNACA  NACA TN-1424  P 8StScU  U  U     U  U  c  *0-2FWf         1
30 1430+1   H 1 3L154 3310-10.6 N N .37 9 U U R  N  N   NN N N 6.9CRD N  N   N U U  2
31          H 1 3L154 3210 -9.4 N N .24 9 U U R  N  N   NN N N 6.9CRD N  N   N U U  2
32          H 1 3L157 3310 -9.4 N N .26 8 U U R  N  N   NN N N 4.3CRD N  N   N U U  2
33          H 1 3L154 3310-10.0 N N .18 9 U U R  N  N   NN N N 7.1CRD N  N   N U U  2
34          H 1 3L154 3310 -9.4 N N .30 9 U U R  N  N   NN N N 5.6CRD N  N   N U U  2
35 1520-1   H 1 2L137 3210 -8.9 N N .28 8 U U R  N  N   NN N N 7.1CRD N  N   N U U  2
36 F30A    010647MKONACA  NACA TN-1424  P 6StSaU  U  U     U  U  c  *1SAFWf         1
37 1600+1   H 1 3L187 3700-20.0 N N .16 9 U U R  N  N   NN N N 3.8CRD N  N   N U U  2
38 F30B    010747EAUNACA  NACA TN-1424  P 8StSaU  U  U     U  U  cP  FCf            1
39 0930+4   H 3 9L183 4550-22.8 N N .1011 U U R  N  N   NN N N  .91RD N  N   N U U  2
40 F30C    010847DLHNACA  NACA TN-1424  P14StSaU  U  U     U  U  c  *2-3AWkWf       1
41 1100+4   H 2 6L183 4000-17.5 N N .1312 U U R  N  N   NN N N 1.01RD N  N   N U U  2
42 F16     011647 LE NACA NACA TN-1424  P 6StSaU  U  U     U  U  c  *1-3FCf         1
43 16:20    H 2 4L135 4085 -6.1 N N .12 7 U U R  N  N   NN N N  .71RD N  N   N U U  2
44 F20     012947TVC NACA NACA TN-1424  P 6 As U  U  U     U  U  c  *3N4ASmWf       1
45 0930+2   H 1 2L146 8270 -5.0 N N .2012 U U R  N  N   NN N N  .71RD N  N   N 0 U  2
46 F34     012947 LHNACA  NACA TN-1424  P 6 As U  U  U     U  U  cP *3N4ASmWf       1
47 1130+1   H 1 3L187 7400-12.2 N N .1812 U U R  N  N   NN N N  .61RD N  N   N 0 U  2
48          H 1 3L181 6200 -7.8 N N .1818 U U R  N  N   NN N N 1.61RD N  N   N 0 U  2
49 1230-1   H 1 3L186 9000 -9.4 N N .1720 U U R  N  N   NN N N 2.81RD N  N   N 0 U  2
50 F35     013147 LENACA  NACA TN-1424  P 6StSaU  U  U     U  U  cP NyCy6FFmLc      1
51 1030+3   H 1 3L178 3700-20.0 N N .16 9 U U R  N  N   NN N N  .41RD N  N   N U U  2
52 F21     021747 MINACA  NACA TN-1424  P 6StSaU  U  U     U  U  c  <1ACf,SrLp      1
53 1440+1   H 1 2L133 2920 -2.2 N N .50 9 U U R  N  N   NN N N 5.3CRD N  N   N U U  2
54 1600-1   H 1 2L138 2920 -3.3 N N .30 9 U U R  N  N   NN N N 1.61RD N  N   N U U  2
55 F22     021847 LENACA  NACA TN-1424  P 6 Sc U  U  U     U  U  c  DC1*0-2FCf      1
56 1330+1   H 1 3L157 3670 -3.9 N N .3013 U U R  N  N   NN N N 2.21RD N  N   N U U  2
57 F37     022547CLENACA  NACA TN-1424  P 7StSaU  U  U     U  U  cP NyCy9FSrLc      1
58 1330+3   H 2 6L178 7900-15.8 N N .1416 U U R  N  N   NN N N 1.71RD N  N   N U U  2
            1111111111222222222233333333334444444444555555555566666666667777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
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            TABLE A-4.  THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
                              Data File No. 5

                  ------Card Column No.----------------------------------------
                  11111111112222222222333333333344444444445555555555666666666677777777778
        12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                                 Card (Record) Contents
 1 F38     022647CLE NACA NACA TN-1424  P 7 5c U  U  U     U  U  cP NyCy9FSrLc      1
 2 1200+2   H 1 3L181 6500 15.0 N N .1215 U U R   N  N   NN N N 1.3IRD N  N    N U U  2
 3          H 1 3L181 6500-15.0 N N .1136 U U R   N  N   NN N N 1.3IRD N  N    N U U  2
 4 1400-2   H 1 3L181 6500-15.0 N N .4012 U U R   N  N   NN N N 1.3IRD N  N    N U U  2
 5 F40     030347CLE NACA NACA TN-1424  P 75t5cU  U  U     U  U  cP NyCy4FSrLc      1
 6 1200+3   H 1 3L168 5750-16.7 N N .0612 U U R   N  N   NN N N  N  N  N  N    N U U  2
 7 F41     030547 LE NACA NACA TN-1424  P 65t5cU  U  U     U  U  c  NyCy9FSrLc      1
 8 1420+1   H 1 3L166 3370-10.0 N N .22 8 U U  R N  N   NN N N  .5IRD N  N    N U U  2
 9 F24     020647RUA NACA NACA TN-1424  P M Am U  U  U     U  U  c  #3-4AWkWf       1
10 1220+1   H 2 6L194 9810 -7.2 N N .2718 U U R   N  N   NN N N 2.7IRD N  N    N 0 U  2
11 1330-1   H 2 6L176 9910 -6.7 N N .1418 U U R   N  N   NN N N  N  N  N  N    N 0 U  2
12 F44     031347CLE NACA NACA TN-1424  P 7 Am U  U  U     U  U  c  #4ACf           1
13 1500+3   H 1 3L17111040 -6.1 N N .1824 U U R   N  N   NN N N 2.3IRD N  N    N U U  2
14 F27     031447 LE NACA NACA TN-1424  P 6 5c U  U  U     U  U  c  #<1FCf          1
15 1300+1   H 1 3L155 5600 -6.7 N N .3415 U U R   N  N   NN N N 2.2IRD N  N    N U U  2
16          H 1 3L158 5375 -6.1 N N .1513 U U R   N  N   NN N N 2.9IRD N  N    N U U  2
17 1430-1   H 1 3L161 5480 -6.1 N N .1914 U U R   N  N   NN N N 1.7IRD N  N    N U U  2
18 F49     040747 LE NACA NACA TN-1424  P 6 5c U  U  U     U  U  c  NyCy3FSmCf      1
19 1030+2   H 1 3L157 4300  7.2 N N .3025 U U R   N  N   NN N N 4.0IRD N  N    N U U  2
20          H 1 3L164 4300 -7.2 N N .4215 U U R   N  N   NN N N 3.6IRD N  N    N U U  2
21          H 1 3L157 4300 -7.2 N N .1311 U U R   N  N   NN N N  .4IRD N  N    N U U  2
22 1230-2   H 1 3L161 4300 -7.2 N N .2116 U U R   N  N   NN N N  N  N  N  N    N U U  2
23 B-24M1  121147LE NACA NACA TN-1793   P 6 5c B         U#62*-13 cP *.4AWkCf       1
24 12:30   1H 1 3L151 5560-11.7 N N .2813 U  UR   N  N   NN N  U   U U N    U U U  U 2
25 12:40   2H 1 3L178 6170-12.8 N N .10 9 U  UR   N  N   NN N  U   U U N    U U U  U 2
26 12:51   3H 1 3L166 5640 11.7 N N .0810 U  UR   N  N   NN N  U   U U N    U U U  U 2
27 B-24M2  010248CLENACA NACA TN-1793   P 75c5tC         U        Uc   WkCf         1
28 15:30   1H 1 3L148 3600 -6.1 N N .57 8 U  UR   N  N   NN N  U   U U N    U U U  U 2
29 15:30   2H 1 3L149 3600 -3.9 N N .32 8 U  UR   N  N   NN N  U   U U N    U U U  U 2
30 XB-25E303034BwNYNACA NACA TN 1793   P 6 5c C         U        UcP SrNWPg         1
31 12:14   1H 1 3L175 3650 11.7 N N .2411 U  UR   N  N   NN N  U   U U N    U U U  U 2
32 12:21   2H 1 3L166 3650-11.7 N N .40 9 U  UR   N  N   NN N  U   U U N    U U U  U 2
33 12:33   3H 1 3L160 3090-10.0 N N .1511 U  UR   N  N   NN N  U   U U N    U U U  U 2
34 12:40   4H 1 3L178 3150-10.6 N N .0810 U  UR   N  N   NN N  U   U U N    U U U  U 2
35 13:09   5H 1 3L176 3620 09.4 N N .1512 U  UR   N  N   NN N  U   U U N    U U U  U 2
36 13:16   6H 1 3L175 3620 10.6 N N .2110 U  UR   N  N   NN N  U   U U N    U U U  U 2
37 13:28   7H 1 3L173 3150 11.7 N N .08 9 U  UR   N  N   NN N  U   U U N    U U U  U 2
38 B-24M4  030348cDHNACA NACA TN-1793   P 75c  U         U        Uc  1.5FCf&Lp     1
39 10:36   1H 1 3L159 3740  7.2 N N .3114 U  UR   N  N   NN N  U   U U N    U U U  U 2
40 10:45   2H 1 3L151 3890  5.6 N N .3813 U  UR   N  N   NN N  U   U U N    U U U  U 2
41 10:53   3H 1 3L153 3540  6.1 N N .1918 U  UR   N  N   NN N  U   U U N    U U U  U 2
42 11:04   4H 1 3L159 3620  5.0 N N .1421 U  UR   N  N   NN N  U   U U N    U U U  U 2
43 11:14   5H 1 3L168 3090  5.6 N N .1620 U  UR   N  N   NN N  U   U U N    U U U  U 2
44 11:25   6H 1 3L154 3800 -4.4 N N .1822 U  UR   N  N   NN N  U   U U N    U U U  U 2
45 B-24M5  03044H#PANACA NACA TN-1793   P M5c  U         U        Uc  SrNWPq        1
46 12:05   1H 1 3L165 2920 -5.6 N N .1015 U  UR   N  N   NN N  U   U U N    U U U  U 2
47 B-24M6  031648DFINACA NACA TN-1793   P 65c  U         U        Uc  3.5FCf        1
48 15:08   1H 1 3P172 6080 -3.3 N N .1820 U  UR   N  N   NN N  U   U U N    U U U  U 2
49 15:20   2H 1 3P175 6130  3.9 N N .2115 U  UR   N  N   NN N  U   U U N    U U U  U 2
50 15:32   3H 1 3P176 7300 -5.0 N N .2317 U  UR   N  N   NN N  U   U U N    U U U  U 2
51 B-24M7  032348aMINACA NACA TN-1793   P3351CrU         U        Uc  Um0-2FStCf    1
52 18:20   1H 1 3L172 8900 -6.1 N N .1515 U  UR   N  N   NN N  U   U U N    U U U  U 2
53 18:32   2H 1 3L177 8100 -6.7 N N .1720 U  UR   N  N   NN N  U   U U N    U U U  U 2
54 18:44   3H 1 3L172 8710 -7.8 N N .1322 U  UR   N  N   NN N  U   U U N    U U U  U 2
55 18:53   4H 1 3L176 9250 -8.3 N N .1021 U  UR   N  N   NN N  U   U U N    U U U  U 2
56 19:00   5H 1 3L179 9110 -8.9 N N .2211 U  UR   N  N   NN N  U   U U N    U U U  U 2
57 19:13   6H 1 3L164 9210  9.4 N N .1215 U  UR   N  N   NN N  U   U U N    U U U  U 2
58 19:16   7H 1 3L178 9050 -8.9 N N .05 7 U  UR   N  N   NN N  U   U U N    U U U  U 2
                  11111111112222222222333333333344444444445555555555666666666677777777778
        12345678901234567890123456789012345678901234567890123456789012345678901234567890
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TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 6

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   ------------------------------Card Column No.-----------------------------------
            11111111112222222222333333333344444444445555555555666666666677777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                           Card (Record) Contents
 1 B-24M8 033048QUENACA NACA TN-1793   P 6CuScU       U       UcP Hp              1
 2 10:01  1H 1 3L171 6990-10.0 N N .1910 U  UR  N  N  NN N  U   U U N    U U U IW 2
 3 B-24M9 040148eLMNACA NACA TN-1793   P 6Sc  U       U       Uc  Le2-4NSrLc      1
 4 08:41  1H 1 3P160 7190 -5.6 N N .13 5 U  UR  N  N  NN N  U   U U N    U UL-  U 2
 5 09:04  2H 1 3P165 5880 -3.9 N N .47 8 U  UR  N  N  NN N  U   U U N    U U U Le 2
 6 09:09  3H 1 3P165 5720 -4.4 N N .20 8 U  UR  N  N  NN N  U   U U N    U U U  U 2
 7 09:16  4H 1 3P164 6740 -6.7 N N .0810 U  UR  N  N  NN N  U   U U N    U UL-  U 2
 8 09:25  5H 1 3P172 5070 -5.0 N N .39 9 U  UR  N  N  NN N  U   U U N    U U U Le 2
 9 09:33  6H 1 3P165 5170-3.9  N N .4812 U  UR  N  N  NN N  U   U U N    U U U Le 2
10 09:40  7H 1 3P158 4870 -3.9 N N .4412 U  UR  N  N  NN N  U   U U N    U U U Le 2
11 09:53  8H 1 3P166 4830 -3.3 N N .3811 U  UR  N  N  NN N  U   U U N    U U U Le 2
12 10:00  9H 1 3P158 5120 -3.3 N N .3212 U  UR  N  N  NN N  U   U U N    U U U  U 2
13 10:07 10H 1 3P122 4470 -4.4 N N .2812 U  UR  N  N  NN N  U   U U N    U U U  U 2
14 10:14 11H 1 3P150 3890 -3.9 N N .46 5 U  UR  N  N  NN N  U   U U N    U U U Le 2
15 14:35 12H 1 3P173 7290 -8.9 N N .1616 U  UR  N  N  NN N  U   U U N    U U U  U 2
16 151    020448cCANACA NACA TN-1904   P MCu  U U U    U  U    mP 0Pg?            1
17 16:47  1H 3 8L16213500-21.7 N N .0747 U N R  N  N  NN NU  U    U N U   U U  W  2
18 17:00  2H 3 8L155 7400 -8.3 N N .3322 U N R  N  N  NN NU  U    U N U   U U  W  2
19 17:05  3H 4 9L135 5900 -6.1 N N .2317 U N R  N  N  NN NU  U    U N U   U U  W  2
20 17:25  4H 1 2L137 8900-12.2 N N .4132 U N R  N  N  NN NU  U    U N U   U U  W  2
21 17:29  5H 1 2L14010400-15.6 N N .2426 U N R  N  N  NN NU  U    U N U   U U  W  2
22 152    020648cCANACA NACA TN-1904   P MCu  U U U    U  U    mP 1-4SWWkLc       1
23 15:14  1H 2 5L15211200-17.2 N N .361832 N R  N  N  NN NU  U    U N U   U U  W  2
24 15:46  2H 3 8L159 7000 -8.3 N N .411820 N R  N  N  NN NU  U    U N U   U U  W  2
25 15:50  3H 3 7L145 7100 -8.3 N N .231919 N R  N  N  NN NU  U    U N U   U U  W  2
26 15:53  4H 1 2L139 7000 -8.3 N N .402026 N R  N  N  NN NU  U    U N U   U U  W  2
27 16:07  5H 1 2L130 8200-10.6 N N .972228 N R  N  N  NN NU  U    U N U   U U  W  2
28 16:13  6H 2 4L126 9300-13.3 N N .6327 U N R  N  N  NN NU  U    U N U   U U  W  2
29 153    020748wWANACA NACA TN-1904   P UAc  U U U    U  U    mP *5E&ASrLc       1
30 16:31  1H 3 9L175 6900 -6.1 N N .1150 U N R  N  N  NN NU  U    U N U   U U  W  2
31 16:38  2H 3 8L160 6900 -6.7 N N .0550 U N R  N  N  NN NU  U    U N U   U U  W  2
32 154    020848wWANACA NACA TN-1904   P UAsAcU U U    U  U    mP CyCl&P1SLc      1
33 14:15  1H 3 8L155 9300-12.2 N N .102225 N R  N  N  NN NU  U    U N U   U S-mW  2
34 14:19  2H 3 8L166 9300-12.2 N N .022322 N R  N  N  NN NU  U    U N U   U S mS  2
35 14:55  3H 3 9L17612300-18.9 N N .040809 N R  N  N  NN NU  U    U N U   U S mS  2
36 154A   020848wWANACA NACA TN-1904   P UCbCuU U U    U  U    mP CyCl&P1SLc      1
37 15:35  1H 3 8L153 7000 -9.4 N N .011215 N R  N  N  NN NU  U    U N U   U S mS  2
38 15:56  2H 1 3L157 8300-13.9 N N .522550 N R  N  N  NN NU  U    U N U   U S-mW  2
39 16:17  3H 1 2L144 4700 -6.1 N N .3823 U N R  N  N  NN NU  U    U N U   U U  W  2
40 155    020948wWANACA NACA TN-1904   P 0CuCbU U U    U  U    mP UaCy&P3FLc      1
41 15:01  1H 410L147 9600-16.7 N N .5629 U N R  N  N  NN NU  U    U N U   U S-mW  2
42 15:13  2H 1 3L15310400-18.3 N N .2127 U N R  N  N  NN NU  U    U N U   U S-mW  2
43 15:16  3H 1 2L140 9300-16.1 N N .4426 U N R  N  N  NN NU  U    U N U   U S-mW  2
44 15:19  4H 2 5L138 9500-16.7 N N .4224 U N R  N  N  NN NU  U    U N U   U S-mW  2
45 15:41  5H 3 7L145 8000-12.8 N N .5518 U N R  N  N  NN NU  U    U N U   U U  W  2
46 15:46  6H 1 2L141 8700-14.4 N N .2328 U N R  N  N  NN NU  U    U N U   U S-mW  2
47 15:50  7H 1 2L141 8700-14.4 N N .2218 U N R  N  N  NN NU  U    U N U   U S-mW  2
48 15:54  8H 1 2L135 8500-14.4 N N .101518 N R  N  N  NN NU  U    U N U   U U  W  2
49 15:57  9H 2 5L136 8100-13.3 N N .521818 N R  N  N  NN NU  U    U N U   U U  W  2
50 16:01 10H 1 2L143 8100-12.8 N N .541515 N R  N  N  NN NU  U    U N U   U S-mW  2
51 16:35 11H 1 3L155 7800-12.2 N N .372222 N R  N  N  NN NU  U    U N U   U U  W  2
52 16:41 12H 1 2L128 5700 -7.8 N N .671418 N R  N  N  NN NU  U    U N U   U U  W  2
53 16:50 13H 1 3L152 6300 -8.9 N N .5521 U N R  N  N  NN NU  U    U N U   U S-mW  2
54 17:23 14H 1 2L135 7700-12.2 N N .551320 N R  N  N  NN NU  U    U N U   U U  W  2
55 17:26 15H 1 2L142 7500-12.2 N N .391618 N R  N  N  NN NU  U    U N U   U U  W  2
56 17:29 16H 1 2L120 7300-11.7 N N .821518 N R  N  N  NN NU  U    U N U   U U  W  2
57 156    021048eIDNACA NACA TN-1904   P MAc  U U U    U  U    Mm  *<3WLc         1
58 17:30  1H 411L17113000-26.1 N N .020813 N R  N  N  NN NU  U    U N U   U U  W  2
59 17:34  2H 3 9L17713000-26.1 N N .031215 N R  N  N  NN NU  U    U N U   U U  W  2
            11111111112222222222333333333344444444445555555555666666666677777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 7

```
    ------------------------- Card Column No.----------------------------------------
              11111111112222222222333333333344444444445555555555666666666677777777778
     12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                          Card (Record) Contents
 1 159      021348 ILNACA NACA TN-1904    P 6 StNUU  U     U  U     c   Lp+P         1
 2 11:59    1H 3 7L1422000  -2.8 N N .082050 N R  N  N  NN NU  U    U  N U   U ZR mW 2
 3 12:04    2H 3 7L1402000  -3.3 N N .091850 N R  N  N  NN NU  U    U  N U   U ZR mW 2
 4 12:32    3H 2 4L1241300  -3.9 N N .015050 N R  N  N  NN NU  U    U  N U   U RS mS 2
 5 12:39    4H 3 7L1362500  -6.7 N N .040914 N R  N  N  NN NU  U    U  N U   U U  W  2
 6 166      030848cCANACA NACA TN-1904    P MCuCbU U U    U  U     mP WkHp?          1
 7 17:55    1H 1 2L14512400-11.7 N N .473344 N R  N  N  NN NU  U    U  N U   U U  W  2
 8 18:00    2H 2 5L15111600-11.7 N N .3150 U N R  N  N  NN NU  U    U  N U   U U  W  2
 9 18:07    3H 1 2L14710800-10.0 N N .1419 U N R  N  N  NN NU  U    U  N U   U U  W  2
10 18:11    4H 1 2L13611400-11.1 N N .4756 U N R  N  N  NN NU  U    U  N U   U S-mW  2
11 18:14    5H 1 3L16611200-10.0 N N .5444 U N R  N  N  NN NU  U    U  N U   U S-mW  2
12 18:16    6H 1 3L16511200-11.1 N N .20 U U N R  N  N  NN NU  U    U  N U   U U  W  2
13 167      030948nAZNACA NACA TN-1904    P MCbCuU U U    U  U     MmPCy+Lp*2SLc     1
14 14:07    1H 1 3L18714600-19.4 N N .311919 N R  N  N  NN NU  U    U  N U   U U  W  2
15 14:10    2H 1 3L17214200-18.9 N N .261923 N R  N  N  NN NU  U    U  N U   U U  W  2
16 14:13   13H 1 3L15814500-20.0 N N .2921 U N R  N  N  NN NU  U    U  N U   U S-mW  2
17 14:16    4H 1 3L17114400-20.0 N N .22 9 U N R  N  N  NN NU  U    U  N U   U U  W  2
18 14:19    5H 2 5L15414700-20.6 N N .2022 U N R  N  N  NN NU  U    U  N U   U S mS  2
19 14:55    6H 1 3L16014700-20.0 N N .381720 N R  N  N  NN NU  U    U  N U   U S mS  2
20 15:09    7H 1 2L14914400-18.9 N N .392021 N R  N  N  NN NU  U    U  N U   U U  W  2
21 15:22    8H 1 2L14014700-20.0 N N .1228 U N R  N  N  NN NU  U    U  N U   U S mS  2
22 16:49    9H 2 5L16014500-15.0 N N .3620 U N R  N  N  NN NU  U    U  N U   U S-mW  2
23 17:00   10H 1 3L16613400-12.8 N N .5917 U N R  N  N  NN NU  U    U  N U   U U  W  2
24 170      031248wORNACA NACA TN-1904    P 0AcAsU U U    U  U     mP *1-3SWkLc      1
25 13:30    1H 2 5L15310000 -9.4 N N .0918 U N R  N  N  NN NU  U    U  N U   U S mS  2
26 13:33    2H 3 7L14610100 -9.4 N N .2233 U N R  N  N  NN NU  U    U  N U   U S mS  2
27 13:45    3H 411L17310000 -9.4 N N .131448 N R  N  N  NN NU  U    U  N U   U S-mW  2
28 13:53    4H 2 5L16210200-10.0 N N .151416 N R  N  N  NN NU  U    U  N U   U S-mW  2
29 13:56    5H 3 8L15910300-10.6 N N .181616 N R  N  N  NN NU  U    U  N U   U S-mW  2
30 14:06    6H 411L16610200-10.0 N N .1523 U N R  N  N  NN NU  U    U  N U   U S-mW  2
31 14:20    7H 514L1679900 -10.6 N N .091043 N R  N  N  NN NU  U    U  N U   U S-mW  2
32 14:26    8H 3 9L17110100-10.0 N N .101543 N R  N  N  NN NU  U    U  N U   U U  W  2
33 14:34    9H 3 8L16310150-10.0 N N .131634 N R  N  N  NN NU  U    U  N U   U S-mW  2
34 170A     031248oORNACA NACA TN-1904    P 0Sc  U U U    U  U     mP *1-3SWkLc      1
35 14:29    1H 1 2L1486500  -3.3 N N .101221 N R  N  N  NN NU  U    U  N U   U U  W  2
36 14:52    2H 3 7L1436700  -4.4 N N .341517 N R  N  N  NN NU  U    U  N U   U S-mW  2
37 15:51    3H 1 3L1728700  -8.9 N N .1120 U N R  N  N  NN NU  U    U  N U   U S-mW  2
38 15:53    4H 1 3L1738300  -8.9 N N .222429 N RI N  N  NN NU  U    U  N U   U S-mW  2
39 16:02    5H 411L1768000  -7.8 N N .041529 N RI N  N  NN NU  U    U  N U   U S-mW  2
40 171      031348oORNACA NACA TN-1904    P UCuCbB U U    U  U     mP LpTr           1
41 13:20    1H 1 3L1788700  -8.9 N N .211122 N RI N  N  NN NU  U    U  N U   U U  W  2
42 13:22    2H 3 9L1819400  -8.9 N N .391028 N RI N  N  NN NU  U    U  N U   U U  W  2
43 13:25    3H 1 2L1398400 -10.0 N N .382830 N RI N  N  NN NU  U    U  N U   U S mW  2
44 13:29    4H 310L1479550 -11.7 N N .6527 U N RI N  N  NN NU  U    U  N U   U S-mW  2
45 13:41    5H 2 5L1548900 -11.7 N N .362641 N RI N  N  NN NU  U    U  N U   U S-mW  2
46 13:47    6H 1 2L1348550 -11.7 N N .3621 U N RI N  N  NN NU  U    U  N U   U U  W  2
47 13:55    7H 2 5L1508100  -8.9 N N .5823 U N RI N  N  NN NU  U    U  N U   U S-mW  2
48 14:02    8H 1 3L1688200  -9.4 N N .362122 N RI N  N  NN NU  U    U  N U   U S-mW  2
49 14:05    9H 1 3L1558300  -9.4 N N .211122 N RI N  N  NN NU  U    U  N U   U U  W  2
50 14:08   10H 1 3L1698500  -9.4 N N .4845 U N RI N  N  NN NU  U    U  N U   U S-mW  2
51 14:19   11H 1 3L1548200  -7.8 N N .4821 U N RI N  N  NN NU  U    U  N U   U S-mW  2
52 14:25   12H 1 3L1507800  -8.3 N N .592122 N RI N  N  NN NU  U    U  N U   U U  W  2
53 14:30   13H 410L1449200 -10.6 N N .2519 U N RI N  N  NN NU  U    U  N U   U S-mW  2
54 15:06   14H 3 8L1557700  -8.9 N N .501822 N RI N  N  NN NU  U    U  N U   U U  W  2
55 15:31   15H 410L14312000-16.1 N N .5635 U N RI N  N  NN NU  U    U  N U   U S-mW  2
56 16:07   16H 2 9L17311800-16.7 N N .882028 N RI N  N  NN NU  U    U  N U   U U  W  2
57 16:15   17H 2 9L17511800-16.7 N N .722128 N RI N  N  NN NU  U    U  N U   U S-mW  2
              11111111112222222222333333333344444444445555555555666666666677777777778
     12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 8

```
   ---------------------------Card Column No.--------------------------------------
            111111111122222222223333333333444444444455555555556666666666777777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                           Card (Record) Contents
 1 174    031948cCANACA NACA TN-1904   P MCu  UU  U    U  U    mP *0-2FFmCf       1
 2 14:02  1H 3 8L16211400-16.7 N N .8812 U N RI N  N  NN NU  U   U  N U   U 0  W  2
 3 14:08  2H 2 4L12711500-16.7 N N 1.21117 N RI N  N  NN NU  U   U  N U   U 0  W  2
 4 14:15  3H 2 5L15512200-18.9 N N .920911 N RI N  N  NN NU  U   U  N U   U 0  W  2
 5 175A   032248oCANACA NACA TN-1904   P 0A*AcUU  U    U  U    mP  Cf             1
 6 12:32  1H 412L17913000 -7.8 N N .1423 U N RI N  N  NN NU  U   U  N U   U S mS  2
 7 13:58  2H 2 5L1557900  -7.8 N N .0724 U N RI N  N  NN NU  U   U  N U   U S mS  2
 8 175    032248oORNACA NACA TN-1904   P 0CbCuUU  U    U  U    mP *<1FCf          1
 9 14:09  1H 1 2L1486700  -6.7 N N .174547 N RI N  N  NN NU  U   U  N U   U S mS  2
10 14:14  2H 1 3L1567300  -8.3 N N .272437 N RI N  N  NN NU  U   U  N U   U U  W  2
11 14:19  3H 1 3L1596000  -7.8 N N .282025 N RI N  N  NN NU  U   U  N U   U U  W  2
12 14:23  4H 2 5L1458700  -8.3 N N .232537 N RI N  N  NN NU  U   U  N U   U S-mW  2
13 14:39  5H 411L1728800 -11.7 N N .242534 N RI N  N  NN NU  U   U  N U   U S-mW  2
14 14:55  6H 1 3L1628000 -10.6 N N .692022 N RI N  N  NN NU  U   U  N U   U U  W  2
15 15:05  7H 3 7L1498900 -11.7 N N .562023 N RI N  N  NN NU  U   U  N U   U S-mW  2
16 15:11  8H 1 3L1569200 -12.8 N N .6822 U N RI N  N  NN NU  U   U  N U   U S-mW  2
17 15:14  9H 2 5L1379700 -13.3 N N .262323 N RI N  N  NN NU  U   U  N U   U S-mW  2
18 15:19 10H 2 5L1629900 -14.4 N N .9532 U N RI N  N  NN NU  U   U  N U   U S-mW  2
19 15:27 11H 410L1559800 -15.6 N N .4626 U N RI N  N  NN NU  U   U  N U   U S mS  2
20 15:34 12H 1 3L16110300-16.7 N N .6331 U N RI N  N  NN NU  U   U  N U   U S-mW  2
21 176    032348MFRNACA NACA TN-1904   P13CuCbUU  U    U  U    mP CyLpTrSmCf      1
22 14:02  1H 2 5L165 9900-10.6 N N .371318 N RI N  N  NN NU  U   U  N U   U U  W  2
23 14:08  2H 411L169 8800 -9.4 N N .2916 U N RI N  N  NN NU  U   U  N U   U U  W  2
24 14:15  3H 3 8L15211500-12.2 N N .5425 U N RI N  N  NN NU  U   U  N U   U U  W  2
25 14:21  4H 1 2L14011900-11.7 N N .5327 U N RI N  N  NN NU  U   U  N U   U U  W  2
26 16:24  5H 3 7L14911600-10.6 N N .332729 N RI N  N  NN NU  U   U  N U   U S-mW  2
27 16:55  6H 2 5L14410200-10.0 N N .6828 U N RI N  N  NN NU  U   U  N U   U S-mW  2
28 17:03  7H 2 5L148 9800 -7.7 N N .3726 U N RI N  N  NN NU  U   U  N U   U S-mW  2
29 177    032448oCANACA NACA TN-1904   P 0CuCbUU  U    U  U    mP  CyLpTr         1
30 13:29  1H 3 8L15113000-19.4 N N .1050 U N RI N  N  NN NU  U   U  N U   U S mS  2
31 14:51  2H 1 3L157 8800 -9.4 N N .282645 N RI N  N  NN NU  U   U  N U   U U  W  2
32 14:58  3H 1 3L160 9100 -8.3 N N .582745 N RI N  N  NN NU  U   U  N U   U S-mW  2
33 15:05  4H 1 3L165 9300 -8.8 N N .432943 N RI N  N  NN NU  U   U  N U   U S-mW  2
34 179    032948cCANACA NACA TN-1904   P 0CuCbU U U    U  U    mP WkHp            1
35 12:03  1H 1 3L17013700-13.9 N N .782327 N RI N  N  NN NU  U   U  N U   U S-mW  2
36 12:17  2H 1 3L19513700-14.4 N N .2628 U N RI N  N  NN NU  U   U  N U   U U  W  2
37 12:25  3H 3 9L18411800-10.6 N N .7423 U N RI N  N  NN NU  U   U  N U   U S-mW  2
38 12:32  4H 1 3L16811700-10.0 N N .642324 N RI N  N  NN NU  U   U  N U   U S-mW  2
39 12:39  5H 2 5L15812100-10.6 N N .9824 U N RI N  N  NN NU  U   U  N U   U U  W  2
40 12:44  6H 1 3L15211750-11.1 N N .6118 U N RI N  N  NN NU  U   U  N U   U S-mW  2
41 12:48  7H 1 3L16211500-10.6 N N .6132 U N RI N  N  NN NU  U   U  N U   U S-mW  2
42 12:57  8H 2 5L14011400-10.0 N N .9825 U N RI N  N  NN NU  U   U  N U   U U  W  2
43 13:02  9H 2 5L15810400 -8.9 N N .8823 U N RI N  N  NN NU  U   U  N U   U U  W  2
44 13:15 10H 1 3L15711600-10.6 N N .842022 N RI N  N  NN NU  U   U  N U   U U  W  2
45 13:29 11H 1 3L15413600-15.0 N N .40 U U N RI N  N  NN NU  U   U  N U   U S-mW  2
46 13:33 12H 1 3L18714800-15.0 N N .462326 N RI N  N  NN NU  U   U  N U   U S-mW  2
47 14:00 13H 1 3L17014500-14.4 N N 1.714 U N RI N  N  NN NU  U   U  N U   U S-mW  2
48 14:26 14H 1 3L17214600-14.4 N N 1.219 U N RI N  N  NN NU  U   U  N U   U S-mW  2
49 14:28 15H 1 3L17913700-12.2 N N .9425 U N RI N  N  NN NU  U   U  N U   U U  W  2
50 15:47 16H 2 5L16311800 -9.4 N N 1.12528 N RI N  N  NN NU  U   U  N U   U U  W  2
51 181    040248RDDNACA NACA TN-1904   P MAcA*U U U    U  U    mP P*0-1ACf        1
52 15:10  1H 3 9L17213100-12.2 N N .182228 N RI N  N  NN NU  U   U  N U   U U  W  2
53 15:15  2H 513L15013100-11.7 N N .0127 U N RI N  N  NN NU  U   U  N U   U S mS  2
54 183    040548SEANACA NACA TN-1904   P UAcA*U U U    U  U    mP *0-1E&ALc       1
55 14:26  1H 2 7L22411450-16.7 N N .041524 N RI N  N  NN NU  U   U  N U   U S mS  2
56 14:49  2H 3 8L15014700-24.4 N N .0410 U N RI N  N  NN NU  U   U  N U   U S mS  2
57 15:27  3H 410L144 9200-12.2 N N .0931 U N RI N  N  NN NU  U   U  N U   U S mS  2
58 15:45  4H 3 9L179 9400-14.4 N N .082728 N RI N  N  NN NU  U   U  N U   U S-mW  2
59 15:54  5H 2 5L162 8000-10.0 N N .0924 U N RI N  N  NN NU  U   U  N U   U S-mW  2
            111111111122222222223333333333444444444455555555556666666666777777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
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TABLE A 4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 9

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    -- --- ---------- --- --------Card Column No.---------------------------------------
                 1111111111222222222233333333334444444444555555555566666666667777777778
       12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                              Card (Record) Contents
  1 183A    040548SEANACA NACA TN-1904    P 0Ac  U U U    U  U    mP *0-1E&ALc        1
  2 15:59   1H 3 6L179 7900-11.1 N N .2837 U N RI N   N  NN NU   U   U  N U   U U mW  2
  3 16:10   2H 3 8L157 7900-11.1 N N .2447 U N RI N   N  NN NU   U   U  N U   U U mW  2
  4 16:18   3H 410L161 8000-11.1 N N .101722 N RI N   N  NN NU   U   U  N U   U U  W  2
  5 16:29   4H 514L162 8000-10.0 N N .1923 U N RI N   N  NN NU   U   U  N U   U U mW  2
  6 16:35   5H 2 5L156 8000-12.2 N N .2818 U N RI N   N  NN NU   U   U  N U   U U mW  2
  7 16:41   5H 513L160 8100-12.2 N N .172122 N RI N   N  NN NU   U   U  N U   U U mW  2
  8 17:26   7H 514L166 8100-10.6 N N .1321 U N RI N   N  NN NU   U   U  N U   U U mW  2
  9 15:14   8H 2 6L16814650-25.0 N N .0320 U N RI N   N  NN NU   U   U  N U   U S-mW  2
 10 15:21   9H 1 3L192 9500-14.4 N N .1946 U N RI N   N  NN NU   U   U  N U   U S-mW  2
 11 15:33  10H 1 3L172 9000-12.8 N N .1850 U N RI N   N  NN NU   U   U  N U   U S-mW  2
 12 183B    040548SEANACA NACA TN-1904    P 0CuCbU U U     U  U    mP *0-1E&ALc        1
 13 14:05   1H 1 3L17112700-21.7 N N .4929 U N RI N   N  NN NU   U   U  N U   U S-mW  2
 14 14:31   2H 2 5L16310900-16.1 N N .3721 U N RI N   N  NN NU   U   U  N U   U U  W  2
 15 14:36   3H 1 3L17511600-19.4 N N 1.220 U N RI N   N  NN NU   U   U  N U   U U  W  2
 16 185     040648cORNACA NACA TN-1904   P49Cu  U U U    U  U    Mm *3-4NW&FLc        1
 17 20:10   1H 1 3L182 8900-10.0 N N .612225 N RI N   N  NN NU   U   U  N U   U U  W  2
 18 186     040948nCANACA NACA TN-1904   P20Ac  U U U    U  U    mPk*4-5SWkLc         1
 19 12:51   1H 1 3L17312000-11.1 N N .081426 N RI N   N  NN NU   U   U  N U   U U  W  2
 20 12:59   2H 1 3L16310900-10.0 N N .062331 N RI N   N  NN NU   U   U  N U   U U  W  2
 21 13:10   3H 2 5L15010600-08.9 N N .3239 U N RI N   N  NN NU   U   U  N U   U U  W  2
 22 13:40   4H 2 6L16611200-10.6 N N .1637 U N RI N   N  NN NU   U   U  N U   U U  W  2
 23 13:53   5H 3 7L14912400-12.8 N N .1529 U N RI N   N  NN NU   U   U  N U   U S-mW  2
 24 187A    041048sORNACA NACA TN-1904   P605c  U U U    U  U    Mm WkHp?             1
 25 12:34   1H 2 6L185 8900-10.0 N N .2420 U N RI N   N  NN NU   U   U  N U   U U  W  2
 26 187B    041048nNVNACA NACA TN-1904   P MAc  U U U    U  U    Mm WkCy?             1
 27 16:14   1H 3 9L17413200-11.1 N N .121050 N RI N   N  NN NU   U   U  N U   U S-mW  2
 28 15:24   2H 3 9L18413300-15.0 N N .1717 U N RI N   N  NN NU   U   U  N U   U U  W  2
 29 15:40   3H 411L17213100-13.3 N N .0813 U N RI N   N  NN NU   U   U  N U   U S mS  2
 30 187C    041048sWYNACA NACA TN-1904   P MCu  U U U    U  U    c  BtCf=2S&3N        1
 31 15:59   1H 3 9L18313000-11.1 N N .392230 N RI N   N  NN N U U   U  N U   U U  W  2
 32 16:05   2H 2 6L17512900-11.1 N N .242122 N RI N   N  NN NU   U   U  N U   U U  W  2
 33 14:41   3H 1 3L18612700-14.4 N N .4516 U N RI N   N  NN NU   U   U  N U   U U  W  2
 34 189     041248wNBNACA NACA TN-1904   P34CuCbU U U     U  U    cP *1-2SWkWf         1
 35 13:34   1H 1 2L134 8000 -5.6 N N .6522 U N RI N   N  NN NU   U   U  N U   U U  W  2
 36 13:46   2H 2 6L173 7000 -6.7 N N .2018 U N RI N   N  NN NU   U   U  N U   U U  W  2
 37 14:05   3H 512L148 8400 -6.1 N N .2612 U N RI N   N  NN NU   U   U  N U   U U  W  2
 38 14:12   4H 2 6L187 9000 -6.7 N N .2311 U N RI N   N  NN NU   U   U  N U   U U  W  2
 39 15:08   5H 2 5L164 7800 -8.3 N N .6926 U N RI N   N  NN NU   U   U  N U   U S-mW  2
 40 189A    041248wNBNACA NACA TN-1904   P34Ac  U U U    U  U    cP *1-2SWkWf         1
 41 14:36   1H 411L16810900-11.1 N N .0917 U N RI N   N  NN NU   U   U  N U   U S-mW  2
 42 14:43   2H 411L16711100-11.7 N N .1420 U N RI N   N  NN NU   U   U  N U   U U  W  2
 43 14:50   3H 3 8L15611100-11.7 N N .162021 N RI N   N  NN NU   U   U  N U   U S-mW  2
 44 14:58   4H 617L16711400-12.8 N N .081516 N RI N   N  NN NU   U   U  N U   U S-mW  2
 45 193     041648DETNACA NACA TN-1904   P 6Ac  U U U    U  U    cP FmCf              1
 46 11:22   1H 3 8L15310000 -3.9 N N .3111 U N RI N   N  NN NU   U   U  N U   U U  W  2
 47 11:30   2H 2 5L151 9900 -3.9 N N .300609 N RI N   N  NN NU   U   U  N U   U U  W  2
 48 11:42   3H 515L17511100 -8.9 N N .251012 N RI N   N  NN NU   U   U  N U   U U  W  2
 49 193A    041648 MINACA NACA TN-1904   P 65c  U U U    U  U    cP *<1FFmCf          1
 50 12:22   1H 512L148 5800 -3.9 N N .281317 N RI N   N  NN NU   U   U  N U   U U  W  2
 51 12:53   2H 3 7L148 4300 -5.0 N N .2914 U N RI N   N  NN NU   U   U  N U   U U  W  2
 52 15:58   3H 3 8L152 4200 -7.2 N N .131214 N RI N   N  NN NU   U   U  N U   U U  W  2
 53 194     041748cIANACA NACA TN-1904   P 9Acc U U U    U  U    cP *3-4AWf           1
 54 12:49   1H 2 6L16713100 -5.0 N N .0307 U U RI N   N  NN NU   U   U  N U   U U  W  2
 55 12:55   2H 410L14814600 -6.1 N N .2413 U U RI N   N  NN N U U   U  N U   U U  W  2
                 1111111111222222222233333333334444444444555555555566666666667777777778
       12345678901234567890123456789012345678901234567890123456789012345678901234567890
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          TABLE A-4.  THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
                      Data File No. 10

   --------------------------Card Column No.--------------------------------------
            11111111112222222222333333333344444444445555555555666666666677777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                            Card (Record) Contents
 1 197    043048MRYNACA NACA TN-1904   P 0Cb  U U U    U  U    mP Hc              1
 2 12:35  1H 2 5L143 6700 -4.4 N N .102048 N RI N  N  NN N N U   U  N  N  U S-mW  2
 3 198    050448wORNACA NACA TN-1904   P 0Ac  U U U    U  U    mP Hc?             1
 4 11:20  1H 2 6L16710400 -3.3 N N .071550 N RI N  N  NN N N U   U  N  N  U U  W  2
 5 11:44  2H 3 8L16212000 -6.1 N N .072542 N RI N  N  NN N N U   U  N  N  U U  W  2
 6 11:56  3H 3 8L15812100 -6.7 N N .0750 U N RI N  N  NN N N U   U  N  N  U U  W  2
 7 198A   050448wORNACA NACA TN-1904   P 0Cu  U U U    U  U    mP Hc?             1
 8 13:30  4H 1 3L167 6800 -5.6 N N .371735 N RI N  N  NN N N U   U  N  N  U U  W  2
 9 199    050548SEANACA NACA TN-1904   P 0AcAsU U U    U  U    mP SmCf2SWkLc      1
10 13:50  1H 2 6L19111800 -6.1 N N .163838 N RI N  N  NN N N U   U  N  N  U U  W  2
11 13:56  2H 2 5L15112000 -5.6 N N .302644 N RI N  N  NN N N U   U  N  N  U U  W  2
12 16:06  3H 2 5L16313400 -9.4 N N .1747 U N RI N  N  NN N N U   U  N  N  U S-mW  2
13 16:10  4H 3 5L15813700 -8.9 N N .142540 N RI N  N  NN N N U   U  N  N  U S-mW  2
14 200    050648SEANACA NACA TN-1904   P 0CuCbU U U    U  U    mPk2FSmCf          1
15 13:53  1H 1 3L16511000-10.0 N N .992324 N RI N  N  NN N N U   U  N  N  U U  W  2
16 13:56  2H 1 3L15710000-10.6 N N 1.42125 N RI N  N  NN N N U   U  N  N  U U  W  2
17 13:58  3H 1 3L154 9500-10.0 N N .702124 N RI N  N  NN N N U   U  N  N  U U  W  2
18 14:03  4H 1 3L165 9100-10.0 N N .692425 N RI N  N  NN N N U   U  N  N  U U  W  2
19 14:05  5H 1 2L145 9300 -9.4 N N .6722 U N RI N  N  NN N N U   U  N  N  U U  W  2
20 14:12  6H 1 3L17210500-12.8 N N .6823 U N RI N  N  NN N N U   U  N  N  U U  W  2
21 14:15  7H 1 3L173 9300-11.1 N N .691821 N RI N  N  NN N N U   U  N  N  U U  W  2
22 14:17  8H 1 3L162 9000-10.0 N N .451923 N RI N  N  NN N N U   U  N  N  U S-mW  2
23 14:21  9H 2 5L157 8900-10.6 N N .1226 U N RI N  N  NN N N U   U  N  N  U U  W  2
24 14:32 10H 1 3L173 9700-11.7 N N .6221 U N RI N  N  NN N N U   U  N  N  U S-mW  2
25 14:35 11H 1 3L160 9200-10.6 N N .3922 U N RI N  N  NN N N U   U  N  N  U U  W  2
26 14:37 12H 1 3L170 8900-10.0 N N .502229 N RI N  N  NN N N U   U  N  N  U U  W  2
27 14:45 13H 1 2L149 9000 -9.4 N N .6824 U N RI N  N  NN N N U   U  N  N  U U  W  2
28 14:50 14H 1 3L169 8500-10.0 N N .492122 N RI N  N  NN N N U   U  N  N  U U  W  2
29 14:54 15H 1 3L165 8200 -8.9 N N .6925 U N RI N  N  NN N N U   U  N  N  U U  W  2
30 15:14 16H 3 9L17311100-14.4 N N .0822 U N RI N  N  NN N N U   U  N  N  U S mS  2
31 201    050748wORNACA NACA TN-1904   P 0CbCuU U U    U  U    mPk*6FSmCf         1
32 14:04  1H 1 3L15413300-17.8 N N .8821 U N RI N  N  NN N N U   U  N  N  U S-mW  2
33 14:09  2H 1 3L17613800-20.6 N N .8624 U N RI N  N  NN N N U   U  N  N  U S-mW  2
34 14:37  3H 1 3L15715000-23.3 N N 1.32224 N RI N  N  NN N N U   U  N  N  U U  W  2
35 14:45  4H 1 2L14414600-21.7 N N 1.32428 N RI N  N  NN N N U   U  N  N  U S-mW  2
36 14:49  5H 1 2L13914800-21.1 N N .0326 U N RI N  N  NN N N U   U  N  N  U S mS  2
37 15:12  6H 1 3L19314400-21.7 N N .02 U U N RI N  N  NN N N U   U  N  N  U S mS  2
38 17:04  7H 1 3L18211700-14.4 N N .392428 N RI N  N  NN N N U   U  N  N  U S-mW  2
39 201A   050748nCANACA NACA TN-1904   P 0AcAsU U U    U  U    mP SrPg6FSmCf      1
40 16:18  1H 1 3L155 9000-10.0 N N .0308 U N RI N  N  NN N N U   U  N  N  U S-mW  2
41 16:33  2H 2 6L15010500-13.3 N N .1014 U N RI N  N  NN N N U   U  N  N  U S mS  2
42 16:39  3H 1 3L17611300-15.6 N N .262228 N RI N  N  NN N N U   U  N  N  U S-mW  2
43 202    051248wORNACA NACA TN-1904   P UAc  U U U    U  U    mP *<1FCf          1
44 17:43  1H 2 6L18911000-10.6 N N .241839 N RI N  N  NN N N U   U  N  N  U U  W  2
45 17:46  2H 1 3L18010000 -8.9 N N .222242 N RI N  N  NN N N U   U  N  N  U U  W  2
46 18:12  3H 2 6L18513000-16.1 N N .071625 N RI N  N  NN N N U   U  N  N  U U  W  2
47 204    051448eMTNACA NACA TN-1904   P MCuCbU U U    U  U    Mm *6-8FFmCf       1
48 12:40  1H 1 3L164 9200 -8.9 N N .181116 N RI N  N  NN N N U   U  N  N  U U  W  2
49 12:43  2H 1 3L166 9200 -8.3 N N .06 U16 N RI N  N  NN N N U   U  N  N  U U  W  2
50 12:46  3H 1 3L164 9200 -8.3 N N .14 U14 N RI N  N  NN N N U   U  N  N  U U  W  2
51 12:57  4H 2 6L15911000-12.8 N N .1717 U N RI N  N  NN N N U   U  N  N  U U  W  2
52 13:01  5H 1 3L16311700-13.3 N N .271821 N RI N  N  NN N N U   U  N  N  U U  W  2
53 13:04  6H 1 3L17411400-13.3 N N .411924 N RI N  N  NN N N U   U  N  N  U U  W  2
54 15:48  7H 3 9L17115000-16.7 N N .311725 N RI N  N  NN N N U   U  N  N  U S-mW  2
55 15:55  8H 1 3L16413900-14.4 N N .29 U17 N RI N  N  NN N N U   U  N  N  U S-mW  2
            11111111112222222222333333333344444444445555555555666666666677777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
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TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 11

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   ---------------------------Card Column No.--------------------------------------
            11111111112222222222333333333344444444445555555555666666666677777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                           Card (Record) Contents
 1 204A   051448eMTNACA NACA TN-1904   P MSc  U U U    U  U    Mm #4-6FFmCf        1
 2 13:11  1H 3 9L16111300-12.0 N N .2616 U N RI N  N  NN N N U   U  N  N  U U  W  2
 3 13:17  2H 3 8L14712200-14.4 N N .291822 N RI N  N  NN N N U   U  N  N  U S-mW  2
 4 13:27  3H 3 9L15613200-15.6 N N .211824 N RI N  N  NN N N U   U  N  N  U S-mW  2
 5 13:32  4H 2 6L17013000-13.9 N N .211920 N RI N  N  NN N N U   U  N  N  U S-mW  2
 6 205    051548cMNNACA NACA TN-1904   P 6ScAcU U U    U  U    cP #2-3FFmCf        1
 7 11:05  1H 3 8L160 8900 -5.6 N N .121213 N RI N  N  NN N N U   U  N  N  U U  W  2
 8 11:45  2H 3 8L16310900 -8.9 N N .271218 N RI N  N  NN N N U   U  N  N  U U  W  2
 9 11:16  3H 3 8L159 9900 -5.6 N N .321516 N RI N  N  NN N N U   U  N  N  U U  W  2
10 205A   051548 WINACA NACA TN-1904   P 6CuCbU U U    U  U    cP #0-2FFmCf        1
11 11:31  1H 1 2L14611200 -9.4 N N .381719 N RI N  N  NN N N U   U  N  N  U U  W  2
12 11:35  2H 2 6L16511200 -9.4 N N .461718 N RI N  N  NN N N U   U  N  N  U U  W  2
13 11:13  3H 1 2L142 9800 -6.7 N N .45 915 N RI N  N  NN N N U   U  N  N  U U  W  2
14 12:14  4H 1 3L17911800-10.0 N N .451217 N RI N  N  NN N N U   U  N  N  U U  W  2
15 12:40  5H 1 3L16213600-11.1 N N .541321 N RI N  N  NN N N U   U  N  N  U S-mW  2
16 206    051648aNJNACA NACA TN-1904   P 0Ac  U U U    U  U    mT PSmOf            1
17 13:33  1H 1 4L21814100 -8.3 N N .071520 N RI N  N  NN N N U   U  N  N  U U  W  2
18 13:37  2H 3 8L15814200 -7.2 N N .222021 N RI N  N  NN N N U   U  N  N  U U  W  2
19 13:45  3H 2 5L16214500 -7.8 N N .212021 N RI N  N  NN N N U   U  N  N  U U  W  2
20 207    051848wPANACA NACA TN-1904   P35CuCbU U U    U  U    cP Ny#5FCf          1
21 14:04  1H 1 3L16513600-12.8 N N 1.219 U N RI N  N  NN N N U   U  N  N  U U  W  2
22 14:07  2H 2 5L15613300-13.9 N N .8218 U N RI N  N  NN N N U   U  N  N  U U  W  2
23 14:11  3H 2 5L13913800-12.8 N N 1.119 U N RI N  N  NN N N U   U  N  N  U U  W  2
24 14:20  4H 1 3L17413600-13.9 N  N1.220 U N RI N  N  NN N N U   U  N  N  U U  W  2
25 14:22  5H 1 3L15913600-13.3 N N .781718 N RI N  N  NN N N U   U  N  N  U S-mW  2
26 14:24  6H 1 3L15313800-13.3 N N .791521 N RI N  N  NN N N U   U  N  N  U S-mW  2
27 14:29  7H 1 3L17413900-13.3 N N 1.70815 N RI N  N  NN N N U   U  N  N  U U  W  2
28 14:35  8H 1 3L18014300-15.6 N N 1.21415 N RI N  N  NN N N U   U  N  N  U U  W  2
29 14:38  9H 1 2L14814400-15.0 N N 1.01316 N RI N  N  NN N N U   U  N  N  U U  W  2
30 14:40 10H 2 5L14413300-13.3 N N 1.018 U N RI N  N  NN N N U   U  N  N  U U  W  2
31 14:44 11H 1 2L13012400-11.7 N N .751119 N RI N  N  NN N N U   U  N  N  U U  W  2
32 15:13 12H 1 3L15612200 -8.3 N N 1.01416 N RI N  N  NN N N U   U  N  N  U U  W  2
33 209    052048aCANACA NACA TN-1904   P 0ScAcU U U    U  U    Mm Hp?              1
34 18:11  1H 1 3L18912100-12.2 N N .041036 N RI N  N  NN N N U   U  N  N  U U  W  2
35 18:25  2H 4 3L189 8100 -5.0 N N .092230 N RI N  N  NN N N U   U  N  N  U S mS  2
36 18:36  3H 3 9L183 8100 -6.1 N N .211922 N RI N  N  NN N N U   U  N  N  U U  W  2
37 18:40  4H 2 6L182 8200 -6.1 N N .101516 N RI N  N  NN N N U   U  N  N  U U  W  2
38  2     112348aLENACA NACA TN-2306   P 6Sc  C U U    U  U    c  #2-4FCf          1
39 11:18  1H#2 6L166 6600 -8.3 N N .8812 U  UR  N  N  NN N   U   U U N    U U U  U 2
40 11:50  2H#2 6L174 5900 -7.2 N N .5112 U  UR  N  N  NN N   U   U U N    U U U  U 2
41 11:55  3H#3 8L167 5900 -7.2 N N .4514 U  UR  N  N  NN N   U   U U N    U U U  U 2
42 12:02  4H#2 6L167 5900 -7.2 N N .6613 N  UR  N  N  NN N   U   U U N    U U U  U 2
43 12:08  5H#2 5L163 5700 -7.2 N N .8512 U  UR  N  N  NN N   U   U U N    U U U  U 2
44 12:15  6H#2 5L163 4600 -5.6 N N .7413 U  UR  N  N  NN N   U   U U N    U U U  U 2
45  3     112348LE NACA NACA TN-2306   P 6Sc  C U U    U  U    c  #2-3FCf          1
46 12:18  1H#410L145 5100 -7.2 N N .34 9 U  UR  N  N  NN N   U   U U N    U U U  U 2
47 12:29  2H#2 5L147 4900 -7.2 N N .5213 U  UR  N  N  NN N   U   U U N    U U U  U 2
48 12:38  3H#2 5L141 5000 -7.2 N N .7414 U  UR  N  N  NN N   U   U U N    U U U  U 2
49  4     030849 LMNACA NACA TN-2306   P 6Sc  C U U    U  U    c   U               1
50 14:06  1H#514L166 5800 -3.9 N N .2114 U  UR  N  N  NN N   U   U U N    U U U  U 2
51 14:16  2H#411L172 6000 -3.9 N N .3217 U  UR  N  N  NN N   U   U U N    U U U  U 2
52 14:22  3H#3 9L172 6400 -5.0 N N .4816 U  UR  N  N  NN N   U   U U N    U U U  U 2
53 14:27  4H#514L172 6000 -3.9 N N .2616 U  UR  N  N  NN N   U   U U N    U U U  U 2
54 14:34  5H#2 5L158 6400 -5.6 N N .4912 U  UR  N  N  NN N   U   U U N    U U U  U 2
55 14:41  6H#514L172 6000 -5.0 N N .2418 U  UR  N  N  NN N   U   U U N    U U U  U 2
56 14:47  7H#411L166 5800 -5.0 N N .3813 U  UR  N  N  NN N   U   U U N    U U U  U 2
57 14:53  8H#411L158 5400 -3.9 N N .3615 U  UR  N  N  NN N   U   U U N    U U U  U 2
58 15:00  9H#411L165 5500 -5.0 N N .3319 U  UR  N  N  NN N   U   U U N    U U U  U 2
59 15:06 10H#3 8L183 5000 -3.9 N N .3815 U  UR  N  N  NN N   U   U U N    U U U  U 2
            11111111112222222222333333333344444444445555555555666666666677777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
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TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 12

```
   --------------------------Card Column No.---------------------------------------
            11111111112222222222333333333344444444445555555555666666666677777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                          Card (Record) Contents
 1 1      112248 INNACA NACA TN-2306   P 7Sc C  U   U   U  U   c 1-2WSfWkTr       1
 2 12:54  1H#617L168 5000 -7.2 N N .1614 U  UR  N  N  NN N  U   U U N    U U U  U 2
 3 13:03  2H#411L160 4500 -6.1 N N .3212 U  UR  N  N  NN N  U   U U N    U U U  U 2
 4 13:11  3H#3 8L160 4700 -6.1 N N .4112 U  UR  N  N  NN N  U   U U N    U U U  U 2
 5 13:20  4H#411L160 4500 -6.7 N N .3614 U  UR  N  N  NN N  U   U U N    U U U  U 2
 6 13:43  5H#2 6L165 5600 -6.7 N N .5012 U  UR  N  N  NN N  U   U U N    U U U  U 2
 7 13:50  6H#3 8L183 4900 -6.7 N N .4412 U  UR  N  N  NN N  U   U U N    U U U  U 2
 8 14:00  7H#2 5L160 4900 -7.2 N N .5712 U  UR  N  N  NN N  U   U U N    U U U  U 2
 9 4      030849 LMNACA NACA TN-2306   P 6Sc C  U   U   U  U   c   U              1
10 15:12 11H#3 8L164 5200 -3.9 N N .4811 U  UR  N  N  NN N  U   U U N    U U U  U 2
11 15:16 12H#617L165 5300 -3.9 N N .1619 U  UR  N  N  NN N  U   U U N    U U U  U 2
12 15:23 13H#514L165 5300 -3.3 N N .2110 U  UR  N  N  NN N  U   U U N    U U U  U 2
13 15:30 14H#617L162 6000 -5.6 N N .1820 U  UR  N  N  NN N  U   U U N    U U U  U 2
14 15:36 15H#617L162 6300 -5.6 N N .0920 U  UR  N  N  NN N  U   U U N    U U U  U 2
15 15:44 16H#411L165 5400 -4.4 N N .3716 U  UR  N  N  NN N  U   U U N    U U U  U 2
16 15:56 17H#616L180 4000 -2.8 N N .1715 U  UR  N  N  NN N  U   U U N    U U U  U 2
17 16:09 18H#410L150 3200 -2.8 N N .3715 U  UR  N  N  NN N  U   U U N    U U U  U 2
18 5      032249 LSNACA NACA TN-2306   P 6Sc C  U   U   U  U   cP 0-2NWFFmLc      1
19 12:00  1H#617L172 4200 -9.4 N N .1618 U  UR  N  N  NN N  U   U U N    U U U  U 2
20 12:06  2H#617L172 4500 -9.4 N N .1323 U  UR  N  N  NN N  U   U U N    U U U  U 2
21 12:11  3H#619L186 3800 -8.9 N N .0727 U  UR  N  N  NN N  U   U U N    U U U  U 2
22 12:16  4H#617L174 3400 -9.4 N N .1717 U  UR  N  N  NN N  U   U U N    U U U  U 2
23 12:22  5H#617L174 3700 -9.4 N N .1016 U  UR  N  N  NN N  U   U U N    U U U  U 2
24 12:37  6H#618L179 3400-10.6 N N .0612 U  UR  N  N  NN N  U   U U N    U U U  U 2
25 6      032249wLMNACA NACA TN-2306   P 6As C  U   U   U  U   c  FmCf            1
26 17:57  1H#619L190 8700 -4.4 N N .0618 U  UR  N  N  NN N  U   U U N    U U U  U 2
27 19:06  2H#619L187 9300 -5.6 N N .1816 U  UR  N  N  NN N  U   U U N    U U U  U 2
28 7      032549MSPNACA NACA TN-2306   P 8Sc C  U   U   U  U   c  #2-3FLc#Df      1
29 10:24  1H#616L159 3200 -2.8 N N .0710 U  UR  N  N  NN N  U   U U N    U U U  U 2
30 11:22  2H#2 5L161 4400 -5.0 N N .5010 U  UR  N  N  NN N  U   U U N    U U U  U 2
31 11:25  3H#513L161 4500 -6.1 N N .2714 U  UR  N  N  NN N  U   U U N    U U U  U 2
32 11:30  4H#411L160 4400 -6.7 N N .3418 U  UR  N  N  NN N  U   U U N    U U U  U 2
33 11:35  5H#514L174 4300 -6.1 N N .2813 U  UR  N  N  NN N  U   U U N    U U U  U 2
34 11:40  6H#412L174 4300 -6.1 N N .2912 U  UR  N  N  NN N  U   U U N    U U U  U 2
35 11:43  7H#411L161 4500 -5.6 N N .3615 U  UR  N  N  NN N  U   U U N    U U U  U 2
36 11:47  8H#513L161 4400 -5.6 N N .2513 U  UR  N  N  NN N  U   U U N    U U U  U 2
37 11:50  9H#616L162 4200 -4.4 N N .1714 U  UR  N  N  NN N  U   U U N    U U U  U 2
38 11:54 10H#616L162 4200 -4.4 N N .1211 U  UR  N  N  NN N  U   U U N    U U U  U 2
39 11:57 11H#513L162 4200 -4.4 N N .2312 U  UR  N  N  NN N  U   U U N    U U U  U 2
40 12:02 12H#411L165 4200 -5.6 N N .3512 U  UR  N  N  NN N  U   U U N    U U U  U 2
41 12:06 13H#3 8L165 4200 -5.6 N N .4012 U  UR  N  N  NN N  U   U U N    U U U  U 2
42 12:10 14H#3 8L167 4400 -5.0 N N .4010 U  UR  N  N  NN N  U   U U N    U U U  U 2
43 12:14 15H#513L161 4400 -5.0 N N .2211 U  UR  N  N  NN N  U   U U N    U U U  U 2
44 12:20 16H#411L161 4400 -5.0 N N .2910 U  UR  N  N  NN N  U   U U N    U U U  U 2
45 12:25 17H#411L162 4400-5.0  N N .3110 U  UR  N  N  NN N  U   U U N    U U U  U 2
46 8      032749 MNNACA NACA TN-2306   P 8Sc C  U   U   U  U   c  #1-2FFmLc       1
47 14:00  1H#513L159 3900 -5.0 N N .2514 U  UR  N  N  NN N  U   U U N    U U U  U 2
48 14:06  2H#513L157 4100 -3.9 N N .2614 U  UR  N  N  NN N  U   U U N    U U U  U 2
49 14:12  3H#4 8L159 3800 -4.4 N N .3412 U  UR  N  N  NN N  U   U U N    U U U  U 2
50 14:17  4H#513L159 3800 -4.4 N N .2517 U  UR  N  N  NN N  U   U U N    U U U  U 2
51 14:22  5H#411L162 3800 -5.6 N N .3016 U  UR  N  N  NN N  U   U U N    U U U  U 2
52 14:29  6H#411L165 3800 -5.6 N N .3612 U  UR  N  N  NN N  U   U U N    U U U  U 2
53 14:34  7H#513L164 3800 -5.6 N N .2413 U  UR  N  N  NN N  U   U U N    U U U  U 2
54 15:16  8H#616L165 3600 -3.9 N N .1118 U  UR  N  N  NN N  U   U U N    U U U  U 2
55 15:22  9H#513L154 3600 -3.3 N N .2116 U  UR  N  N  NN N  U   U U N    U U U  U 2
56 15:27 10H#513L160 3600 -5.0 N N .2213 U  UR  N  N  NN N  U   U U N    U U U  U 2
57 15:33 11H#513L155 3600 -3.3 N N .2213 U  UR  N  N  NN N  U   U U N    U U U  U 2
58 15:39 12H#513L160 3600 -5.0 N N .2414 U  UR  N  N  NN N  U   U U N    U U U  U 2
59 15:43 13H#615L155 3600 -3.3 N N .1814 U  UR  N  N  NN N  U   U U N    U U U  U 2
60 15:48 14H#616L160 3400 -3.3 N N .1412 U  UR  N  N  NN N  U   U U N    U U U  U 2

            11111111112222222222333333333344444444445555555555666666666677777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
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TABLE A 4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 13

```
   --------------------------Card Column No.---------------------------------------
            1111111111222222222233333333334444444444555555555566666666667777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                           Card (Record) Contents
 1 9      032749MSPNACA NACA TN-2306   P 8 Sc C U   U   U  U   c 1-2FFmLc         1
 2 19:13  1H*4 8L164 3400 -3.3 N N .30 8 U  UR  N  N  NN N  U   U U N    U U U  U 2
 3 19:18  2H*513L160 3600 -3.9 N N .2410 U  UR  N  N  NN N  U   U U N    U U U  U 2
 4 19:23  3H*513L161 4200 -5.0 N N .2210 U  UR  N  N  NN N  U   U U N    U U U  U 2
 5 19:28  4H*513L163 4500 -5.0 N N .2012 U  UR  N  N  NN N  U   U U N    U U U  U 2
 6 19:33  5H*513L154 4800 -3.9 N N .2310 U  UR  N  N  NN N  U   U U N    U U U  U 2
 7 19:38  6H*513L186 5400 -5.0 N N .2016 U  UR  N  N  NN N  U   U U N    U U U  U 2
 8 19:43  7H*513L160 3600 -3.9 N N .2114 U  UR  N  N  NN N  U   U U N    U U U  U 2
 9 19:48  8H*616L160 3600 -3.3 N N .1119 U  UR  N  N  NN N  U   U U N    U U U  U 2
10 19:52  9H*513L162 4300 -4.4 N N .2020 U  UR  N  N  NN N  U   U U N    U U U  U 2
11 19:59 10H*616L160 4300 -3.9 N N .1116 U  UR  N  N  NN N  U   U U N    U U U  U 2
12 10     041849MFDNACA NACA TN-2306   P 9Sc  C U   U   U  U   c *0-1FSrLc        1
13 12:24  1H*3 8L159 4500 -3.9 N N .4816 U  UR  N  N  NN N  U   U U N    U U U  U 2
14 12:29  2H*3 8L169 5000 -3.9 N N .4415 U  UR  N  N  NN N  U   U U N    U U U  U 2
15 12:34  3H*3 8L164 5000 -3.9 N N .4011 U  UR  N  N  NN N  U   U U N    U U U  U 2
16 12:50  4H*3 8L169 4800 -3.9 N N .4612 U  UR  N  N  NN N  U   U U N    U U U  U 2
17 12:40  5H*3 8L168 4700 -3.9 N N .4814 U  UR  N  N  NN N  U   U U N    U U U  U 2
18 10A    041849MFDNACA NACA TN-2306   P 9Cu  C U   U   U  U   c *U-1FSrLc        1
19 12:45  1H*2 6L169 5000 -4.4 N N .5911 U  UR  N  N  NN N  U   U U N    U U U  U 2
20 12:55  2H*2 5L163 4700 -3.9 N N .5012 U  UR  N  N  NN N  U   U U N    U U U  U 2
21 11     041949ADDNACA NACA TN-2306   P1/Sc  C U   U   U  U   cP Wy*4FFmCf       1
22 13:16  1H*3 8L168 6400 -7.8 N N .42 8 U  UR  N  N  NN N  U   U U N    U U U  U 2
23 13:50  3H*619L187 7800 -8.9 N N .19 8 U  UR  N  N  NN N  U   U U N    U U U  U 2
24 14:05  4H*412L174 7200-11.7 N N .3411 U  UR  N  N  NN N  U   U U N    U U U  U 2
25 11A    041849ADDNACA NACA TN-2306   P1/Cu  C U   U   U  U   cP Wy*4FFmCf       1
26 14:24  5H*2 6L174 7200-11.7 N N .7011 U  UR  N  N  NN N  U   U U N    U U U  U 2
27 13:32  2H*514L182 7500 -8.3 N N 1.3 5 U  UR  N  N  NN N  U   U U N    U U U  U 2
28 12     052749 LENACA NACA TN-2306   P 6AcAsC U   U   U  U   cP  U              1
29 14:53  1H*621L211 7600 -7.2 N N .1612 U  UR  N  N  NN N  U   U U N    U U U  U 2
30 15:08  2H*518L211 8800 -9.4 N N .24 7 U  UR  N  N  NN N  U   U U N    U U U  U 2
31 15:17  3H*621L211 9000 -9.4 N N .0014 U  UR  N  N  NN N  U   U U N    U U U  U 2
32 13     120749CLENACA NACA TN-2306   P 6Sc  C U   U   U  U   cP *0-2FFmCf       1
33 13:54  1H*413L188 5000-10.6 N N .3114 U  UR  N  N  NN N  U   U U N    U U U  U 2
34 14     011950DRFNACA NACA TN-2306   P 0St  C U   U   U  U   *a *2FSmCf         1
35 16:05  1H*618L180 3000 -1.0 N N .1314 U  UR  N  N  NN N  U   U U N    U U U  U 2
36 15     013050CLENACA NACA TN-2306   P 6Sc  C U   U   U  U   cP Hp              1
37 12:45  1H*617L167 4000-11.7 N N .06 9 U  UR  N  N  NN N  U   U U N    U U U  U 2
38 16     013150CLENACA NACA TN-2306   P 6Sc  C U   U   U  U   c *3W&FWkLc        1
39 11:58  1H*617L176 2000 -3.9 N N .15 914  UR  N  N  NN N  U   U U N    U U U  U 2
40 12:15  2H*515L176 2000 -6.1 N N .26 914  URF N  N  NN N  U   U U N    U U U  U 2
41 12:24  3H*515L176 3000 -6.7 N N .2310 U  U R N  N  NN N  U   U U N    U U U  U 2
42 17     020750CLENACA NACA TN-2306   P 6Sc  C U   U   U  U   c HpR              1
43 10:59  1H*514L171 3000 -5.6 N N .24 716  URF N  N  NN N  U   U U N    U U U  U 2
44 11:07  2H*618L180 3000 -6.1 N N .18 718  URF N  N  NN N  U   U U N    U U U  U 2
45 11:18  3H*618L180 3000 -6.7 N N .17 913  URF N  N  NN N  U   U U N    U U U  U 2
46 11:38  4H*515L180 3000 -6.7 N N .29 918  URF N  N  NN N  U   U U N    U U U  U 2
47 11:44  5H*515L180 3000 -6.1 N N .29 919  URF N  N  NN N  U   U U N    U U U  U 2
48 18     020750 OHNACA NACA TN-2306   P 6Sc  C U   U   U  U   c Hp3-4FFmCf       1
49 15:08  1H*3 9L181 3700 -7.2 N N .40 715  URF N  N  NN N  U   U U N    U U U  U 2
50 15:25  2H*618L181 3700 -7.2 N N .10 8 U  UR  N  N  NN N  U   U U N    U U U  U 2
51 15:46  3H*515L185 3700 -5.0 N N .26 815  URF N  N  NN N  U   U U N    U U U  U 2
52 15:51  4H*514L167 3700 -5.6 N N .25 816  URF N  N  NN N  U   U U N    U U U  U 2
            1111111111222222222233333333334444444444555555555566666666667777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
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TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)

Data File No. 14

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   ---------------------------Card Column No.--------------------------------------
            11111111112222222222333333333344444444445555555555666666666677777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                           Card (Record) Contents
 1 19     020950cOHNACA NACA TN-2306   P115c C  U   U   U  U   c  #0-1FFmCf       1
 2 14:43  1H#618L183 3700 -2.8 N N .121017  URF N  N  NN N  U   U U N    U U U  U 2
 3 14:54  2H#3 9L176 2700 -3.3 N N .45 820  URF N  N  NN N  U   U U N    U U U  U 2
 4 14:58  3H#3 9L176 2700 -3.9 N N .46 921  URF N  N  NN N  U   U U N    U U U  U 2
 5 15:12  4H#412L165 2600 -3.3 N N .33 816  URF N  N  NN N  U   U U N    U U U  U 2
 6 15:23  5H#412L188 2800 -3.9 N N .381126  URF N  N  NN N  U   U U N    U U U  U 2
 7 15:31  6H#2 6L171 2800 -3.9 N N .60 824  URF N  N  NN N  U   U U N    U U U  U 2
 8 15:38  7H#2 6L171 2800 -4.4 N N .52 924  URF N  N  NN N  U   U U N    U U U  U 2
 9 15:44  8H#412L187 2000 -2.8 N N .31 6 U  UR  N  N  NN N  U   U U N    U U U  U 2
10 20     021050MFDNACA NACA TN-2306   P13Sc U  U   U   U  U   c  ?,0Pg           1
11 14:18  1H#515L179 3700 -4.4 N N .241016  URF N  N  NN N  U   U U N    U U U  U 2
12 14:23  2H#412L173 4000 -5.6 N N .39 920  URF N  N  NN N  U   U U N    U U U  U 2
13 14:23  3H#3 9L176 3500 -6.1 N N .42 817  URF N  N  NN N  U   U U N    U U U  U 2
14 21     032350cOHNACA NACA TN-2306   P10Sc C  U   U   U  U   c  #3-4FSrLc       1
15 13:02  1H#513L157 4000 -2.8 N N .241128  URF N  N  NN N  U   U U N    U U U  U 2
16 13:09  2H#615L151 4200 -3.3 N N .1612 U  UR  N  N  NN N  U   U U N    U U U  U 2
17 22     032950wWVNACA NACA TN-2306   P 9bc C  U   U   U  U   cP +-0-1Cf         1
18 10:31  1H#411L172 7000-12.2 N N .301119  URF N  N  NN N  U   U U N    U U U  U 2
19 10:40  2H#2 5L164 7000-11.1 N N .50 823  URF N  N  NN N  U   U U N    U U U  U 2
20 10:44  3H#411L163 7000 -12. N N .3114 U  URF N  N  NN N  U   U U N    U U U  U 2
21 10:49  4H#618L163 7000-12.2 N N .1410 U  UR  N  N  NN N  U   U U N    U U U  U 2
22 10:56  5H#411L163 7000-11.7 N N .321422  URF N  N  NN N  U   U U N    U U U  U 2
23 11:03  6H#411L169 7000-11.7 N N .331018  URF N  N  NN N  U   U U N    U U U  U 2
24 11:10  7H#2 5L164 7000-11.1 N N .5310 U  UR  N  N  NN N  U   U U N    U U U  U 2
25 11:15  8H#411L173 7000-10.6 N N .351115  URF N  N  NN N  U   U U N    U U U  U 2
26 11:23  9H#3 9L173 7000-10.6 N N .4311 U  UR  N  N  NN N  U   U U N    U U U  U 2
27 11:37 10H#411L173 7000-10.0 N N .3811 U  UR  N  N  NN N  U   U U N    U U U  U 2
28 F42    041346nUTNACA NACA TN-1393   P MCu I  U   U   U  U   U  #0-2FCf         1
29 1450+129H5 12V13911614V0408 N N .1606 U U R  N  N  NN N N  N  N  N  N  N U mW  2
30 1540+129H 1 2V13911614V0408 N N .3 05 U U R  N  N  NN N N  N  N  N  N  N U mW  2
31 196    041948sWYNACA NACA TN-1904   P MAc U  U   U   U  U   cP EWPg#4FCf       1
32 09:29  1H 612L11513400-11.7 N N .181517 U RI  N  N  NN NU  U   U  N U   U U  W  2
33 09:43  2H 619L19213800-15.0 N N .0915 U U RI  N  N  NN NU  U   U  N U   U S mS  2
34 09:51  3H 3 8L16213700-14.4 N N .2823 U U RI  N  N  NN NU  U   U  N U   U S-mW  2
35 10:03  4H 1 3L17613700-15.0 N N .332127 N RI  N  N  NN N N U   U  N  N  U U  W  2
36 10:12  5H 2 6L17813700-14.4 N N .182123 N RI  N  N  NN N N U   U  N  N  U S-mW  2
37 10:16  6H 3 8L15412800-11.1 N N .2825 U N RI  N  N  NN N N U   U  N  N  U S-mW  2
38 10:25  7H 1 3L16312600-10.6 N N .121418 N RI  N  N  NN N N U   U  N  N  U U  W  2
            11111111112222222222333333333344444444445555555555666666666677777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
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TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 15

```
   --------------------------Card Column No.---------------------------------------
            111111111122222222223333333333444444444455555555556666666666777777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                         Card (Record) Contents
 1 A711AC1020679MSP MRI MRI 79 DV-1679 P 7 St B  U  U    U  U   eP U              1
 2 12:44  1J 2 3L 90 4900-10.4 N N .03122464  A N  N  NN N.03 U  RO  U U  10 U U  2
 3 12:47  2A 4 6L 90 4950-10.6 N N .06223616  A N  N  NN N.05 U  RO  X U  10 U U  2
 4 12:54  3G 2 3L 90 5100-10.4 N N .07233313  A N  N  NN N.04 U  RO  U U  10 U U  2
 5 12:56  4D 4 6L 85 5150-10.2 N N .17213363  A N  N  NN N.10 U  RO.12 U  10 U U  2
 6 13:01  5D 710L 85 5150 -9.5 N N .08152795  A N  N  NN N.05 U  RO.07 U  10 U U  2
 7 13:08  6A 913L 85 5250 -9.3 N N .19213864  A N  N  NN N.10 U  RO.13 U  10 U U  2
 8 A711AC2020679MSP MRI MRI 79 DV-1679 P 7 St B  U  U    U  U   eP U              1
 9 13:19  1J1522L 90 5000-10.3 N N .171933 77 A N  N  NN N.08 U  RO.11 U  10 U U  2
10 13:37  2J 4 6L 90 5000-11.5 N N .05 927219 A N  N  NN N.02 U  RO.06 U  10 U U  2
11 13:43  3A 6 9L 88 4900-11.3 N N .06 818245 A N  N  NN N.03 U  RO.04 U  10 U U  2
12 A1518C1021379MSP MRI MRI 79 DV-1679 P 7NCStC  U  U    U  U  e    Hp            1
13 14:19  1G1216L 82 5450 -5.4 N N .151424160 A N  N  NN N.13 U  RO.15 U  10 U U  2
14 14:31  2G 5 7L 82 5400 -5.6 N N .141118270 A N  N  NN N.11 U  RO.13 U  10 U U  2
15 14:36  3A1520L 82 5500 -5.4 N N .151324195 A N  N  NN N.11 U  RO.13 U  10 U U  2
16 A1518C2021379MSP MRI MRI 79 DV-1679 P 7NCStC  U  U    U  U  e    Hp            1
17 14:56  1A3445L 80 5400 -5.2 N N .111121195 A N  N  NN N.07 U  RO.09 U  10 U U  2
18 A1418C1021379MSP MRI MRI 79 DV-1679 P 7NCStC  U  U    U  U  e    Hp            1
19 10:44  1J1320L 80 4950 -5.5 N N .062030 34 A N  N  NN N.10 U  RO.10 U  10 U U  2
20 10:58  2A1216L 82 5300 -5.6 N N .071021178 A N  N  NN N.09 U  RO.12 U  10 U U  2
21 A1418C2021379MSP MRI MRI 79 DV-1679 P 7NCStC  U  U    U  U  e    Hp            1
22 11:14  1D1826L 88 5400 -5.6 N N .101127201 A N  N  NN N.12 U  RO.13 U  10 U U  2
23 11:32  2A 3 5L 90 5200 -6.8 N N .171836132 A N  N  NN N.17 U  RO.20 U  10 U U  2
24 A1720C1021579MSP MRI MRI 79 DV-1679 P 7 St B  U  U    U  U  e  NWPgRAHe        1
25 11:33  1J 2 3L 80 8000 -9.0 N N .083042 81 A N  N  NN N.07 U  RO  N N  N  U U  2
26 A1720C1021579MSP MRI MRI 79 DV-1679 P 7 St C  U  U    U  U  e  NWPgRAHe        1
27 11:37  2G 3 4L 80 8000 -8.8 N N .112136 48 A N  N  NN N.08 U  RO.08 U  10 U U  2
28 11:40  3D 4 5L 8010000 -9.1 N N .111936 75 A N  N  NN N.06 U  RO.08 U  10 U U  2
29 11:44  4G 5 7L 80 8980 -8.2 N N .122236 52 A N  N  NN N.09 U  RO.10 U  10 U U  2
30 11:50  5G 1 2L 80 8980 -8.2 N N .081830122 A N  N  NN N.06 U  RO.08 U  10 U U  2
31 11:51  6G 3 4L 82 9000 -7.8 N N .052133 46 A N  N  NN N.03 U  RO.06 U  10 U U  2
32 11:54  7G 1 2L 82 9000 -7.6 N N .081730132 A N  N  NN N.06 U  RO.04 U  10 U U  2
33 11:55  8G 2 3L 81 9000 -7.6 N N .132033 56 A N  N  NN N.09 U  RO.09 U  10 U U  2
34 11:58  9G 6 8L 80 9050 -7.9 N N .141833 85 A N  N  NN N.09 U  RO.12 U  10 U U  2
35 12:05 10A 5 7L 80 8950 -8.0 N N .082136 53 A N  N  NN N.07 U  RO.09 U  10 U U  2
36 A1720C2021579MSP MRI MRI 79 DV-1679 P 7 St C  U  U    U  U  e  NWPgRAHe        1
37 12:12  1A1826L 82 8030 -8.9 N N .102436 53 A N  N  NN N.06 U  RO.09 U  10 U U  2
38 A2329CA031079SYR MRI MRI 79 DV-1679 P 4St  B 62 -2.7  U  U  e  Of              1
39 09:46  1G 3 4L 71 8000 -6.4.4112.421421351 A N  N  NN N.40 U  RO.43 U  10 U U  2
40 09:49  2A 2 3L 80 7630 -6.0.1212.121221180 A N  N  NN N.08 U  RO  X U  10 U U  2
41 10:00  3D 4 5L 82 7660 -6.2.2212.251321350 A N  N  XN N.20 U  RO.20 U  10 U U  2
42 10:03  4D 912L 82 7660 -5.4.2712.331633266 A N  N  XN N.25 U  RO.30 U  10 U U  2
43 10:12  5A 311L 82 7500 -5.3.2612.251321283 A N  N  XN N.20 U  RO.24 U  10 U U  2
44 10:26  6E1318L 82 7600 -5.3.2112.241421280 A N  N  XN N.15 U  RO.19 U  10 U U  2
45 10:39  7E 1 1L 30 6900 -4.1.1112.041018139 A N  N  XN N.04 U  RO  X U  10 U U  2
46 10:40  8A 1 1L 90 6200 -2.7.0412.02 712119 A N  N  0N N.01 U  RO  X U  10 U U  2
47 A2022CA022079MSP MRI MRI 79 DV-1679 P 7St  C  U  U    U  U  e  #1NWkLe         1
48 13:35  1D 812L 88 2750 -2.5 N N .171933132 A N  N  NN N.20 U  RO  X U  10 U U  2
49 13:43  2D 812L 88 2860 -2.8 N N .151424191 A N  N  NN N.17 U  RO  X U  10 U U  2
50 13:50  3A 2 3L 88 2600 -2.8 N N .071224178 A N  N  NN N.08 U  RO  X U  10 U U  2
51 16:42  052280oWA MRI MRI 80 FR-1766 P 0 Cu 5#35 #0   100  U  mP  #5FCf         1
52 16:42  1A 3 9L18010000-11.0.32JW.3221 U106 F N  N  NN N  N  N  N  N  N N U  U  2
53 17:08  2A 618L175 8000 -8.0.05JW.1119 U 55 F N  N  NN N  N  N  N  N  N N  U U  2
54 17:17  3A 412L175 7800 -7.5.10JW.1721 U 58 F N  N  NN N  N  N  N  N  N N  U U  2
            111111111122222222223333333333444444444455555555556666666666777777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 10

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   --------------------------Card Column No.---------------------------------------
            11111111112222222222333333333344444444445555555555666666666677777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                           Card (Record) Contents
 1 17:03  052380wWA MRI MRI 80 FR-1/66 P 0 Cu S U  U     U  U  mP  UpLo           1
 2 17:14  1A 1 3L180 8800 -8.4.36JW.4619 U182 F N  N  NN N N  N  N  N  N  N U  U  2
 3 17:17  2A 2 6L175 8700 -7.5.45JW.4518 U197 F N  N  NN N N  N  N  N  N  N U  U  2
 4 17:20  3A 2 6L170 8800 -7.2.23JW.2417 U150 F N  N  NN N N  N  N  N  N  N U  U  2
 5 17:21  4A 1 3L190 8700 -7.5.69JW.4417 U248 F N  N  NN N N  N  N  N  N  N U  U  2
 6 17:31  5B 412L175 7400 -4.5 X JW.3216 U254 F N  N  NN N N  N  N  N  N  N U  U  2
 7 17:35  6E 3 9L175 7700 -3.2 X JW.1114 U183 F N  N  NN N N  N  N  N  N  N U  U  2
 8 17:37  7A 2 6L175 8300 -3.5 X JW.0613 U132 F N  N  NN N N  N  N  N  N  N U  U  2
 9 09:16  040180cKS MRI MRI 80 FR-1766 P325tSoÜ U  U     U  U  o  Lo}1NLo         1
10 09:16  1G 618L175 9000 -8.3 N N .1316 U118 F N  N  NN N N  N  N  N  N  N U  U  2
11 09:23  2G 3 9L175 9200 -8.5 N N .2616 U258 F N  N  NN N N  N  N  N  N  N U  U  2
12 09:28 2AE 1 3L18010300 -9.2 N N .1415 U145 F N  N  NN N N  N  N  N  N  N U  U  2
13 09:29  3E 2 6L18511100-10.5 N N .0524 U 36 F N  N  NN N N  N  N  N  N  N U  U  2
14 09:31  4G 2 6L17510100-10.5 N N .0826 U 49 F N  N  NN N N  N  N  N  N  N U  U  2
15 09:32  5G 1 3L18010300-10.3 N N .2225 U125 F N  N  NN N N  N  N  N  N  N U  U  2
16 09:33  6J 2 6L18510200-10.4 N N .0924 U 58 F N  N  NN N N  N  N  N  N  N U  U  2
17 09:36  7A 1 3L18010000 -9.6 N N .0627 U 27 F N  N  NN N N  N  N  N  N  N U  U  2
18 14:23  040180cNB MRI MRI 80 FR-1766 P325tSoC U  U     U  U  o  #<2NWLo         1
19 14:23  1E 411L165 7400 -4.4.10JW.1215 U176 F N  N  NN N N  N  N  N  N  N U  U  2
20 14:29  2A 2 6L175 7000 -4.2.06JW.0207 U162 F N  N  NN N N  N  N  N  N  N U  U  2
21 14:52  3P N NP155 6800 -4.5.10JW.1615 U172 F N  N  NN N N  N  N  N  N  N U  U  2
22 14:53  4P N NP155 6300 -3.8.10JW.1214 U143 F N  N  NN N N  N  N  N  N  N U  U  2
23 14:54  5P N NP155 5800 -2.6.12JW.0913 U130 F N  N  NN N N  N  N  N  N  N U  U  2
24 14:56  6H 411L180 6500 -4.0.13JW.0915 U154 F N  N  NN N N  N  N  N  N  N U  U  2
25 15:01  7D 3 8L180 6600 -4.3.15JW.0711 U216 F N  N  NN N N  N  N  N  N  N U  U  2
26 15:03  8A 2 6L170 6500 -3.6.13JW.0307 U253 F N  N  NN N N  N  N  N  N  N U  U  2
27 00:42  123179wOR MRI MRI 80 FR-1739 P 75o  U b/ -4.0167 U   mP 3FCf&Üf         1
28 00:42  1A 617L165 8100 -4.6 N N .2232 U 29 F N  N  NN N N  N  N  N  N  N U  U  2
29 00:51  2G 1 3L180 9800 -6.0 N N .3131 U 45 F N  N  NN N N  N  N  N  N  N U  U  2
30 00:52  3A1030L180 9800 -4.5 N N .1028 U 16 F N  N  NN N N  N  N  N  N  N U  U  2
31 01:07  4J 1 3L18511900 -5.9 N N .0929 U 13 F N  N  NN N N  N  N  N  N  N U  U  2
32 01:10  5E 2 6L18511400 -7.5 N N .1030 U 15 F N  N  NN N N  N  N  N  N  N U  U  2
33 F372   010280PAE MRI MRI 80 FR-1739 P 75t  8 55 U   130 U   mP #<1FCf          1
34 13:48  1P N NP13011000-10.6 N N .0215 U 22 F N  N  NN N N  N  N  N  N  N U  U  2
35 13:49  2P N NP13111950-13.0 N N .0620 U 27 F N  N  NN N N  N  N  N  N  N U  U  2
36 13:50  3P N NP13512550-14.2 N N .1322 U 45 F N  N  NN N N  N  N  N  N  N U  U  2
37 13:51  4J 3 9L17512800-14.5 N N .0926 U 22 F N  N  NN N N  N  N  N  N  N U  U  2
38 13:57  5J 2 6L18512700-14.9 N N .2834 U 32 F N  N  NN N N  N  N  N  N  N U  U  2
39 14:02  6J 2 6L18012800-15.0 N N .2033 U 27 F N  N  NN N N  N  N  N  N  N U  U  2
40 14:04  7J 1 3L18012800-14.8 N N .2834 U 28 F N  N  NN N N  N  N  N  N  N U  U  2
41 14:06  8J 2 6L18012500-13.7 N N .1225 U 24 F N  N  NN N N  N  N  N  N  N U  U  2
42 14:11  9J 1 3L17012700-14.0 N N .0617 U 70 F N  N  NN N N  N  N  N  N  N U  U  2
43 14:17 10J 2 6L18812800-15.8 N N .1633 U 22 F N  N  NN N N  N  N  N  N  N U  U  2
44 14:31 11D 2 6L19012800-15.5 N N .0828 U 22 F N  N  NN N N  N  N  N  N  N U  U  2
45 14:33 12D 3 9L18512400-14.8 N N .5433 U 58 F N  N  NN N N  N  N  N  N  N U  U  2
46 14:37 13H 514L17012700-15.3 N N .1324 U 65 F N  N  NN N N  N  N  N  N  N U  U  2
            11111111112222222222333333333344444444445555555555666666666677777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
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TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 17

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     ----------------------------Card Column No.-----------------------------------
              11111111112222222222333333333344444444445555555555666666666677777777778
     12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                              Card (Record) Contents
  1 F377   020180wWA MRI MRI 80 FR-1739 P 65t  C 50 #0  128-10.5mP #>4FWf           1
  2 10:45  1A 412L18010300 -6.2 N N .1128 U 18 F N   N  NN N N  N  N  N  N  N U  U  2
  3 11:16  2A 1 3L188 9900 -5.7 N N .0827 U 13 F N   N  NN N N  N  N  N  N  N U  U  2
  4 11:36  3P N NU20012200-10.2 N N .1722 U 44 F N   N  NN N N  N  N  N  N  N U  U  2
  5 11:37  4P N NU20011000 -7.5 N N .0622 U 20 F N   N  NN N N  N  N  N  N  N U  U  2
  6 11:37  5P N NU20010200 -5.1 N N .0923 U 35 F N   N  NN N N  N  N  N  N  N U  U  2
  7 11:38  6P N NU180 9100 -3.8 N N .0524 U 15 F N   N  NN N N  N  N  N  N  N U  U  2
  8 11:42  7J 3 9L180 9900 -4.4 N N .1723 U 45 F N   N  NN N N  N  N  N  N  N U  U  2
  9 11:49  8A 3 9L175 9900 -2.4 N N .1725 U 37 F N   N  NN N N  N  N  N  N  N U  U  2
 10 F381   021480FLG MRI MRI 80 FR-1739 P MUrLnC140 -7.0 U  U   Mm 4A&ELc&SCf       1
 11 11:01  1G 3 8L15514900 -9.0 N N .5023 U108 F N   N  NN N N  N  N  N  N  N 0  U  2
 12 11:05 2aD 1 3L15015100 -8.3 N N .3421 U100 F N   N  NN N N  N  N  N  N  N 0  U  2
 13 11:06 2bG 1 3L15515100 -7.6 N N .6725 U144 F N   N  NN N N  N  N  N  N  N 0  U  2
 14 11:07 2cJ 1 3L16015200 -5.6 N N .8527 U380 F N   N  NN N N  N  N  N  N  N 0  U  2
 15 11:12  3H 1 3L16015200 -3.9 N N .8531 U187 F N   N  NN N N  N  N  N  N  N 0  U  2
 16 F381a  021480cAZ MRI MRI 80 FR-1739 P MCb  U#8U#+4.  U  U   Mm 4A&ELc&SCF       1
 17 11:48  4J 515L18510100 -0.4 N N .2630 U 43 F N   N  NN N N  N  N  N  N  N R  U  2
 18 11:54  5A 2 8L18510100 -0.1 N N .4026 U 73 F N   N  NN N N  N  N  N  N  N R  U  2
 19 10:57  052280oWA MRI MRI 80 FR-1766 P 0Cu  S#35 #0  100  U  mP  #5FCf          1
 20 10:57  1A.3 1L175 8300 -7.8.90JW.7722 U236 F N   N N N N N  N  N  N  N  N #S U  2
 21 10:58  2A.3 1L165 8300 -7.7.42JW.5623 U150 F N   N N N N N  N  N  N  N  N #S U  2
 22 10:59  3A.3 1L181 8100 -6.8.68JW.8223 U229 F N   N N N N N  N  N  N  N  N #S U  2
 23 11:00  4A 1 3L174 8100 -5.7.66JW.6023 U186 F N   N N N N N  N  N  N  N  N #S U  2
 24 11:02  5H.3 1L163 8000 -4.2.69JW.7223 U226 F N   N N N N N  N  N  N  N  N #S U  2
 25 11:27  6A.3 1L18510100-10.8 X JW.3121 U208 F N   N N N N N  N  N  N  N  N #S U  2
 26 11:29  7A.3 1L18310000-10.2 W JW.1416 U186 F N   N N N N N  N  N  N  N  N #S U  2
 27 11:30  8H.3 1L18010200 -8.9 W JW.1215 U212 F N   N N N N N  N  N  N  N  N #S U  2
 28 12:26  9A.3 1L18711900-16.8 X JW.6523 U155 F N   N N N N N  N  N  N  N  N #S U  2
 29 12:28 10A.6 2L18411800-15.7 X JW.7025 U130 F N   N N N N N  N  N  N  N  N #S U  2
 30 12:30 11A.3 1L18011700-13.7 X JW.5923 U113 F N   N N N N N  N  N  N  N  N #S U  2
 31 12:31 12A.3 1L17711800-12.8 X JW.5423 U130 F N   N N N N N  N  N  N  N  N #S U  2
 32 12:34 13A.3 1L19211600-13.7 X JW.7724 U277 F N   N N N N N  N  N  N  N  N #S U  2
 33 12:36 14G.2.6L17011100-10.5 X JW1.124 U369 F N   N N N N N  N  N  N  N  N #S U  2
 34 12:37 15A.6 2L18011300-13.0 X JW1.324 U537 F N   N N N N N  N  N  N  N  N #S U  2
 35 11:26  052480AST MRI MRI 80 FR-1766 P 0Cu  S U  U     U  U   mP EWPgAHc          1
 36 11:26  1A.3 1L172 7800 -4.6.60JW1.121 U269 F N   N N N N N  N  N  N  N  N  U U  2
 37 11:27  2A.6 2L180 7700 -4.3.35JW.5021 U140 F N   N N N N N  N  N  N  N  N  U U  2
 38 11:28  3A.6 2L176 7800 -4.3.38JW.5321 U139 F N   N N N N N  N  N  N  N  N  U U  2
 39 11:29  4A.3 1L173 7800 -4.1.55JW.9021 U245 F N   N N N N N  N  N  N  N  N  U U  2
 40 11:31  5A.3 1L173 7500 -3.8.44JW.7321 U200 F N   N N N N N  N  N  N  N  N  U U  2
 41 11:32  6A.3 1L171 7300 -3.8.28JW.4720 U160 F N   N N N N N  N  N  N  N  N  U U  2
 42 11:33  7A.3 1L159 7800 -3.9.47JW.7621 U188 F N   N N N N N  N  N  N  N  N  U U  2
 43 11:38  8A.3 1L160 7300 -4.0.54JW.8721 U223 F N   N N N N N  N  N  N  N  N  U U  2
 44 11:40  9A.6 2L178 7300 -3.9.37JW.5021 U155 F N   N N N N N  N  N  N  N  N  U U  2
 45 11:41 10A.3 1L178 7300 -4.2.33JW.4520 U180 F N   N N N N N  N  N  N  N  N  U U  2
 46 11:42 11A.3 1L181 7800 -4.8.60JW.7221 U190 F N   N N N N N  N  N  N  N  N  U U  2
 47 11:43 12A.3 1L155 7300 -3.5.53JW.8721 U208 F N   N N N N N  N  N  N  N  N  U U  2
 48 11:48 13A 3 9L165 7200 -3.8.34JW.6422 U172 F N   N N N N N  N  N  N  N  N  U U  2
 49 11:52 14A 2 6L160 7600 -4.8.60JW.6522 U166 F N   N N N N N  N  N  N  N  N  U U  2
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     12345678901234567890123456789012345678901234567890123456789012345678901234567890
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TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 18

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    ---------------------------Card Column No.----------------------------------------
              1111111111222222222233333333334444444444555555555566666666667777777777778
    12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                              Card (Record) Contents
 1 Cloud1 120380cLM UWY Priv Comm 5/81 S 6 *ScC 16 -7.3 39-10.8 cPHp,LeCldCOLM,I391
 2 13:53 A1J 822L157 3460-10.6.20JW.311317131 F .8.06<1 NN N  8c RO m   N  CS U U  2
 3 14:29 B3J 412L163 2410 -8.4.06JW.071012132 F .6.19*3 NN N  3c RO m   N  CS U U  2
 4 150012C1P N NP155 3590-10.6.13JW.1814 m109 F .3 0  0 NN N  U  RO.09 N  CS U U  2
 5 150048C2P N NP157 3050 -9.9.19JW.1814 m145 F .5 .1 1 NN N *6c RO.17 N  CS U U  2
 6 150124C3P N NP152 2615 -9.0.11JW.1011 m144 F .7 .1 1 NN N *4c RO.13 N  CS U U  2
 7 150218C4P N NP145 2285 -8.2.03JW.04 8 m123 F .9 .2 3 NN N *2c RO.06 N  CS U U
 8 150318C5P N NP149 2830 -9.0.17JW.1612 m153 F .5 .1 0 NN N *6c RO.17 N  CS U U
 9 150336C6P N NP150 3235 -9.7.16JW.1613 m128 F .8 .1 0 NN N *6c RO.17 N  CS U U
10 150400C7P N NP139 3870-10.8.25JW.2416 m122 F .8 .1 0 NN N *6c RO.26 N  CS U U  2
11 15:26 D3D 1 2L166 2945 -8.8.05JW.07 9 m144 F .4 .1<1 NN N  4c RO m   N  CS U U  2
12 15:27 D4G 3 9L161 2940 -8.7.11JW.141214143 F .5 .1<1 NN N  5c RO m   N  CS U U  2
13 153148E1P N NP163 2670 -8.7.12JW.1210 m214 F  1 .3 3 NN N *6c RO.13 N  CS U U  2
14 153224E2P N NP164 2140 -7.9.09JW.06 7 m285 F  1 .4 5 NN N *3c RO.09 N  CS U U  2
15 153254E3P N NP166 1680 -7.3.01JW.03 6 m238 F  1 .3 2 NN N *2c RO.05 N  CS U U  2
16 Cloud2 120380cLM UWY Priv Comm 5/81 S 6 *ScB*16*-7.3 35-10.5 cPHp,LeCldCOLM,I351
17 14:02 A2G 2 5L166 3460-10.4.29JW.2513 m244 F .6.05<1 NN N 15c RO m   N  CS U U  2
18 14:04 A3A 2 5L163 3440-10.5.13JW.1110 m175 F .0.01<1 NN N  4c RO m   N  CS U U  2
19 15:20 D1J 1 2L170 2945 -9.3.07JW.03 6 9190 F .1 0  0 NN N  0  RO.02 N  CS U U  2
20 15:22 D2J 1 2L168 2925 -9.1.07JW.04 7 9147 F .1 0  0 NN N  0  RO.01 N  CS U U  2
21 Cloud3 120380cLM UWY Priv Comm 5/81 S 6 *ScC 16 -7.3*33*-9.9 cP Hp,LeCldCOLM,I?1
22 14:35 B4G 1 4L166 2410 -9.6.03JW.05 811125 F .5.15*3 NN N <1c RO.07 N  CS U U  2
23 14:37 B5A.6 2L163 2420-10.1.02JW.03 710134 F .4 .1*1 NN N <1c RO.05 N  CS U U  2
24 153554E6P N NP134 1550 -7.6  0JW.02 5 m270 F .8 .2 0 NN N  0  RO 0  N  CS U U  2
25 153612E7P N NP128 2015 -8.5.01JW.04 6 m284 F .5 .2 1 NN N  0  RO.03 N  CS U U  2
26 153642E8P N NP139 2525 -9.2.05JW.07 8 m224 F .8 .1 1 NN N <1c RO.06 N  CS U U  2
27 15:37 E9A 2 6L162 2925 -9.7.09JW.04 813131 F .3  0<1 NN N  2c RO.08 N  CS U U  2
28 Cloud1 121080cLM UWY Priv Comm 5/81 S 6 Sc B*22 *-8  50-14.0cP Hp*4FCf,I50     1
29 15:35 A1J 3 7L159 4830-14.1.34JW.2710 m460 F .8.14 0 NN N  9c RO.25 N  CS U U  2
30 15:39 A2J.8 2L158 4870-14.1.29JW.2510 m450 F .7.1  0 NN N  7c RO.22 N  CS U U  2
31 15:43 A3A.8 2L159 4820-13.6.32JW.2410 m470 F1.4.25<1 NN N  7c RO.25 N  CS U U  2
32 Cloud2 121080cLM UWY Priv Comm 5/81 S 6 Sc B 23 -8.9 46-13.4cP Hp*4FCf,I46     1
33 154730B1P N NS158 4555-13.3.20JW.16 9 m384 F .3 0  0 NN N *6c RO.10 N  CS U U  2
34 154818B2P N NS162 4050-12.1.34JW.3110 m553 F .2 0  0 NN N *6c .3.31 N  CS U U  2
35 15:49 B4J 1 3L158 3860-12.0.09JW.06 7 m238 F1.4.2  1 NN N  3c RO.07 N  CS U U  2
36 15:51 B6E 923L154 3800-11.9.21JW.20 9 m513 F1.6.3  m NN N  6c RO  m N  CS U U  2
37 160106B7P N NS154 3280-11.0.08JW.12 8 m508 F2.2.6 12 NN N *2c RO.14 N  CS U U  2
38 160130B8P N NS160 2785-10.0 0 JW.05 6 m410 F2.0.7  9 NN N *2c RO.07 N  CS U U  2
39 160218B9P N NS168 2445 -9.2.02JW.02 5 m163 F1.9.5  8 NN N  0c RO.02 N  CS U U  2
40 160536C1P N NS140 2515 -9.6 0 JW.02 6 m208 F2.1.5  3 NN N  0c RO.04 N  CS U U  2
41 160600C2P N NS149 3045-10.9.11JW.09 7 m575 F1.5.4  0 NN N *3c RO.13 N  CS U U  2
42 16:06 C4E 615L155 3330-11.3.22JW.21 9 m560 F .7.2 <1 NN N  6c RO  m N  CS U U  2
43 16:13 C6E 3 7L155 2795 -9.1.23JW.16 8 m590 F1.0.2  2 NN N  6c RO  m N  CS U U  2
44 161624C7P N NP165 2395 -8.0.14JW.07 6 m471 F1.4.3 *2 NN N *3c RO.11 N  CS U U  2
45 Cloud1 121380MKG UWY Priv Comm 5/81 S 6 Sc C 44-15.4 56-17.4cA Hp*6FFmCf,I56   1
46 163954A1P N NP172 4475-15.5.03JW.01 7 m108 F1.1 .3 0 NN N  0  RO 0  N  CS U U  2
47 164042A2P N NP166 5025-16.2.28JW.2413 m204 F1.2 .3 0 NN N *15cRO.20 N  CS U U  2
48 164136A3P N NP158 5545-17.4.42JW.3815 m207 F1.0 .2 0 NN N  X  RO.28 N  CS U U  2
49 164836B1P N NP178 5335-17.6.11JW.1213 m105 F .7 .2 0 NN N *6c RO.09 N  CS U U  2
50 16:49 B3E 411L166 4745-16.1.07JW.0910 m155 F1.5 .4 m NN N 3.4cRO m   N  CS U U  2
51 Cloud3 121380MKG UWY Priv Comm 5/81 S 6 Sc B 41-14.5*50*-17 cA Hp*6FFmCf      1
52 180754C1P N NP164 4070-14.7.09JW.05 8 m204 F1.3  0 1 NN N *3c RO.02 N  CS U U  2
53 18:09 C3G 514L171 4730-15.9.13JW.1210 m181 F .9 .2 m NN N 4.3cRO m   N  CS U U  2
54 18:14 C4J 2 7L171 4715-15.6.07JW.05 8 m149 F .4 .1 m NN N 2.5cRO m   N  CS U U  2
55 18:18 C5J 2 5L174 4730-15.5.09JW.1010 m157 F .8 .1 m NN N *4c RO m   N  CS U U  2
56 18:22 C6J 1 4L175 4720-15.2.06JW.04 7 m165 F1.2 .2 2 NN N 3.0cRO m   N  CS U U  2
57 18:23 C7D 1 4L172 4710-15.1.12JW.1111 m169 F1.5 .4 3 NN N  7c RO m   N  CS U U  2
58 18:25 C8A 3 8L168 4706-14.8.24JW.2313 m183 F1.3 .3 m NN N  12cRO m   N  CS U U  2
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TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 19

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Rec.
No.                          Card (Record) Contents
 1 Cloud2 121380cLM UWY Priv Comm 5/81 S 6 Sc B<36 U   *45*-15 cA Hp*6FFmCf        1
 2 17:03 B5J 1 2L166 3720-13.8.03JW.04 9 m 94 F3.5 .7 4 NN N  0  RO     N  CS U U  2
 3 17:05 BGD 3 8L164 3725-13.4.13JW.1110 m211 F3.0 .8 m NN N 4.8cRO m   N  CS U U  2
 4 17:08 B7H 3 9L169 3710-14.0.08JW.05 8 m130 F2.1 .5 m NN N 2.3cRO m   N  CS U U  2
 5 17:12 B8J 3 9L167 3705-14.3.17JW.1411 m205 F1.6 .3 m NN N 5.0cRO m   N  CS U U  2
 6 17:16 B9J 1 3L172 3685-14.7.06JW.09 9 m140 F .5 .1.4 NN N *3c RO.07 N  CS U U  2
 7 17:17 10J.9 2L170 3695-14.6.14JW.1410 m174 F .4 .1.3 NN N *3c RO.09 N  CS U U  2
 8 17:23 11J 1 4L170 3695-14.6.05JW.0910 m142 F1.1 .2 1 NN N *5c RO.08 N  CS U U  2
 9 17:25 12J.7 2L174 3715-14.5.16JW.1511 m197 F1.0 .1.7 NN N *4c RO.13 N  CS U U  2
10 17:26 13J 2 6L170 3705-14.3.16JW.1511 m231 F .8 .1<1 NN N *10cRO m   N  CS U U  2
11 17:28 14G 2 8L169 3715-14.1.17JW.1611 m247 F .9 .1 m NN N 7.6cRO m   N  CS U U  2
12 17:31 15G.9 3L173 3700-14.0.06JW.04 9 m 98 F .6 .1.3 NN N *3c RO.03 N  CS U U  2
13 17:32 16J 310L167 3705-13.6.15JW.1610 m260 F1.2 .2 m NN N 6.5cRO m   N  CS U U  2
14 17:36 17J 3 8L172 3695-13.9.16JW.1411 m227 F .8 .2 m NN N *5c RO m   N  CS U U  2
15 17:39 18J 2 5L168 3710-14.1.14JW.1511 m236 F .9 .4 m NN N 6.5cRO m   N  CS U U  2
16 17:41 19G 310L169 3740-13.7.11JW.1010 m195 F1.8  0 m NN N 6.0cRO m   N  CS U U  2
17 17:45 20J.9 3L169 3700-13.3.08JW.09 9 m204 F .9  0 1 NN N *4c RO.05 N  CS U U  2
18 17:49 21D 1 3L170 3710-12.5.15JW.1611 m210 F3.6  013 NN N *6c RO.10 N  CS U U  2
19 17:50 22A 1 4L171 3705-12.7.04JW.05 7 m192 F2.5  0 7 NN N *2c RO.06 N  CS U U  2
20 Cloud1 121680cLM UWY Priv Comm 5/81 S 6 St 1105-19.0117 -21 cP Hc               1
21 14:16 A3D 1 4L18411030-20.3.06JW.0410 m 60 F .2 0  U NN N <1c RO m   N  CS U U  2
22 14:18 A4J 1 5L18311010-20.0.02JW.01 7 m 44 F .2 .1 0 NN N <1c RO m   N  CS U U  2
23 14:21 A5J 311L18611565-20.9.05JW.02 8 m 71 F .8 .3<1 NN N <1c RO m   N  CS U U  2
24 Cloud2 121680cLM UWY Priv Comm 5/81 S 6 St C 40-10.7 58-13.6cP Hc,Wk158         1
25 144942B1P N NP168 5650-13.8.26JW.2515 m134 F1.3 .2 0 NN N 7.6cRO.20 N  CS U U  2
26 145136B2P N NP163 5165-13.2.27JW.2213 m190 F1.8 .3 1 NN N 7.6cRO.20 N  CS U U  2
27 145312B3P N NP159 4635-11.7.19JW.1712 m188 F1.8 .2 1 NN N 6.0cRO.15 N  CS U U  2
28 145506B4P N NP165 4155-10.7.03JW.01 5 m174 F1.5 .313 NN N <1c RO.02 N  CS U U  2
29 15:54 D1G 2 6L166 5500-12.7.34JW.2813 m247 F4.0 .8 2 NN N 7.8cRO.31 N  CS U U  2
30 15:56 D2J 3 9L170 5460-12.8.20JW.1614 m117 F1.8 .3 m NN N 6.0cRO m   N  CS U U  2
31 16:00 D3J 2 6L172 5455-12.5.10JW.1415 m 78 F2.0 .5 m NN N 7.0cRO m   N  CS U U  2
32 16:02 D4G 2 6L176 5450-12.5.13JW.1114 m 66 F1.8 .4 5 NN N 5.0cRO m   N  CS U U  2
33 16:04 D5G 2 5L174 5015-11.8.22JW.1913 m172 F1.8 .411 NN N 7.2cRO m   N  CS U U  2
34 16:06 D6G 2 6L168 4915-11.4.28JW.2412 m267 F1.8 .310 NN N 8.4cRO m   N  CS U U  2
35 16:08 D7E 3 8L167 4970-11.5.39JW.3512 m371 F2.2 .721 NN N 9.0cRO m   N  CS U U  2
36 16:12 D8G 2 4L166 4445-10.6.22JW.2212 m238 F1.9 .430 NN N 6.3cRO m   N  CS U U  2
37 16:13 D9E 2 5L166 4445-10.7.16JW.0612 m 68 F2.3 .624 NN N 5.3cRO m   N  CS U U  2
38 16:16 12G 1 2L175 4025 -9.8.07JW.02 8 m 76 F2.5 .513 NN N *2c RO.16 N  CS U U  2
39 16:17 13A 313L172 3940 -9.6.13JW.09 9 m207 F2.2 .4 m NN N 4.3cRO m   N  CS U U  2
40 Cloud3 121680cLM UWY Priv Comm 5/81 S 6 St 1*78-14.7 89-17.1cP Hc,Wk189         1
41 153124C1P N NP181 8825-17.1.08JW.1210 m199 F .7 0  0 NN N  <1cRO.07 N  CS U U  2
42 153224C2P N NP177 8230-16.3.03JW.02 6 m182 F2.0 .7 6 NN N  0  RO.03 N  CS U U  2
43 15:36 C4A 3 9L178 7970-15.6.01JW.02 6 m140 F1.4 .3 m NN N  <1cRO.03 N  CS U U  2
44 Cloud1 121980GLL UWY Priv Comm 5/81 550 St U<75 U   *85*-13 c  WkUf2FSmCf,Sr1851
45 18:34 A1G 412L182 7595-11.8 X JW.0513 m 39 F2.4 0  m NN N 4.3cRO m   N  CS U U  2
46 18:38 A2G 1 3L174 7610-11.2.05JW.1214 m 78 F5.6 0 50 NN N 6.8cRO.14 N  CS U U  2
47 18:39 A3G 2 7L171 7595-11.2.15JW.2116 m103 F9.2 .1 m NN N 8.4cRO m   N  CS U U  2
48 18:41 A4G 1 3L172 7585-11.1.07JW.0813 m 69 F1.8 .1 9 NN N 5.5cRO m   N  CS U U  2
49 18:42 A5G 1 4L176 7600-11.4.13JW.1413 m127 F1.8 .1 m NN N 6.5cRO m   N  CS U U  2
50 18:44 A6G 1 3L171 7585-11.5.17JW.1913 m175 F .8 0  6 NN N 7.6cRO.19 N  CS U U  2
51 18:45 A7G 1 3L170 7600-11.4.23JW.2513 m228 F .3 0  2 NN N 7.6cRO.25 N  CS U U  2
52 18:46 A8D 2 5L169 7575-11.3.11JW.1311 m159 F3.3 0  m NN N 5.3cRO m   N  CS U U  2
53 18:48 A9D 411L175 7610-11.4.08JW.08 9 m200 F8.3 .260 NN N 5.0cRO m   N  CS U U  2
54 18:52 10G 2 6L175 7595-11.9.17JW.1913 m173 F1.5 0  m NN N 7.0cRO m   N  CS U U  2
55 18:54 11G 2 6L172 7600-12.3.14JW.1915 m106 F .6 0  m NN N 6.7cRO m   N  CS U U  2
56 18:56 12G 1 4L171 7615-12.9.10JW.1617 m 69 F1.6 0  m NN N 6.0cRO.17 N  CS U U  2
57 18:58 13J 3 9L171 7615-13.0.06JW.0916 m 37 F2.1 0  m NN N 5.0cRO m   N  CS U U  2
58 19:03 14G 1 4L174 7615-12.2.09JW.0919 m 25 F1.9 0  m NN N 7.0cRO.11 N  CS U U  2
              11111111112222222222333333333344444444445555555555666666666677777777778
    12345678901234567890123456789012345678901234567890123456789012345678901234567890
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TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 20

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    ----------------------------Card Column No.-----------------------------------------
            11111111112222222222333333333344444444445555555555666666666677777777778
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Rec.
No.                            Card (Record) Contents
 1 Cloud2 121980LHX UWY Priv Comm 5/81 S45 St C 72-10.1>86 U   c  WkUf2FSmCf       1
 2 19:20 15E 3 8L165 8520 -9.3.01JW.1215 m 74 F7.4 .1 m NN N 6.6cR0 m  N  CS U U  2
 3 19240016P N NP178 8010 -9.0.03JW.0914 m 61 F4.3 .120 NN N *6 cR0.15 N  CS U U  2
 4 19243617P N NP182 7515 -9.6.07JW.1112 m130 F9.4 .425 NN N <3 cR0.18 N  CS U U  2
 5 19250018P N NP179 7105-11.6 0 JW.01 7 m 42 F7.3 .327 NN N <1 cR0.06 N  CS U U  2
 6 21:22 44G 514L177 7575 -9.8.03JW.0410 m 61 F3.0 0  m NN N 3.4cR0 m  N  CS U U  2
 7 21:27 45E 3 9L175 7570-11.2.06JW.0712 m 93 F1.5 0  m NN N 6.0cR0.09 N  CS U U  2
 8 Cloud3 121980LHX UWY Priv Comm 5/81 S40 St B 55-10.7 61-11.1c  WkUf2FSmCf       1
 9 19264219P N NP170 6035-11.1.06JW.05 7 m219 F1.1 .1 1 NN N <1 cR0.02 N  CS U U  2
10 19:27 20A 1 3L164 5555-10.3.05JW.05 9 m139 F2.1 .1 m NN N <1 cR0.06 N  CS U U  2
11 19321821P N NP158 5505 -9.1 0 JW.01 6 m101 F .2  0 0 NN N  0  R0 0  N  CS U U  2
12 19324822P N NP154 5995 -9.3.04JW.04 7 m224 F .1  0 0 NN N  0  R0.01 N  CS U U  2
13 Cloud4 121980LHX UWY Priv Comm 5/81 S50 St C 77 -8.1 94-11.4c  WkUf2FSmCf,SrI941
14 19344823P N NP153 7900 -8.5.02JW.02 7 m147 F1.4  0 7 NN N  0 cR0.03 N  CS U U  2
15 19352424P N NP158 8290 -9.2.06JW.0911 m120 F .6  0 0 NN N *<2cR0.11 N  CS U U  2
16 19355425P N NP157 8745-10.2.13JW.2014 m141 F2.4  0 7 NN N *8 cR0.22 N  CS U U  2
17 19362426P N NP154 9270-11.3.12JW.2816 m126 F1.7  0 5 NN N *10cR0.28 N  CS U U  2
18 19:47 27G 1 3L184 8590-10.0.07JW.1513 m122 F .4  0<1 NN N 6.6cR0.09 N  CS U U  2
19 19:48 28D 1 3L177 8540-10.4.07JW.1611 m193 F .1  0 0 NN N  6 cR0 m  N  CS U U  2
20 19:52 29E1748L176 8460-11.7.09JW.0911 m116 F1.7 .1 m NN N 4.5cR0 m  N  CS U U  2
21 Cloud4a121980DHT UWY Priv Comm 5/81 S38 St C 82-11.4 93-11.9c  WkUf3FSmCf,SrI931
22 20:21 30D 3 8L190 8550-11.6.09JW.0611 m 97 F1.0 .1 m NN N 2.5cR0 m  N  CS U U  2
23 20:23 31E 514L184 8535-11.1.03JW.0510 m 91 F1.4 .3 m NN N 3.5cR0 m  N  CS U U  2
24 20353033P N NP208 9330-10.9.14JW.1112 m113 F1.7 .1 2 NN N *7 cR0.14 N  CS U U  2
25 20361834P N NP201 9030-10.4.06JW.0612 m 81 F2.7 .113 NN N *6 cR0.07 N  CS U U  2
26 20:38 35E 411L182 8505-10.5 0 JW.0410 m 78 F1.4 .2 m NN N 1.3cR0 m  N  CS U U  2
27 20:53 40D1337L175 8525 -9.6.01JW.0913 m 67 F4.9  0 m NN N 5.0cR0 m  N  CS U U  2
28 Cloud5 121980AKO UWY Priv Comm 5/81 S44 St B*62-10.3 80-11.8c  WkUf2FSmCf,SrI801
29 21414247P N NP166 7100-10.6.01JW.01 6 m 67 F 0   0 0 NN N  0 cR0.01 N  CSS- U  2
30 21422448P N NP168 7605-11.5.03JW.0510 m 82 F .3  0 0 NN N  U  R0.03 N  CSS- U  2
31 21425449P N NP171 7930-11.9.05JW.0713 m 54 F .2  0 0 NN N  U  R0.07 N  CSS- U  2
32 Cloud6 121980AKO UWY Priv Comm 5/81 S50 St C 62-13.3 79-12.8c  WkUf2FSmCf,SrI791
33 21464850P N NP202 7880-12.8.18JW.2215 m138 F .8  0 1 NN N *14cR0.17 N  CS U U  2
34 21:47 51G1133L179 7580-12.0.10JW.1717 m123 F3.9 .1 m NN N 7.0cR0 m  N  CS U U  2
35 21:59 52A 618L172 7635-13.2.03JW.0814 m 63 F4.1  0 m NN N 5.6cR0 m  N  CS U U  2
36 Cloud7 121980CYS UWY Priv Comm 5/81 S58 St C 62-13.3 73-14.8c  WkUf2FSmCf,SrI731
37 22:07 53E 4 9L158 7265-13.6 0 JW.0412 m 47 F2.0  0 m NN N 3.8cR0 m  N  CS U U  2
38 22140056P N NP162 6280-13.0.03JW.03 7 m167 F2.0 .626 NN N U  cR0 0  N  CSS- U  2
39 22142457P N NP156 6840-14.2.11JW.1311 m188 F2.6 .528 NN N *6 cR0.05 N  CSS- U  2
40 22150058P N NP165 7240-14.8.14JW.1812 m221 F1.5 .4 6 NN N *7 cR0.07 N  CSS- U  2
41 Cloud1 122380CDR UWY Priv Comm 5/81 S31 St C 38 -9.6 56 -5.4cP 0SmCf,WkI45,I57 1
42 20:45 C1G 2 5L162 5350 -6.6.11JW.1714 m108 F .9 0  m NN N 7.5cR0 m  N  CS U U  2
43 20:47 C2A 512L158 5100 -7.9.15JW.1814 m118 F1.2 0  m NN N 8.0cR0 m  N  CS U U  2
44 210012D1P N NP181 5650 -4.1.04JW.08 9 m108 F .3 0  U NN N <1 cR0.04 N  CS U U  2
45 21:00 D3E 412L164 5250 -7.4.15JW.1715 m*90 F*1  0  m NN N 8.0cR0.19 N  CS U U  2
46 21:05 3DE 2 7L166 5000 -8.2.14JW.1415 m*90 F*1  0  m NN N 7.5cR0.17 N  CS U U  2
47 21:07 D4E 2 5L162 4835-10.1.12JW.1212 m159 F2.7 .1 m NN N 7.0cR0.18 N  CS U   U 2
48 210948D5P N NP162 4270-10.7.04JW.06 7 m265 F .9 0  7 NN N <1 cR0.01 N  CS U   U 2
49 211006D6P N NP164 3945 -9.9.05JW.03 8 m207 F .3 0  1 NN N <1 cR0 0  N  CS U   U 2
50 211206D7P N NP150 3910 -9.5 0 JW.01 3 m 90 F2.4 .224 NN N  U  R0 0  N  CS U   U 2
51 211224D8P N NP157 4280 -9.9.12JW.11 7 m306 F1.5 0 11 NN N  U  R0.09 N  CS U   U 2
52 211242D9P N NP151 5000 -8.8.15JW.1915 m105 F1.6 0  3 NN N *6 cR0.17 N  CS U   U 2
53 21130610P N Np150 5560 -5.4.07JW.1214 m 89 F .3 0  0 NN N  U  R0.11 N  CS U   U 2
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TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 21

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   -----------------------------Card Column No.---------------------------------------
            111111111122222222223333333333444444444455555555556666666666777777777778
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Rec.
No.                                Card (Record) Contents
 1 Cloud1 010781cLM UWY Priv Comm 5/81 S 6 St C 36-18.5 55-23.3cA U,WkI55                1
 2 14:02 A1G 1 3L182 3975-19.4.11JW.0610 m103 F8.43.6 m NN N *4 cRO m  N  CSS  U  2
 3 14:03 A2D 2 5L173 4010-19.5.11JW.0810 m139 F5.72.9 m NN N  4 cRO m  N  CSS  U  2
 4 14:05 A3E 1 3L165 4045-19.9.06JW.06 9 m128 F7.63.6 m NN N  3 cRO m  N  CSS  U  2
 5 140754A5P N NP155 4450-20.8.10JW.1312 m136 F18 5.413 NN N *4 cRO.09 N  CSS  U  2
 6 140830A6P N NP154 5025-22.2.15JW.1914 m141 F9.33.4 2 NN N *4 cRO.14 N  CSS  U  2
 7 140854A7P N NP152 5420-23.1.16JW.1814 m119 F2.5 .6 0 NN N *4 cRO.14 N  CSS- U  2
 8 14:15 B1E 2 4L171 5240-23.1.17JW.1514 m108 F2.2 .8 m NN N  3 cRO m  N  CSS- U  2
 9 14:17 B2G 717L159 5025-21.8.13JW.1413m 120 F6.42.7 m NN N  X  RO m  N  CSS  U  2
10 14:24 B3H 720L160 5010-21.6.10JW.1212 m123 F11 3.8 m NN N  X  RO m  N  CSS  U  2
11 14:31 B4J 2 5L159 4980-22.1.09JW.1110 m198 F25 5.9 m NN N  X  RO m  N  CSS  U  2
12 14:33 B5J 2 6L162 5025-22.4.12JW.1310 m222 F35 7.4 m NN N *4 c m m  N  CSS  U  2
13 14:36 B6J.7 2L163 5020-22.0.24JW.2211 m287 F43 8.589 NN N  X  RO m  N  CSS  U  2
14 14:38 B7J.6 2L164 5055-22.4.12JW.1311 m176 F28 5.439 NN N  X  RO.13 N  CSS  U  2
15 14:39 B8A 718L161 5015-22.4.13JW.1212 m112 F18 4.8 m NN N  X  RO m  N  CSS  U  2
16 Cloud2 010781cLM UWY Priv Comm 5/81 S 6 Sc 8 U    U  29-20.6cA U                     1
17 15:47 C1J.6 2L157 2835-20.3.07JW.06 7 m384 F2.81.3 7 NN N  U  RO.04 N  CSS- U  2
18 16:14 C2A.6 1L145 2825-15.6.04JW.01 7 m287 F12 3.627 NN N  0  RO.03 N  CSS  U  2
19 Cloud4 010781cLM UWY Priv Comm 5/81 S 6 St V U    U  43-22.5cA U,pClO                1
20 16:30 D1G 412L175 3830-20.3.08JW.07 7 m301 F16 4.4 m NN N *3 cRO m  N  CSS  U  2
21 16:34 D2A 620L168 3885-20.7.10JW.09 7 m390 F8.02.6 m NN N *2 c m N  N  CSS  U  2
22 Cloud5 010781cLM UWY Priv Comm 5/81 S 6 Sc 8 U    U  U   U  cA  U                    1
23 16:44 E1J.5 2L192 4520-22.5.13JW.11 8 m312 F2.4 .8 6 NN N U   RO.10 N  CSS- U  2
24 16:45 E2J.5 2L190 4520-22.2.07JW.08 8 m213 F2.6 .8 5 NN N U   RO.06 N  CSS- U  2
25 16:47 E3J 1 3L187 4505-22.1.18JW.15 9 m364 F6.41.516 NN N X   RO.12 N  CSS- U  2
26 16:49 E4J.7 2L183 4520-21.7.08JW.10 9 m264 F4.9 0  8 NN N X   RO.04 N  CS U U  2
27 16:52 E5J.7 2L180 4515-21.4.07JW.09 9 m237 F11  0 22 NN N X   RO.06 N  CS U U  2
28 16:53 E6J 1 3L178 4520-21.3.09JW.10 9 m261 F17  0 30 NN N X   RO m  N  CS U U  2
29 16:59 E7A.6 2L172 4510-20.1.07JW.08 9 m203 F24  0 82 NN N U   RO.06 N  CS U U  2
30 17:04 F1D 1 5L227 5780-25.0.03JW.03 8 m 89 F4.4 0  9 NN N U   RO m  N  CS U U  2
31 17:05 F2A 1 5L228 5860-24.6.11JW.1111 m154 F19  0 26 NN N U   RO m  N  CS U U  2
32 CloudA 010881cLM UWY Priv Comm 5/81 S 6 Sc 8 44-17.0 64-21.3cA U,I64                  1
33 133806A1P N NP164 4430-17.0.06JW.07 8 m297 F2.51.4 0 NN N  X  RO.03 N  CSS- U  2
34 133900A2P N NP158 4945-18.1.04JW.08 9 m183 F1.91.0 0 NN N  X  RO.04 N  CSS- U  2
35 133948A3P N NP161 5450-19.0.06JW.07 9 m186 F18 4.4 9 NN N  X  RO.06 N  CSS    U 2
36 134048A4P N NP159 5965-20.3.26JW.2511 m318 F2.21.2 1 NN N  X  RO.19 N  CSS-   U 2
37 134124A5P N NP159 6380-21.3.42JW.3412 m350 F1.1 .2 1 NN N  X  RO.35 N  CS U   U 2
38 13:57 A6J.5 2L176 6335-20.9.14JW.1410 m188 F .8 .1<1 NN N  U  RO.09 N  CS U   U 2
39 14:00 A7J 1 3L164 6290-21.2.25JW.2210 m370 F1.9 .6 3 NN N  X  RO.20 N  CSS-   U 2
40 14:02 A8E 513L163 6280-20.9.35JW.2911 m418 F4.01.7 m NN N  X  RO m  N  CSS-   U 2
41 14:06 A9D 719L161 5830-19.7.30JW.2811 m418 F6.91.9 m NN N  X  RO m  N  CSS-   U 2
42 14:14 10G 3 7L162 5820-19.9.17JW.1610 m327 F7.32.9 m NN N  X  RO m  N  CSS    U 2
43 14:16 11J 2 5L167 5630-19.7.06JW.06 9 m176 F8.93.226 NN N  X  RO m  N  SCS    U 2
44 14:20 12J2  6L166 5290-18.8.05JW.08 8 m291 F11 4.5 m NN N  X  RO m  N  CSS    U 2
45 14:22 13J 2 7L166 5290-18.5.12JW.11 8 m398 F13 5.4 m NN N  X  RO m  N  CSS    U 2
46 14:25 14E 2 6L166 5275-18.4.19JW.15 9 m370 F12  X  m NN N  X  RO m  N  CS U   U 2
47 14:27 15J 2 4L173 4845-17.4.21JW.17 9 m376 F11  X  m NN N  X  RO m  N  CS U   U 2
48 14:30 16J 1 3L166 4760-17.2.16JW.13 9 m321 F19  X  m NN N  X  RO m  N  CS U   U 2
49 14:33 17A.7 2L165 4765-17.2.09JW.08 7 m381 F18  X  m NN N  X  RO m  N  CS U   U 2
50 Cloud8 010881cLM UWY Priv Comm 5/81 S 6 Sc I<27  U  >43  U  cA U,pCILO                1
51 14:55 B1J 1 3L167 4220-15.8.22JW.15 9 m385 F18  X 91 NN N  X  RO m  N  CS U   U 2
52 14:57 B2J.5 1L168 3745-14.7.25JW.18 9 m457 F11  X 68 NN N  X  RO m  N  CS U   U 2
53 14:58 B3A.8 2L170 3720-14.7.21JW.13 9 m410 F16  X 95 NN N  X  RO.16 N  CS U   U 2
54 15:15 B4G.5 2L177 3120-13.4.21JW.11 8 m442 F14  X 54 NN N  X  RO.16 N  CS U   U 2
55 15:17 B5A 1 3L169 2760-12.5.21JW.12 8 m532 F10  X 36 NN N  X  RO.15 N  CS U   U 2
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TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 22

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              1111111111222222222233333333334444444444555555555566666666667777777777778
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Rec.
No.                               Card (Record) Contents
  1 CloudC 010881cLM UWY Priv Comm 5/81 S 6 Sc 1 48-16.6>58  U  cA U,pCILO        1
  2 155906C1P N NP164 5040-17.3.18JW.13 9 m344 F62 12 51 NN N  X  RO.17 N  CSS+  U 2
  3 155930C2P N NP153 5580-18.5.21JW.2510 m480 F20 5.230 NN N  X  RO.20 N  CSS   U 2
  4 15:59 C3A 1 4L169 5810-19.2.22JW.1610 m303 F15 3.9 m NN N  X  RO m  N  CSS   U 2
  5 Cloud1 011181cLM UWY Priv Comm 5/81 S 6 St 1*20-18.1>36  U  cA U,Wk158,pCILO  1
  6 14:17 A1G 1 3L169 3540-19.4.11JW.08 7 m419 F12 4.0*5 NN N *6 cRO m  N  CSS-  U 2
  7 14:18 A2G 1 4L167 3535-19.8.08JW.07 7 m316 F9.22.4*5 NN N *6 cRO m  N  CSS   U 2
  8 14:20 A3J 1 3L165 3525-19.9.11JW.09 7 m405 F7.42.2 m NN N  X  RO m  N  CSS   U 2
  9 142606B1P N NP175 2870-19.2.06JW.04 6 m313 F .3 0  1 NN N  0  RO.02 N  CS U  U 2
 10 142718B2P N NP175 2110-18.1 0 JW.01 5 m124 F .6 0  0 NN N  0  RO 0  N  CS U  U 2
 11 Cloud2 011181cLM UWY Priv Comm 5/81 S 6 St I 24*-18 36 *19  cA U,pCILO        1
 12 16:10 C1G.6 2L158 3510-19.4.06JW.05 7 m213 F14 4.1 9 NN N  U  RO m  N  CSS   U 2
 13 16:13 C2J.8 2L153 3555-18.8.06JW.05 7 m293 F6.52.5 5 NN N  U  RO m  N  CSS   U 2
 14 16:16 C3J 1 3L156 3560-18.3.06JW.05 8 m152 F20 6.8 8 NN N  U  RO m  N  CSS   U 2
 15 16:31 C4J.9 2L154 3560-17.9.12JW.1010 m166 F16 5.3 8 NN N  U  RO m  N  CSS   U 2
 16 16:37 C6J.5 1L165 3655-18.4.15JW.1312 m180 F15 4.810 NN N  U  RO m  N  CSS   U 2
 17 Cloud3 011181cLM UWY Priv Comm 5/81 S 6 St 1*41-19.3*60  U  cA U              1
 18 16:43 D1J 1 3L165 4150-19.4.06JW.0711 m110 F26 9.013 NN N *4 cRO m  N  CSS+  U 2
 19 16:46 D2J.5 1L167 4125-19.2.15JW.1511 m169 F19 6.6 8 NN N  U  RO m  N  CSS   U 2
 20 16:57 D3J.7 2L165 4545-20.2.09JW.0911 m100 F18 6.8 6 NN N  U  RO m  N  CSS   U 2
 21 16:59 D5J 2 5L170 4555-20.6.12JW.0910 m142 F16 5.8 m NN N  X  RO m  N  CSS   U 2
 22 17:07 D6J.6 2L161 4545-19.9.16JW.1512 m150 F20 6.611 NN N *7 cRO m  N  CSS   U 2
 23 17:09 D7J.8 2L158 4530-20.0.12JW.1011 m124 F25 7.813 NN N  X  RO m  N  CSS   U 2
 24 17:12 D8J.9 2L158 4580-20.1.22JW.1712 m173 F24 7.214 NN N *6 cRO m  N  CSS   U 2
 25 17:17 10J.6 1L145 4500-20.1.15JW.1011 m131 F11 4.2 8 NN N  U  RO m  N  CSS   U 2
 26 Cloud1 011281cLM UWY Priv Comm 5/81 S 6 St C 17 -8.8 36-11.0cP Le,logSIGMET,I351
 27 200330A1P N NP190 3400-12.2.32JW.27 9 m635 F .1 0  0 NN N *8 cRO.21 N  CS U  U 2
 28 20:04 A3J 616L165 2915-12.0.18JW.17 8 m692 F .1 0  0 NN N 6.8cRO m  N  CS U  U 2
 29 204736D1P N NP149 1870 -9.2.02JW.05 7 m278 F 0  0  0 NN N 0  cRO.01 N  CS U  U 2
 30 204806D2P N NP154 2475-10.5.16JW.15 7 m678 F 0  0  0 NN N *5 cRO.12 N  CS U  U 2
 31 20:48 D4E1028L164 2960-11.0.31JW.21 9 m647 F1.0 .3 m NN N 7.5cRO m  N  CS U  U 2
 32 Cloud1a011281cLM UWY Priv Comm 5/81 S 6 Sc I 17 -8.8 30-11.0cP Le, SrI30      1
 33 20:10 B1J.7 2L161 2975-11.0.12JW.08 6 m350 F .1 0  0 NN N *3 cRO.10 N  CS U  U 2
 34 20:11 B2J.9 21161 2965-10.5.07JW.07 8 m247 F 0  0  0 NN N *4 cRO m  N  CS U  U 2
 35 20:39 C1J 2 5L173 2940-10.7.17JW.12 9 m353 F .1 0  0 NN N 6.5cRO m  N  CS U  U 2
 36 20:42 C2J.9 2L163 2945-10.9.15JW.10 8 m422 F 0  0  0 NN N *6 cRO.10 N  CS U  U 2
 37 20:43 C3E.8 2L162 2930-10.8.13JW.09 8 m347 F .1 0  0 NN N *3 cRO m  N  CS U  U 2
 38 204506C4P N NP156 2400-10.7.16JW.14 7 m736 F .2 0  0 NN N U  cRO.11 N  CS U  U 2
 39 204542C5P N NP163 1770 -9.3.02JW.05 6 m466 F 0  0  0 NN N U  cRO.03 N  CS U  U 2
 40 Cloud1b011281MKG UWY Priv Comm 5/81 S 8 St C 14 -7.5*40  U  cP Le, log SIGMET  1
 41 20:58 D5G.9 2L163 2585 -9.9.17JW.15 9 m337 F3.11.038 NN N 6.0cRO.13 N  CSS-  U 2
 42 20:59 D6E 411L159 2555 -9.7.24JW.2310 m503 F11 1.7 m NN N 7.5cRO m  N  CSS- U  2
 43 210412D7P N NP162 1915 -8.5.17JW.09 8 m405 F2.0 .332 NN N U  cRO.17 N  CSS-  U 2
 44 210436D8P N NP167 1425 -7.5.06JW.03 5 m384 F1.0 .2 3 NN N U  cRO.06 N  CS U  U 2
 45 Cloud2b011281LAN UWY Priv Comm 5/81 S 8 St C 22-12.9 63-12.9cP Le,Wk122,Wk163  1
 46 21:26 G4H 615L153 2900-10.4.16JW.1913 m176 F15  .2 m NN N 7.3cRO m  N  CS U  U 2
 47 21:31 G5E 2 7L163 2920-10.6.13JW.1511 m207 F2.0 .1 m NN N 5.5cRO m  N  CS U  U 2
 48 213442G6P N NP169 2445-11.3.08JW.07 8 m254 F4.4 .344 NN N  <1cRO.11 N  CS U  U 2
 49 214136H1P N NP151 2230-12.9.02JW.04 4 m112 F1.8 .2 8 NN N  U cRO 0  N  CS U  U 2
 50 214154H2P N NP151 2705-10.4.19JW.2013 m182 F1.8 .114 NN N *3 cRO.18 N  CS U  U 2
 51 214236H3P N NP161 3240-11.0.10JW.09 9 m242 F1.7 .1 2 NN N *3 cRO.07 N  CS U  U 2
 52 214306H4P N NP155 3780-11.8.11JW.08 8 m336 F2.6 .1 9 NN N *3 cRO.06 N  CS U  U 2
 53 214336H5P N NP159 4230-11.7.10JW.1011 m135 F1.4 .1 7 NN N *3 cRO.06 N  CS U  U 2
 54 214412H6P N NP164 4780-12.0.14JW.1516 m 70 F2.8 .120 NN N *7 cRO.13 N  CS U  U 2
 55 214442H7P N NP162 5205-12.1.20JW.2617 m 89 F9.5 .251 NN N *10cRO.21 N  CS U  U 2
 56 214512H8P N NP167 5480-12.7.26JW.3018 m 97 F17  0 93 NN N *15cRO.26 N  CS U  U 2
 57 214536H9P N NP148 6090-12.5.07JW.0717 m 31 F28  0 99 NN N *3 cRO.15 N  CS U  U 2
              1111111111222222222233333333334444444444555555555566666666667777777777778
    12345678901234567890123456789012345678901234567890123456789012345678901234567890
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TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 23

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     ---------------------------Card Column No.--------------------------------------
              1111111111222222222233333333334444444444555555555566666666667777777777 8
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Rec.
No.                              Card (Record) Contents
 1 Cloud1c011281MKG UWY Priv Comm 5/81 S 6StScB 17 -7.7 47-13.8cP Le, Sr145       1
 2 210636E1P N NP150 1695 -7.7.03JW.03 6 m271 F1.2 .2 6 NN N U  cR0.01 N  CS U  U 2
 3 210712E2P N NP152 2375 -9.0.08JW.06 8 m248 F2.41.728 NN N *<1cR0.06 N  CSS-  U 2
 4 210736E3P N NP151 2940-10.4.17JW.16 9 m435 F1.81.122 NN N *7 cR0.13 N  CSS-  U 2
 5 210800E4P N NP156 3405-11.3.34JW.2410 m525 F3.3 .921 NN N *7 cR0.24 N  CSS-  U 2
 6 210824E5P N NP156 3905-12.2.43JW.3010 m589 F5.12.151 NN N *10cR0.32 N  CSS   U 2
 7 210854E6P N NP159 4420-13.3.62JW.3811 m599 F1.2 .2 0 NN N *10cR0.45 N  CS U  U 2
 8 211248F1P N NP177 4715-13.8.58JW.3712 m407 F2.7 .317 NN N *15cR0.41 N  CS U  U 2
 9 211318F2P N NP173 4155-13.0.39JW.2911 m386 F44 2.550 NN N  X cR0.28 N  CSS   U 2
10 211342F3P N NP170 3715-12.1.30JW.2211 m343 F14 1.494 NN N  X  R0.23 N  CSS-  U 2
11 211412F4P N NP166 3210-11.1.18JW.1410 m256 F7.91.459 NN N  X  R0.13 N  CSS-  U 2
12 21:14 F6J.7 2L154 2880-10.4.05JW.05 9 m117 F10 1.6 m NN N  U  R0 m  N  CSS-  U 2
13 21:16 F7A 1 3L149 2885-10.2.12JW.1310 m249 F30 1.499 NN N *6 cR0 m  N  CSS-  U 2
14 21:59 I4D 1 4L169 4030-12.6.07JW.05 9 m126 F4.11.0 m NN N *3 cR0 m  N  CSS-  U 2
15 22:00 I50 2 6L162 3950-12.4.15JW.1511 m224 F5.41.3 m NN N 6.0cR0 m  N  CSS-  U 2
16 22:02 I6E 512L164 3985-12.4.22JW.2011 m298 F6.51.8 m NN N 8.0cR0 m  N  CSS-  U 2
17 220748I7P N NP170 3410-11.3.31JW.2711 m386 F3.51.233 NN N *7 cR0.30 N  CSS-  U 2
18 220812I8P N NP167 2875-10.6.24JW.2011 m289 F2.2 .639 NN N *6 cR0.22 N  CSS-  U 2
19 22:08 10E 2 5L142 2530 -9.8.24JW.1910 m354 F1.3 .2 m NN N 7.0cR0 m  N  CS U  U 2
20 22112411P N NP151 1820 -8.3.08JW.04 7 m269 F .9 .2 7 NN N <1 cR0.04 N  CS U  U 2
21 Cloud2m011281LAN UWY Priv Comm 5/81 S 8 St C*20  U   55-11.2cP Le, I55, Wk145  1
22 21:23 G1D.7 2L159 2935-10.1.04JW.05 7 m213 F11   .299 NN N *6 cR0.08 N  CS U  U 2
23 21:24 G20.6 2L158 2925-10.2.10JW.0910 m182 F31   .399 NN N 6.0cR0.16 N  CS U  U 2
24 21:25 G30.9 2L156 2925-10.3.08JW.0811 m108 F33   .299 NN N *6 cR0.13 N  CS U  U 2
25 215600I1P N NP160 5450-11.2.06JW.0817 m 31 F1.1 0  0 NN N *4 cR0.08 N  CS U  U 2
26 215630I2P N NP164 4970-11.5.05JW.0918 m 28 F 0  0  0 NN N *4 cR0.10 N  CS U  U 2
27 215700I3P N NP164 4455-13.0.10JW.1013 m 96 F1.0 0 0  NN N *4 cR0.13 N  CS U  U 2
28 Cloud1 011481MKG UWY Priv Comm 5/81 S 6StScB 48-10.4 65-13.0cP U,I65           1
29 203736A1P N NP148 4845-10.5 0 JW.01 5 m 87 F2.2 .4 4 NN N  0 cR0 0   N CS U U  2
30 203806A2P N NP159 5370-11.4.11JW.0912 m106 F2.1 .3 6 NN N *6 cR0.10  N CS U U  2
31 203830A3P N NP156 5910-12.4.16JW.1615 m 80 F1.6 .3 0 NN N *6 cR0.15  N CS U U  2
32 203848A4P N NP155 6260-13.2.18JW.1915 m102 F1.4 .1 0 NN N  U cR0.18  N CS U U  2
33 Cloud2 011481MKG UWY Priv Comm 5/81 S 6 St C 38 -8.6 65-12.2cP U,I65           1
34 213142B1P N NP153 6420-13.3.24JW.2213 m201 F1.9 .3 0 NN N *9 cR0.23  N CS U U  2
35 213236B2P N NP154 5940-12.7.16JW.1612 m174 F3.3 .511 NN N *7 cR0.17  N CS U U  2
36 213324B3P N NP146 5470-11.7.16JW.1311 m220 F2.2 .5 5 NN N *6 cR0.14  N CS U U  2
37 213424B4P N NP151 4960-11.1.13JW.1210 m257 F3.1 .516 NN N *5 cR0.11  N CS U U  2
38 213524B5P N NP151 4455-10.0.09JW.07 8 m229 F3.3 .613 NN N *3 cR0.03  N CS U U  2
39 213642B6P N NP149 3950 -9.1.02JW.01 5 m169 F2.5 .4 9 NN N  U cR0 0   N CS U U  2
40 21:40 C6D 412L165 6085-13.1.22JW.1611 m245 F1.6 .3 m NN N 6.8cR0 m   N CS U U  2
41 21:44 C70 821L168 6095-12.7.34JW.2814 m217 F9.0 .4 m NN N 9.5cR0 m   N CS U U  2
42 Cloud3 011481MKG UWY Priv Comm 5/81 S 6 St C 53-10.8 65*-14 cP U,I65           1
43 22:17 D1G.6 2L177 6045-12.8 0 JW.02 6 m128 F .4  0 2 NN N  U cR0.01  N CS U U  2
44 22:18 D2D 928L180 6045-12.7 0 JW.06 7 m278 F .9 .1 m NN N *3 cR0 m   N CS U U  2
45 22:27 D3E 1 3L187 5965-12.2.02JW.09 9 m267 F1.1 .2 4 NN N *4 cR0 X   N CS U U  2
46 222912E1P N NP180 5315-10.8.01JW.02 7 m125 F .6 .2 4 NN N <1 cR0.01  N CS U U  2
47 222930E2P N NP161 5840-12.0.03JW.05 7 m295 F .7 .1 0 NN N <1 cR0.02  N CS U U  2
48 222954E3P N NP155 6335-13.1.13JW.1710 m297 F1.4 .1 7 NN N  U cR0.12  N CS U U  2
49 Cloud1 011681cLM UWY Priv Comm 5/81 S 6 Sc I 19 -8.1 21 -8.4cP U               1
50 13:30 A1A.9 2L162 2015 -8.6.05JW.04 6 m362 F .21.4 0 NN N *0 cR0.08 N  CSS-  U 2
51 Cloud2 011681cLM UWY Priv Comm 5/81 S 6 St I113-26.4118-27.5cP U,I119           1
52 14:21 B1J.8 2L15411575-27.1.02JW.03 6 m246 F1.91.1 3 NN N *0 cR0.01 N  CSS-  U 2
53 14:22 B2J.9 3L17611740-27.0.03JW.02 6 m152 F .5 0  1 NN N *0 cR0.02 N  CS U  U 2
54 14:24 B3A 1 4L19111640-27.2.05JW.02 6 m173 F1.7 .3 m NN N *0 cR0.02 N  CS U  U 2
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     12345678901234567890123456789012345678901234567890123456789012345678901234567890
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TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 24

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Rec.
No.                                 Card (Record) Contents
 1 Cloud3 011681cLM UWY Priv Comm 5/81 S 6 St 8 38-12.0 71-19.2cP U,Wk171           1
 2 145212C1P N NP162 7015-19.0.44JW.3110 m545 F10 13 13 NN N *10cR0.28 N  CSS+   U 2
 3 145324C2P N NP158 6510-18.1.26JW.18 9 m449 F12 15  1 NN N *5 cR0.18 N  CSS+   U 2
 4 145418C3P N NP157 6045-17.0.12JW.07 7 m334 F23 13  7 NN N  U cR0.07 N  CSS+   U 2
 5 145548C4P N NP155 5565-15.8.03JW.02 6 m146 F6.310  1 NN N *0 cR0.02 N  CSS+   U 2
 6 14:56 C5E 1 4L159 4845-14.0.09JW.12 8 m381 F4.82.5 m NN N *4 cR0 m  N  CSSW   U 2
 7 145854C6P N NP160 4435-13.2.09JW.14 8 m499 F7.13.8 3 NN N  U cR0.13 N  CSSW   U 2
 8 150006C7P N NP156 3780-11.9.08JW.10 6 m722 F7.61.4 4 NN N  U cR0.11 N  CSS-   U 2
 9 Cloud4 011681cLM UWY Priv Comm 5/81 S 6 Sc I U   U    U   U  cP U                1
10 15:22 E1J.5 1L149 3455-10.8.20JW.14 7 m622 F8.61.8 m NN N  U cR0 m  N  CSS-   U 2
11 16:00 G1J.8 2L157 3215-11.7 0 JW.04 6 m371 F 0 1.7 0 NN N  U cR0.03 N  CSS-   U 2
12 Cloud5 011681cLM UWY Priv Comm 5/81 S 6 St 8 58-15.6 74-19.1cP U,noI            1
13 152736F1P N NP152 5865-15.8 0 JW.03 8 m 76 F40 9.630 NN N  U cR0.04 N  CSS+   U 2
14 152836F2P N NP154 6365-16.9.48JW.3611 m484 F51 8.124 NN N *8 cR0.38 N  CSS+   U 2
15 152936F3P N NP156 6830-18.5.07JW.0610 m185 F42 15 40 NN N  U cR0.06 N  CSS+   U 2
16 153036F4P N NP151 7345-19.2.07JW.10 8 m330 F .92.5 5 NN N  U cR0.06 N  CSSW   U 2
17 Cloud1 013081GLD UWY Priv Comm 5/81 534 Sc B<36  U    53SrV  cP Hp,SrI53        1
18 17:50 A1J 1 3L169 5170 -9.8.15JW.2114 m133 F .2 0  0 NN N *9 cR0.20 N  CS U   U 2
19 17:57 A2J.7 2L172 5180 -9.6.20JW.2113 m173 F .2 .1 0 NN N *10cR0.19 N  CS U   U 2
20 18:00 A3J.7 2L176 5240 -8.2.10JW.08 8 m282 F .1 0  0 NN N  U cR0.07 N  CS U   U 2
21 180206A4P N NP181 4970 -9.3.21JW.2015 m116 F .5 .4 0 NN N *8 cR0 N  N  CSS-   U 2
22 180236A5P N NP182 4490 -9.9.27JW.2012 m226 F1.7 .1 7 NN N *8 cR0.23 N  CS U   U 2
23 180254A6P N NP183 4060 -9.9.20JW.1411 m197 F2.4 .427 NN N *6 cR0.15 N  CSS-   U 2
24 180330A7P N NP169 3665 -9.3.03JW.06 8 m182 F2.5 .733 NN N *4 cR0.05 N  CSS-   U 2
25 180424A8P N NP162 4225 -9.4.16JW.1410 m271 F3.8 .824 NN N *6 cR0.13 N  CSS-   U 2
26 180454A9P N NP162 4725 -9.9.21JW.2112 m253 F2.0 .2 8 NN N *7 cR0.22 N  CS U   U 2
27 18053010P N NP160 5145 -9.6.22JW.2515 m137 F1.2 0  0 NN N *7 cR0.25 N  CS U   U 2
28 18:05 11J.9 3L173 5190 -9.6.25JW.2515 m145 F .8 0 <1 NN N 9.0cR0.24 N  CS U   U 2
29 18:08 12J 1 3L164 5160 -8.7.15JW.1914 m134 F .3 0  0 NN N 7.5cR0.17 N  CS U   U 2
30 18:10 B1D 2 5L182 5185 -9.3.16JW.2014 m136 F .5 0  0 NN N 8.0cR0 m  N  CS U   U 2
31 18:12 B2D.7 2L166 5190 -8.1.06JW.0811 m111 F 0  0  0 NN N *5 cR0 m  N  CS U   U 2
32 18:13 B3G 514L164 5190 -9.8.19JW.2016 m102 F .6 0 <1 NN N 8.5cR0 m  N  CS U   U 2
33 18:17 B4J 2 7L166 5185 -9.9.29JW.2015 m176 F .8 0  m NN N 9.0cR0 m  N  CS U   U 2
34 18:21 C1J 1 3L163 5185 -9.1.17JW.2815 m162 F .4 0 <1 NN N *8 cR0.22 N  CS U   U 2
35 18:22 C2A 2 6L163 5185 -8.7.13JW.2115 m107 F .4 0  o NN N 8.5cR0 m  N  CS U   u 2
36 18:27 C3D 2 7L170 5190 -7.4.15JW.1713 m126 F .3 0  0 NN N 8.0cR0 X  N  CS U   U 2
37 18:30 C4G 1 4L168 5185 -8.3.21JW.2314 m152 F .6 0 <1 NN N 9.0cR0 X  N  CS U   U 2
38 18:31 C5A 2 6L168 5185 -8.4.25JW.2613 m213 F1.4 0 <1 NN N 9.5cR0 X  N  CS U   U 2
39 Cloud2 013081GCK UWY Priv Comm 5/81 527St5cB 28 -6.5*49 -8.2cP Hp,SrI47          1
40 18:46 D1J 3 9L183 4670 -8.2.17JW.1813 m184 F .5 .1<1 NN N 7.5cR0 X  N  CS U   U 2
41 18:55 D3E 412L164 4330 -8.8.20JW.2612 m253 F .7 0 <1 NN N 7.5cR0 X  N  CS U   U 2
42 19001 D4P N NP172 3760 -6.4.20JW.2010 m361 F1.1 .1 2 NN N *7 cR0 X  N  CS U   U 2
43 190048D5P N NP167 3230 -7.4.12JW.13 9 m362 F1.7 .2 4 NN N *5 cR0 X  N  CS U   U 2
44 190136D6P N NP155 2750 -6.5 0 JW.03 9 m111 F2.0 .212 NN N *3 cR0 X  N  CS U   U 2
45 190154D7P N NP147 3215 -7.3.07JW.13 9 m367 F2.9 .314 NN N  U cR0 X  N  CS U   U 2
46 190212D8P N NP141 3710 -8.3.12JW.2111 m308 F1.7 .117 NN N *7 cR0 X  N  CS U   U 2
47 190242D9P N NP148 4240 -9.1.20JW.3012 m338 F1.1 0  9 NN N *7 cR0 X  N  CS U   U 2
48 19:04 11B 3 9L166 4690 -7.9.20JW.2412 m248 F .3 0  0 NN N 7.5cR0 X  N  CS U   U 2
49 19:08 12A 513L158 4580 -7.9.20JW.2713 m217 F .7 0  m NN N 7.5cR0 X  N  CS U   U 2
            1111111111222222222233333333334444444444555555555566666666667777777777 8
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 25

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   ----------------------------Card Column No.-----------------------------------------
               111111111122222222223333333333444444444455555555556666666666777777777780
      12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                            Card (Record) Contents
 1 Cloud3 013081DDC UWY Priv Comm 55/81S24St8oC 25 -5.6 45 -8.4oP Hp,Sr145         1
 2 19164213P N NP158 4535 -8.4.18JW.2112 m218 F3.4 .253 NN N *9 oR0 X  N  CS U   U 2
 3 19171814P N NP163 4030 -8.1.31JW.2812 m283 F11  0 99 NN N *9 oR0 X  N  CS U   U 2
 4 19:17 15E 3 7L151 3740 -7.4.20JW.2412 m258 F9.1 0  m NN N 8.2oR0 X  N  CS U   U 2
 5 19204817P N NP157 3190 -6.8.22JW.1910 m405 F8.8 .186 NN N 7.5oR0 X  N  CS U   U 2
 6 19:21 18E.8 2L147 2620 -5.7.05JW.07 7 m322 F11  .2 m NN N *3 oR0 X  N  CS U   U 2
 7 19225419P N NP138 3190 -6.8.17JW.2010 m343 F14  .198 NN N *7 oR0 X  N  CS U   U 2
 8 19231820P N NP142 3620 -7.3.21JW.2612 m321 F12  0 99 NN N *7 oR0 X  N  CS U   U 2
 9 19235421P N NP150 4115 -7.5.12JW.2215 m138 F12  0 99 NN N *10oR0 X  N  CS U   U 2
10 19242422P N NP154 4365 -7.8.18JW.1812 m176 F7.4 0 68 NN N  U oR0 X  N  CS U   U 2
11 Cloud4 013081wKS UWY Priv Comm 5/81 S24StSo8*26*-5.7*47*-8.5oP Hp,Sr147          1
12 19:30 E18.5 1L169 4690 -7.4.17JW.1512 m142 F .2 .2 0 NN N *6 oR0 X  N  CS U   U 2
13 19:32 E28 1 3L171 4650 -8.3.20JW.1612 m167 F4.0 0 19 NN N *7 oR0 X  N  CS U   U 2
14 19:34 E3D 2 4L167 4645 -7.5.12JW.1111 m147 F .7 0  m NN N 4.5oR0 X  N  CS U   U 2
15 19:36 E4J 411L160 4640 -8.4.20JW.1812 m176 F11  0  m NN N 8.5oR0 X  N  CS U   U 2
16 19:41 E5J 513L156 4650 -8.5.22JW.1111 m169 F11  0 99 NN N 9.0oR0 X  N  CS U   U 2
17 19:48 E6A1128L159 4645 -8.8.19JW.0910 m178 F11  0  m NN N 5.5oR0 X  N  CS U   U 2
18 Cloud5 013081MCK UWY Priv Comm 5/81 S24 St C 29 -8.7 53-10.5oP Hp,Sr153         1
19 202048F1P N NP185 5315 -9.1.23JW.1915 m103 F3.3 .228 NN N *7 oR0 X  N  CS U   U 2
20 202124F2P N NP178 4800-11.2.17JW.1214 m 88 F14  .199 NN N *6 oR0 X  N  CS U   U 2
21 202154F3P N NP175 4300 -9.2.16JW.0912 m109 F15  .199 NN N *6 oR0 X  N  CS U   U 2
22 20:22 F4E 2 4L156 3850 -9.7.11JW.10 9 m250 F11  .199 NN N 5.5oR0 X  N  CS U   U 2
23 202506F5P N NP163 3325 -9.2.05JW.03 7 m137 F9.2 .179 NN N <1 oR0 X  N  CS U   U 2
24 202542F6P N NP161 3005 -8.7.03JW.02 8 m230 F3.5 .222 NN N <1 oR0 X  N  CS U   U 2
25 20300601P N NP151 3110 -9.1.04JW.02 7 m155 F11  .593 NN N *6 oR0 X  N  CS U   U 2
26 20302402P N NP147 3610-10.1.10JW.10 9 m320 F13  .289 NN N *6 oR0 X  N  CS U   U 2
27 20310003P N NP155 4125 -9.4.05JW.0912 m107 F9.1 .168 NN N *6 oR0 X  N  CS U   U 2
28 20:32 04A1429L157 4810 -9.9.16JW.1915 m108 F12  0 99 NN N 8.5oR0 X  N  CS U   U 2
29 Cloud1 013181LBF UWY Priv Comm 5/81 S28 So B 51 -8.3 64-11.2oP U,CILO            1
30 18:13 A6E 513L166 6200-10.9.14JW.1612 m165 F2.0 .3 m NN N 7.2oR0 m  N  CS UmW+I2
31 181848A7P N NP178 5625 -9.5.11JW.0911 m121 F5.3 .738 NN N *7 oR0.10 N  CSS-mW+I2
32 182006A6P N NP174 5110 -8.3.09JW.04 9 m 85 F6.2 .853 NN N  U oR0.05 N  CSS-mW+I2
33 182824B1P N NP144 5205 -8.6 0 JW.02 6 m176 F2.3 .6 4 NN N  0 oR0 0  N  CS UmW+I2
34 182848B2P N NP151 5765 -9.9.04JW.06 7 m314 F1.0 .2 9 NN N *<1oR0.05 N  CS UmW  2
35 182906B3P N NP148 6235-10.8.22JW.2111 m305 F1.3 .3 6 NN N  U oR0.22 N  CS UmW  2
36 Cloud2 013181LBF UWYPriv Comm 5/81  S28 St V 75-11.0 90 -9.2oP U,CILOWk175      1
37 183000C1P N NP152 7500-11.0.01JW.03 7 m 76 F2.1 .747 NN N  <1oR0.02 N  CSS- W+I2
38 183036C2P N NP159 8125-10.2.02JW.02 9 m 56 F2.1 .819 NN N  <1oR0.03 N  CSS- W+I2
39 183054C3P N NP151 8540 -9.6.04JW.05 9 m119 F2.61.236 NN N  <1oR0.04 N  CSS- W+I2
40 183118C4P N NP156 8900 -9.4.04JW.05 9 m165 F1.8 .717 NN N *<1oR0.05 N  CSS-mW+I2
41 Cloud3 013181LBF UWY Priv Comm 5/81 S28 St V110 -9.7129-13.3oP U,ThCILO         1
42 183312D1P N NP16511050 -9.7.02JW.03 5 m167 F1.8 .8 9 NN N  <1oR0.02 N  CSS-mW  2
43 183336D2P N NP16611540-10.8.10JW.10 9 m278 F2.4 .7 8 NN N  U oR0.11 N  CSS-mW+I2
44 183406D3P N NP17012035-11.6.10JW.11 9 m280 F2.7 .817 NN N *6 oR0.12 N  CSS-mW+I2
45 183430D4P N NP16312560-12.6.13JW.1410 m254 F2.0 .926 NN N  U oR0.16 N  CSS-mW+I2
46 183454D5P N NP17012940-13.3.04JW.05 9 m 91 F1.4 .313 NN N *<1oR0.03 N  CS U W+I2
47 Cloud4 013181LBF UWY Priv Comm 5/81 S28 St 1144-16.7150-17.8oP U,nol>100        1
48 183624E1P N NP17314430-17.3.01JW.01 6 m152 F4.01.415 NN N *0 oR0 0  N  CSS-W?IS2
49 183654E2P N NP17214930-17.6.02JW.02 6 m247 F2.5 0  4 NN N *0 oR0 0  N  CS 0W?+I2
50 Cloud5 013181CDR UWY Priv Comm 5/81 S33 So C U  U    U   U  oP U,*CILO          1
51 19:43 G10.7 2L177 6105-11.4.02JW.01 7 m 59 F8.61.224 NN N *<1oR0.02 N  CSS-mI+S2
52 19:44 G2D 411L174 6295-12.0.05JW.05 9 m145 F4.1 .5 m NN N 3.0oR0 m  N  CS UmW+I2
53 19:47 G3D 2 6L178 6355-12.0.13JW.1110 m219 F2.7 .3*7 NN N 5.0oR0 m  N  CS UmW+I2
54 19:49 G4A 3 7L172 6310-11.8.03JW.03 7 m173 F2.9 .4*8 NN N *2 oR0 m  N  CS UmW+I2
55 Cloud6 013181SNY UWY Priv Comm 5/81 S42 St I U  U    U   U  oP U                1
56 17:48 A1J.9 3L169 6170-10.5.11JW.10 9 m225 F1.8 .4 m NN N  U  R0 m  N  CS UmW+I2
57 17:51 A2J 2 4L172 6175-10.3.08JW.10 9 m234 F1.8 .3 m NN N *2 oR0 m  N  CS UmW+I2
               111111111122222222223333333333444444444455555555556666666666777777777778
      12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 26

```
   --------------------------Card Column No.--------------------------------------
            11111111112222222222333333333344444444445555555555666666666677777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                        Card (Record) Contents
 1 CldSysA021479MCC UWY Sierra Co-op   S20CuUrS*35  *0 120 U   mP Um2FCf&WkLc      1
 2 17:17Z 1G.7 2L175 9300-10.7.15JW.2023 m 30 F m  m m N N N  N  N  N  N  N U  U  2
 3 17:20  2G 1 3L177 8000 -8.4.26JW.3324 m 44 F m  m m N N N  N  N  N  N  N U  U  2
 4 17:21  3A.5 1L175 8000 -8.4.66JW.8529 m 66 F m  m m N N N  N  N  N  N  N U  U  2
 5 17:24  4J.5 1L171 8100 -8.6.27JW.3423 m 57 F m  m m N N N  N  N  N  N  N U  U  2
 6 17:25  5G.2.6L169 8000 -8.1.68JW1.125 m138 F m  m m N N N  N  N  N  N  N U  U  2
 7 17:25  6A.3.9L171 7900 -8.5.24JW.2724 m 38 F m  m m N N N  N  N  N  N  N U  U  2
 8 17:28  7G.5 1L175 7900 -8.5.37JW.6823 m101 F m  m m N N N  N  N  N  N  N U  U  2
 9 17:29  8G.2 1L175 8000 -8.4.60JW.7320 m185 F m  m m N N N  N  N  N  N  N U  U  2
10 CldSysA021479BLU UWY Sierra Co-op   S13CuUrS*33 +0.6120 U   mP Um2FCf&WkLc      1
11 17:55Z27E.4 1P161 3300 +0.6.19JW.1615 m 93 F m  m m N N N  N  N  N  N  N U  U  2
12 18:06 28G.6 2L169 5000 -2.7.30JW.3223 m 51 F m  m m N N N  N  N  N  N  N U  U  2
13 18:07 28G.5 1L171 5000 -2.5.21JW.2318 m 73 F m  m m N N N  N  N  N  N  N U  U  2
14 CldSysA121577BLUUWYO Sierra Co-op81 S200rCuB U   U  120  U  m  Um*1-2FCf;SrCv  1
15 15:37Z 1G.6 2L173 9200 -6.4 N N 1.722 m296 F m  m m N N N  N  N  N  N  N U  U  2
16 CldSysA121577BLUUWYO Sierra Co-op81 S350rCuS U   U  120  U  m  Um*1-2FCf;SrCv  1
17 15:38Z 2G.6 2L167 9100 -7.0 N N .2510 m115 F m  m m N N N  N  N  N  N  N U  U  2
18 15:45  7G 1 4P179 9800 -8.1 N N .2719 m 78 F m  m m N N N  N  N  N  N  N U  U  2
19 CldSysA121577MCCUWYO Sierra Co-op81 S490rCuS U   U  120  U  m  Um*1-2FCf;SrCv  1
20 15:39Z3 G.6 2L163 9100 -6.8 N N .631m m180 F m  m m N N N  N  N  N  N  N U  U  2
21 15:40  4J.5 1L161 9100 -6.8 N N .2017 m 73 F m  m m N N N  N  N  N  N  N U  U  2
22 15:42  50.5 1L173 9100 -6.7 N N .5417 m221 F m  m m N N N  N  N  N  N  N U  U  2
23 15:43  6J.5 1L171 9100 -6.9 N N .3519 m105 F m  m m N N N  N  N  N  N  N U  U  2
24 CldSysA121577MCCUWYO Sierra Co-op81 S210rCuB U   U  120  U  m  Um*1-2FCf        1
25 16:12Z16G 1 4L161 7000 -3.8 N N .3120 m 72 F m  m m N N N  N  N  N  N  N U  U  2
26 16:14 17J 1 3L165 7000 -3.8 N N .2820 m 65 F m  m m N N N  N  N  N  N  N U  U  2
27 16:16 18G.8 2L167 7000 -3.8 N N .4021 m 83 F m  m m N N N  N  N  N  N  N U  U  2
28 16:18 19G.9 3L173 7100 -3.4 N N 1.321 m254 F m  m m N N N  N  N  N  N  N U  U  2
29 16:19 20G.4 1L169 7100 -4.0 N N .4221 m 84 F m  m m N N N  N  N  N  N  N U  U  2
30 16:20 21G.7 2L173 7100 -3.4 N N 1.221 m231 F m  m m N N N  N  N  N  N  N U  U  2
31 16:21 22G.3.8L159 7000 -3.4 N N 1.321 m287 F m  m m N N N  N  N  N  N  N U  U  2
32 16:23 23A.7 2L169 7000 -4.1 N N .4119 m109 F m  m m N N N  N  N  N  N  N U  U  2
33 CldSysA121577MCCUWYO Sierra Co-op81 S340rCuC U   U  120  U  m  Um*1-2FCf;SrCv  1
34 16:55Z24G.8 2L17111000-13.1 N N .2319 m 67 F m  m m N N N  N  N  N  N  N U  U  2
35 16:56 25G.6 2L17111000-13.2 N N .1820 m 44 F m  m m N N N  N  N  N  N  N U  U  2
36 16:57 26J 2 6L17511000-13.2 N N .3220 m 71 F m  m m N N N  N  N  N  N  N U  U  2
37 CldSysA121577BLUUWYO Sierra Co-op81 S360rCuB U   U  120  U  m  Um*1-2FCf;SrCv  1
38 17:20Z27G.4 1L17511000-13.0 N N .2420 m 55 F m  m m N N N  N  N  N  N  N U  U  2
39 17:31 31G.5 2L19811300-13.3 N N .4119 m112 F m  m m N N N  N  N  N  N  N U  U  2
40 CldSysA121577BLUUWYO Sierra Co-op81 S360rCuC U   U  120  U  m  Um*1-2FCf        1
41 17:34Z33G.6 2L19511400-15.3 N N .2720 m 88 F m  m m N N N  N  N  N  N  N U  U  2
42 17:35 34G.7 2L19311400-15.0 N N .3620 m 87 F m  m m N N N  N  N  N  N  N U  U  2
43 17:35 35G 1 3L19511400-15.0 N N .3421 m 73 F m  m m N N N  N  N  N  N  N U  U  2
44 CldSysA121577BLUUWYO Sierra Co-op81 S360rCuB U   U   U   U  m  Um*1-2FCf        1
45 17:25Z280.8 2L19111000-12.7 N N .2419 m 72 F m  m m N N N  N  N  N  N  N U  U  2
46 17:28 290.4 1L18911000-13.3 N N .2819 m 78 F m  m m N N N  N  N  N  N  N U  U  2
47 17:31 30G.8 2L18111000-13.2 N N .8922 m170 F m  m m N N N  N  N  N  N  N U  U  2
48 17:32 32J.8 3L19511400-14.7 N N .2819 m 79 F m  m m N N N  N  N  N  N  N U  U  2
49 17:46 36A.8 3L20411500-13.3 N N .1521 m 31 F m  m m N N N  N  N  N  N  N U  U  2
            11111111112222222222333333333344444444445555555555666666666677777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

Note: On type "2" records for U. Wyo. Sierra Co-op data (Files 26-31),
columns 36-37 contain approximate MVDs estimated from
MVD=mean dia.=100x(cube root of 6xLWC/(pi x conc)).

TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 27

```
    ---------------------------Card Column No.------------------------------------------
             111111111122222222223333333333444444444455555555556666666666777777777788
    12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                                Card (Record) Contents
  1 CldSysA021479MCC UWY Sierra Co-op   S30CuOrS*35  *0 120 U   mP Um2FCf&WkLc      1
  2 17:29Z 90.4 1L175 7900 -8.8.58JW1.019 m272 F m  m m N N N  N  N  N  N  N U   U  2
  3 17:30 100.5 1L169 7900 -8.8.14JW.3019 m 90 F m  m m N N N  N  N  N  N  N U   U  2
  4 17:30 110.4 1L169 8000 -8.8.54JW1.116 m496 F m  m m N N N  N  N  N  N  N U   U  2
  5 17:31 120.3.8L169 7900 -8.9.40JW.6315 m337 F m  m m N N N  N  N  N  N  N U   U  2
  6 17:32 150.7 2L161 7900 -8.4.31JW.4418 m149 F m  m m N N N  N  N  N  N  N U   U  2
  7 17:33 16A.4 1L163 7800 -8.4.44JW.5620 m133 F m  m m N N N  N  N  N  N  N U   U  2
  8 17:38 170.7 2L163 7000 -6.6.26JW.3920 m100 F m  m m N N N  N  N  N  N  N U   U  2
  9 17:38 180.4 1L161 7100 -6.5.44JW.7022 m120 F m  m m N N N  N  N  N  N  N U   U  2
 10 17:39 190.6 2L161 7000 -6.8.13JW.2017 m 83 F m  m m N N N  N  N  N  N  N U   U  2
 11 17:40 200.8 2L161 7000 -6.8.27JW.3817 m136 F m  m m N N N  N  N  N  N  N U   U  2
 12 17:41 210.6 2L165 6900 -6.7.29JW.4221 m 92 F m  m m N N N  N  N  N  N  N U   U  2
 13 17:41 220.7 2L163 6900 -6.7.10JW.1422 m 26 F m  m m N N N  N  N  N  N  N U   U  2
 14 17:42 23E 1 3L163 6900 -6.2.17JW.2521 m 52 F m  m m N N N  N  N  N  N  N U   U  2
 15 17:46 24A.6 2P169 6400 -6.1.13JW.1417 m 57 F m  m m N N N  N  N  N  N  N U   U  2
 16 17:49 25A 1 3P165 5700 -4.2.21JW.3122 m 54 F m  m m N N N  N  N  N  N  N U   U  2
 17 17:52 26E.6 2P165 4900 -2.4.64JW.7622 m143 F m  m m N N N  N  N  N  N  N U   U  2
 18 CldSysA021479MCC UWY Sierra Co-op   S20CuOrS*35  *0 120 U   mP Um2FCf&WkLc      1
 19 18:07Z300.9 3L175 5000 -2.6.63JW.8221 m121 F m  m m N N N  N  N  N  N  N U   U  2
 20 18:10 310.7 2L165 5000 -3.1.28JW.3119 m 83 F m  m m N N N  N  N  N  N  N U   U  2
 21 18:10 32A.6 2L165 5000 -3.0.16JW.1516 m 64 F m  m m N N N  N  N  N  N  N U   U  2
 22 18:13 33A.4 1L165 5000 -3.2.23JW.2418 m 79 F m  m m N N N  N  N  N  N  N U   U  2
 23 18:16 34E.5 1P171 6200 -5.2.77JW.9719 m262 F m  m m N N N  N  N  N  N  N U   U  2
 24 18:16 35E.8 2P169 7000 -7.4.43JW.4619 m130 F m  m m N N N  N  N  N  N  N U   U  2
 25 18:17 360.5 1P167 7700 -8.0.90JW1.222 m227 F m  m m N N N  N  N  N  N  N U   U  2
 26 18:17 370.5 1L177 7800 -9.2.22JW.2318 m 80 F m  m m N N N  N  N  N  N  N U   U  2
 27 18:18 38J.6 2L169 7900 -9.0.34JW.3618 m124 F m  m m N N N  N  N  N  N  N U   U  2
 28 18:20 39J.5 1L169 8000 -8.9.46JW.4321 m 86 F m  m m N N N  N  N  N  N  N U   U  2
 29 CldSysA021479MCC UWY Sierra Co-op   S26CuOrS*35  *0 120 U   mP Um2FCf&WkLc      1
 30 18:22Z40J.8 2L171 7900 -9.1.49JW.6324 m 83 F m  m m N N N  N  N  N  N  N U   U  2
 31 18:23 410.8 2L173 7900 -9.0.25JW.2822 m 48 F m  m m N N N  N  N  N  N  N U   U  2
 32 18:25 430.2.5L167 7900 -8.7.60JW.9821 m185 F m  m m N N N  N  N  N  N  N U   U  2
 33 18:25 440.2.5L163 7950 -3.3.56JW1.121 m238 F m  m m N N N  N  N  N  N  N U   U  2
 34 18:30 470.5 1L167 8000 -8.8.65JW.5815 m380 F m  m m N N N  N  N  N  N  N U   U  2
 35 18:31 48J.3.8L163 7900 -8.7.65JW.7519 m204 F m  m m N N N  N  N  N  N  N U   U  2
 36 18:32 49A.3.8L167 8000 -8.6.92JW.8420 m214 F m  m m N N N  N  N  N  N  N U   U  2
 37 CldSysA021479MCC UWY Sierra Co-op   S12CuOrS*35  *0 120 U   mP Um2FCf&WkLc      1
 38 18:42Z420.5 1L1687900  -8.9.13JW.2023 m 32 F m  m m N N N  N  N  N  N  N U   U  2
 39 18:29 460.7 2L176 8000 -8.8.85JW1.315 m694 F m  m m N N N  N  N  N  N  N U   U  2
 40 19:00Z50A.2.6L177 8000 -8.61.4JW1.219 m348 F m  m m N N N  N  N  N  N  N U   U  2
 41 19:07 510.5 1L173 8000 -8.9.66JW.6120 m139 F m  m m N N N  N  N  N  N  N U   U  2
 42 19:08 520.5 1L173 8000 -8.5.92JW.9819 m256 F m  m m N N N  N  N  N  N  N U   U  2
 43 19:08 530.3.5L167 7900 -7.9.53JW.5718 m175 F m  m m N N N  N  N  N  N  N U   U  2
 44 19:12 54J.5 1L179 7900 -8.7.73JW.8422 m151 F m  m m N N N  N  N  N  N  N U   U  2
 45 19:14 550.7 2L171 8000 -8.9.93JW1.220 m294 F m  m m N N N  N  N  N  N  N U   U  2
 46 CldSysA021479MCC UWY Sierra Co-op   S20CuOrS*35  *0 120 U   mP Um2FCf&WkLc      1
 47 19:19Z560.3.9P181 8000 -9.2.23JW.26.6 m127 F m  m m N N N  N  N  N  N  N U   U  2
 48 19:20 570 1 3P165 7100 -6.8.81JW.8816 m397 F m  m m N N N  N  N  N  N  N U   U  2
 49 19:21 580.8 2L161 6900 -6.5.25JW.2417 m 94 F m  m m N N N  N  N  N  N  N U   U  2
 50 19:23 590.6 2L173 7000 -7.0.38JW.3316 m141 F m  m m N N N  N  N  N  N  N U   U  2
 51 19:24 60A.6 2L163 7000 -6.7.66JW.4918 m152 F m  m m N N N  N  N  N  N  N U   U  2
 52 CldSysA021479MCC UWY Sierra Co-op   S23CuOrS*35  *0 120 U   mP Um2FCf&WkLc      1
 53 19:56Z630.4 1L185 8000 -9.1.49JW.4620 m103 F m  m m N N N  N  N  N  N  N U   U  2
 54 20:00 640.8 2L189 8000 -8.3.98JW1.222 m225 F m  m m N N N  N  N  N  N  N U   U  2
 55 20:00 650.3.9L187 8000 -9.2.44JW.3522 m 60 F m  m m N N N  N  N  N  N  N U   U  2
 56 20:08 670.5 2L185 8000 -8.6.61JW.7122 m132 F m  m m N N N  N  N  N  N  N U   U  2
             111111111122222222223333333333444444444455555555556666666666777777777788
    12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 2H

```
   ---------------------------Card Column No.------------------------------------------
            11111111112222222222333333333344444444445555555555666666666677777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                        Card (Record) Contents
 1 ClDSys*A021479MCC UWY Sierra Co-op   S14CuOrS*35  *0 120 U   mP U*2FCf*WkLc       1
 2 19:52Z61G.4 1L187 8000 -8.4.25JW.2423 m 38 F m  m m N N N  N  N  N  N  N U  U  2
 3 19:55 62G.5 2L183 8000 -8.5.84JW1.123 m174 F m  m m N N N  N  N  N  N  N U  U  2
 4 20:04 66G.5 2L181 7900 -8.6.75JW.6219 m170 F m  m m N N N  N  N  N  N  N U  U  2
 5 20:10 68G.5 1L177 8000 -9.1.47JW.4821 m102 F m  m m N N N  N  N  N  N  N U  U  2
 6 20:11 69G.3.9L181 7900 -8.7.92JW1.019 m266 F m  m m N N N  N  N  N  N  N U  U  2
 7 20:12 70G.4 1L187 8000 -9.3.16JW.2119 m 55 F m  m m N N N  N  N  N  N  N U  U  2
 8 20:13 71G.7 2L183 7900 -9.2.23JW.2216 m 97 F m  m m N N N  N  N  N  N  N U  U  2
 9 20:18 72G.5 1L177 7900 -6.3.43JW.5024 m 72 F m  m m N N N  N  N  N  N  N U  U  2
10 20:19 73G.3.9L187 8000 -6.5.88JW.8320 m220 F m  m m N N N  N  N  N  N  N U  U  2
11 ClDSys*A021479MCC UWY Sierra Co-op   S32CuOrS*35  *0 120 U   mP U*2FCf*WkLc       1
12 20:20Z74A.5 2L181 8000 -7.8.32JW.3922 m 66 F m  m m N N N  N  N  N  N  N U  U  2
13 20:28 78J 1 3L177 8000 -8.7.27JW.2821 m 60 F m  m m N N N  N  N  N  N  N U  U  2
14 20:34 79G.6 2L187 8000 -8.2.27JW.3221 m 69 F m  m m N N N  N  N  N  N  N U  U  2
15 ClDSys*A021479MCC UWY Sierra Co-op   S18CuOrS*35  *0 120 U   mP U*2FCf*WkLc       1
16 20:26Z75G.7 2L185 8000 -9.1.42JW.3417 m130 F m  m m N N N  N  N  N  N  N U  U  2
17 20:27 76G.5 2L181 8000 -9.2.35JW.3016 m134 F m  m m N N N  N  N  N  N  N U  U  2
18 20:27 77G.5 2L181 8000 -8.1.74JW.6018 m183 F m  m m N N N  N  N  N  N  N U  U  2
19 20:35 81G.5 2L185 8000 -8.5.47JW.4016 m172 F m  m m N N N  N  N  N  N  N U  U  2
20 20:36 82G.5 1L171 8000 -8.0.55JW.5619 m152 F m  m m N N N  N  N  N  N  N U  U  2
21 ClDSys*A021479MCC UWY Sierra Co-op   S28CuOrS*35  *0 120 U   mP U*2FCf*WkLc       1
22 20:34Z80G.5 2L183 8100 -8.01.1JW1.119 m328 F m  m m N N N  N  N  N  N  N U  U  2
23 20:37 83J.8 2L171 8000 -8.2.27JW.3820 m 97 F m  m m N N N  N  N  N  N  N U  U  2
24 20:44 84G 1 3L185 9000 -9.0.14JW.2323 m 37 F m  m m N N N  N  N  N  N  N U  U  2
25 20:46 86G.5 1L177 9000-10.7.39JW.3319 m 95 F m  m m N N N  N  N  N  N  N U  U  2
26 ClDSys*A021479MCC UWY Sierra Co-op   S43CuOrS*35  *0 120 U   mP U*2FCf*WkLc       1
27 20:45Z85G.5 2L187 8900 -9.9.27JW.4320 m 98 F m  m m N N N  N  N  N  N  N U  U  2
28 20:47 87J.6 2L189 9000-10.0.50JW.6921 m134 F m  m m N N N  N  N  N  N  N U  U  2
29 20:55 88G.6 2L189 9000-10.3.24JW.3422 m 83 F m  m m N N N  N  N  N  N  N U  U  2
30 20:58 89G.8 2L175 9000-10.2.18JW.2922 m 53 F m  m m N N N  N  N  N  N  N U  U  2
31 ClDSys*A021679BLU UWY Sierra Co-op   S24CuOrC U    U   U   U   mP U**2FWkCf        1
32 16:38Z 10.9 3L169 7900 -7.5.52JW.4227 m 42 F m  m m N N N  N  N  N  N  N U  U  2
33 16:39   20 41 1L161 7800 -7.5.24JW.1922 m 35 F m  m m N N N  N  N  N  N  N U  U  2
34 16:44   30.6 2L187 7800 -7.8.20JW.2423 m 37 F m  m m N N N  N  N  N  N  N U  U  2
35 16:45   40 3 7L161 7800 -7.6.31JW.3819 m 98 F m  m m N N N  N  N  N  N  N U  U  2
36 16:47   5G.9 3L163 7900 -7.8.19JW.2716 m117 F m  m m N N N  N  N  N  N  N U  U  2
37 16:48   6G.6 2L167 7800 -7.4.12JW.1519 m 43 F m  m m N N N  N  N  N  N  N U  U  2
38 16:49   7G 1 4L165 7900 -7.6.42JW.5316 m262 F m  m m N N N  N  N  N  N  N U  U  2
39 16:51   80.6 2L167 7800 -7.8.57JW.2515 m130 F m  m m N N N  N  N  N  N  N U  U  2
40 16:53   90 2 6L163 7900 -7.6.24JW.2421 m 47 F m  m m N N N  N  N  N  N  N U  U  2
41 16:55 100 1 3L163 7800 -7.5.36JW.4423 m 69 F m  m m N N N  N  N  N  N  N U  U  2
42 16:57 110.5 1L161 7800 -7.6.41JW.5023 m 75 F m  m m N N N  N  N  N  N  N U  U  2
43 16:58 120.8 2L157 7800 -7.5.21JW.2821 m 57 F m  m m N N N  N  N  N  N  N U  U  2
44 16:58 130.5 1L155 7800 -7.5.47JW.5925 m 70 F m  m m N N N  N  N  N  N  N U  U  2
45 17:00 140 1 3L165 7800 -7.7.10JW.2120 m 49 F m  m m N N N  N  N  N  N  N U  U  2
46 17:01 150.5 1L163 7800 -7.5.37JW.4822 m 81 F m  m m N N N  N  N  N  N  N U  U  2
47 17:01 160.5 1L165 7800 -7.7.28JW.2719 m 72 F m  m m N N N  N  N  N  N  N U  U  2
48 17:02 170 1 4L167 7900 -7.7.27JW.3623 m 58 F m  m m N N N  N  N  N  N  N U  U  2
49  7:03 180 1 3L165 7800 -7.7.23JW.2721 m 58 F m  m m N N N  N  N  N  N  N U  U  2
50 17:06 190 1 3L165 7900 -7.8.13JW.2322 m 41 F m  m m N N N  N  N  N  N  N U  U  2
51 17:07 200 1 3L169 7900 -7.8.04JW.1319 m 37 F m  m m N N N  N  N  N  N  N U  U  2
52 17:08 210.5 1L169 7800 -7.8.29JW.4121 m 88 F m  m m N N N  N  N  N  N  N U  U  2
53 17:09 220.5 1L167 7800 -7.7.13JW.2319 m 61 F m  m m N N N  N  N  N  N  N U  U  2
54 17:11 230.8 2L169 7800 -8.0.08JW.2018 m 63 F m  m m N N N  N  N  N  N  N U  U  2
55 17:12 240 1 4L171 7800 -8.2.40JW.5822 m102 F m  m m N N N  N  N  N  N  N U  U  2
56 17:15 280 1 3L159 7800 -8.2.43JW.4820 m119 F m  m m N N N  N  N  N  N  N U  U  2
57 17:25 300 2 6L173 8800 -9.9.21JW.1820 m 46 F m  m m N N N  N  N  N  N  N U  U  2

            11111111112222222222333333333344444444445555555555666666666677777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 29

```
       ---------------------------Card Column No.------------------------------------------
                 1111111111222222222233333333334444444444555555555566666666667777777778
       12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                           Card (Record) Contents
 1 CldSysA021679BLU UWY Sierra Co-op   545CuOrB U   U   U   U  mP Um#2FWkCf         1
 2 17:13Z25G.9 3L165 7800 -8.0.25JW.2820 m 72 F m  m m N N N  N  N  N  N  N U  U  2
 3 17:29 31G 2 7L171 8800-10.1.17JW.1420 m 34 F m  m m N N N  N  N  N  N  N U  U  2
 4 17:32 32G.5 1L173 9800-10.4.11JW.1118 m 36 F m  m m N N N  N  N  N  N  N U  U  2
 5 CldSysA021679BLU UWY Sierra Co-op   534CuOrB U   U   U   U  mP Um#2FWkCf         1
 6 17:16Z27G 1 3P155 7900 -8.5.16JW.1818 m 57 F m  m m N N N  N  N  N  N  N U  U  2
 7 17:18 28G.8 2P161 8300 -8.8.20JW.2218 m 78 F m  m m N N N  N  N  N  N  N U  U  2
 8 17:18 290 1 4P167 8800 -9.8.25JW.3519 m 91 F m  m m N N N  N  N  N  N  N U  U  2
 9 17:33 33G.5 1L173 8800-10.4.08JW.1320 m 31 F m  m m N N N  N  N  N  N  N U  U  2
10 17:35 34G 1 4L181 8800-10.8.17JW.1418 m 60 F m  m m N N N  N  N  N  N  N U  U  2
11 17:38 35J.5 1L171 7800 -9.2.31JW.1418 m 69 F m  m m N N N  N  N  N  N  N U  U  2
12 CldSysB021679MCC UWY Sierra Co-op   519CuOrB U   U   U   U  mP Um#2FWkCf         1
13 18:21Z36G.7 2L183 5500 -3.3.18JW.1417 m 51 F m  m m N N N  N  N  N  N  N U  U  2
14 18:21 37G 2 7L181 5200 -2.5.46JW.4518 m149 F m  m m N N N  N  N  N  N  N U  U  2
15 18:24 38G.7 2L179 4900 -2.0.24JW.2015 m115 F m  m m N N N  N  N  N  N  N U  U  2
16 18:25 39G.5 1L169 4800 -2.6.28JW.2515 m145 F m  m m N N N  N  N  N  N  N U  U  2
17 18:26 40J 1 3L171 4800 -2.1.17JW.1814 m132 F m  m m N N N  N  N  N  N  N U  U  2
18 18:29 41J 2 6L175 6800 -6.3.20JW.2518 m 78 F m  m m N N N  N  N  N  N  N U  U  2
19 18:34 42G.3.9L179 6800 -8.21.1JW1.020 m242 F m  m m N N N  N  N  N  N  N U  U  2
20 18:34 43A.6 2L177 6800 -6.1.89JW.7522 m131 F m  m m N N N  N  N  N  N  N U  U  2
21 18:40 44G.4 1L171 7800 -7.91.3JW1.221 m245 F m  m m N N N  N  N  N  N  N U  U  2
22 18:41 45G.9 3L171 7700 -7.8.70JW.6220 m142 F m  m m N N N  N  N  N  N  N U  U  2
23 18:42 46J.7 2L169 7800 -8.1.50JW.4520 m109 F m  m m N N N  N  N  N  N  N U  U  2
24 18:43 47J.4 1L163 7800 -8.2.50JW.4420 m108 F m  m m N N N  N  N  N  N  N U  U  2
25 18:46 48G.5 1L171 7900 -8.6.46JW.4419 m126 F m  m m N N N  N  N  N  N  N U  U  2
26 18:47 49G.9 3L167 7800 -8.2.30JW.3218 m 87 F m  m m N N N  N  N  N  N  N U  U  2
27 18:48 50J.7 2L168 7800 -7.01.3JW1.319 m364 F m  m m N N N  N  N  N  N  N U  U  2
28 18:52 51G.5 1L171 7900 -8.1.61JW.7014 m456 F m  m m N N N  N  N  N  N  N U  U  2
29 18:53 520 2 5L169 7800 -7.5.42JW.4116 m205 F m  m m N N N  N  N  N  N  N U  U  2
30 18:55 53J.5 1L167 7700 -8.3.42JW.4518 m138 F m  m m N N N  N  N  N  N  N U  U  2
31 18:58 54G.8 2L171 7800 -8.8.18JW.1519 m 44 F m  m m N N N  N  N  N  N  N U  U  2
32 18:59 55G.6 2L178 7700 -8.5.60JW.3119 m 88 F m  m m N N N  N  N  N  N  N U  U  2
33 19:06 56J.4 1L171 7800 -7.71.0JW1.219 m348 F m  m m N N N  N  N  N  N  N U  U  2
34 19:07 57G.6 2L175 7800 -7.8.77JW.7418 m247 F m  m m N N N  N  N  N  N  N U  U  2
35 19:08 58G.5 1L173 7800 -7.31.0JW1.119 m304 F m  m m N N N  N  N  N  N  N U  U  2
36 19:08 59G.6 2L169 7800 -7.5.49JW.4616 m188 F m  m m N N N  N  N  N  N  N U  U  2
37 19:09 60J.9 3L171 7800 -7.7.27JW.3017 m111 F m  m m N N N  N  N  N  N  N U  U  2
38 19:13 61G.8 2L171 7800 -7.8.17JW.2117 m 80 F m  m m N N N  N  N  N  N  N U  U  2
39 19:14 62G.6 2P175 7800 -7.9.59JW.5817 m224 F m  m m N N N  N  N  N  N  N U  U  2
40 19:16 63G.6 2P171 7400 -7.1.48JW.5117 m208 F m  m m N N N  N  N  N  N  N U  U  2
41 19:16 64J.5 1P171 7100 -6.7.54JW.5617 m237 F m  m m N N N  N  N  N  N  N U  U  2
42 CldSysB021679MCC UWY Sierra Co-op   529CuOrB U   U   U   U  mP Um#2FWkCf         1
43 19:20Z65G 1 3L173 6800 -5.6.18JW.1715 m 98 F m  m m N N N  N  N  N  N  N U  U  2
44 19:22 66J.8 2L173 6800 -5.4.19JW.2218 m111 F m  m m N N N  N  N  N  N  N U  U  2
45 19:25 67J.6 2L175 6800 -5.4.13JW.1717 m 68 F m  m m N N N  N  N  N  N  N U  U  2
46 19:29 680 2 5L167 6800 -5.7.40JW.4517 m190 F m  m m N N N  N  N  N  N  N U  U  2
47 19:31 69G.4 1L167 6800 -5.7.85JW.8716 m370 F m  m m N N N  N  N  N  N  N U  U  2
48 19:34 70J.6 2L169 6800 -5.5.15JW.1618 m 56 F m  m m N N N  N  N  N  N  N U  U  2
49 19:43 71G.5 1L171 6800 -6.1.59JW.5216 m246 F m  m m N N N  N  N  N  N  N U  U  2
50 CldSysB021679MCC UWY Sierra Co-op   520CuOrB U   U   U   U  mP Um#2FWkCf         1
51 19:44Z720 1 3L171 6800 -6.0.43JW.3815 m205 F m  m m N N N  N  N  N  N  N U  U  2
52 19:45 73G.5 1L167 6800 -5.9.18JW.2014 m155 F m  m m N N N  N  N  N  N  N U  U  2
53 19:46 74J.6 2L163 6800 -6.1.39JW.4816 m206 F m  m m N N N  N  N  N  N  N U  U  2
                 1111111111222222222233333333334444444444555555555566666666667777777778
       12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

Note: On type "2" records for U. Wyo. Sierra Co-op data (Files 26-31),
columns 36-37 contain approximate MVDs estimated from
MVD=mean dia.=100x(cube root of 6xLWC/(pi x conc)).

TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 30

```
   ---------------------------Card Column No.------------------------------------
            1111111111222222222233333333334444444444555555555566666666667777777777
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                          Card (Record) Contents
 1 ClaSysA022679MCC UWY Sierra Co-op    S25CuOr5 U   U   U   U  m  Ua#1FWkCf       1
 2 16:51Z 1J 1 3P175 8600 -8.8.20JW.1921 m 38 F m  m m N N N  N  N  N  N  N U  U  2
 3 16:55  2G.8 2P171 6800 -4.6.24JW.2721 m 53 F m  m m N N N  N  N  N  N  N U  U  2
 4 17:00  3G.5 1P179 6600 -4.0.49JW.4725 m 57 F m  m m N N N  N  N  N  N  N U  U  2
 5 17:01  4G 1 3P173 5800 -2.5.31JW.3220 m 82 F m  m m N N N  N  N  N  N  N U  U  2
 6 17:03  5J.4 1L163 5800 -2.3.46JW.4924 m 71 F m  m m N N N  N  N  N  N  N U  U  2
 7 17:05  6J 1 3L169 4800 -0.5.28JW.3020 m 76 F m  m m N N N  N  N  N  N  N U  U  2
 8 17:08  7J 1 3P173 4800 -1.1.29JW.4318 m152 F m  m m N N N  N  N  N  N  N U  U  2
 9 17:10  8A.9 2P165 7600 -6.0.27JW.3022 m 57 F m  m m N N N  N  N  N  N  N U  U  2
10 ClaSysA022679BLU UWY Sierra Co-op    S48CuOr5 U   U   U   U  m  Ua#1FWkCf       1
11 17:17Z 9G 2 6L19211300-13.8.10JW.2128 m 19 F m  m m N N N  N  N  N  N  N U  U  2
12 17:19 10G 2 5L20611300-14.2.28JW.3126 m 35 F m  m m N N N  N  N  N  N  N U  U  2
13 17:20 11G 2 8L19711200-13.6.16JW.2331 m 15 F m  m m N N N  N  N  N  N  N U  U  2
14 17:22 12G 3 9P18311200-13.3.23JW.2931 m 19 F m  m m N N N  N  N  N  N  N U  U  2
15 17:25 13G 2 6P18210000-11.0.20JW.2630 m 18 F m  m m N N N  N  N  N  N  N U  U  2
16 17:27 14G.8 3P189 8500 -8.0.12JW.1531 m 10 F m  m m N N N  N  N  N  N  N U  U  2
17 17:28 15G.9 3P185 7800 -6.1.10JW.1529 m 12 F m  m m N N N  N  N  N  N  N U  U  2
18 17:30 16G.7 2P187 7000 -4.8.23JW.1722 m 31 F m  m m N N N  N  N  N  N  N U  U  2
19 ClaSysA022679BLU UWY Sierra Co-op    S21CuOr5 U   U   U   U  m  Ua#1FWkCf       1
20 17:30Z17E.9 3P169 6700 -4.5.54JW.2419 m 62 F m  m m N N N  N  N  N  N  N U  U  2
21 17:32 18E.7 2P173 5700 -2.6.28JW.3520 m 82 F m  m m N N N  N  N  N  N  N U  U  2
22 17:33 19A.5 1P163 5500 -2.0.24JW.2218 m 88 F m  m m N N N  N  N  N  N  N U  U  2
23 ClaSysA022679BLU UWY Sierra Co-op    S39CuOr5 U   U   U   U  m  Ua#1FWkCf       1
24 17:54Z20G 2 7L191 8800 -8.5.20JW.2427 m 23 F m  m m N N N  N  N  N  N  N U  U  2
25 17:56 21G.7 2L187 8800 -8.4.12JW.1231 m  8 F m  m m N N N  N  N  N  N  N U  U  2
26 18:01 22G 2 5L185 8800 -8.3.14JW.2029 m 18 F m  m m N N N  N  N  N  N  N U  U  2
27 18:04 23J.5 2L191 8800 -8.0.20JW.2222 m 41 F m  m m N N N  N  N  N  N  N U  U  2
28 18:08 24G 1 3L179 6900 -5.3.49JW.4425 m 53 F m  m m N N N  N  N  N  N  N U  U  2
29 18:09 25G 1 4L187 6800 -4.8.15JW.1327 m 12 F m  m m N N N  N  N  N  N  N U  U  2
30 18:15 26G.6 2L185 7900 -6.5.23JW.2527 m 25 F m  m m N N N  N  N  N  N  N U  U  2
31 18:16 27G.5 1L193 7900 -6.8.32JW.3025 m 38 F m  m m N N N  N  N  N  N  N U  U  2
32 18:18 28J.8 2L183 7800 -6.7.34JW.3222 m 55 F m  m m N N N  N  N  N  N  N U  U  2
33 ClaSysA022679BLU UWY Sierra Co-op    S63CuOr5 U   U   U   U  m  Ua#1FWkCf       1
34 18:26Z29G.9 3L19810900-12.7.21JW.2728 m 24 F m  m m N N N  N  N  N  N  N U  U  2
35 18:27 30E 1 4P20211000-13.1.26JW.3027 m 30 F m  m m N N N  N  N  N  N  N U  U  2
36 18:29 31G 2 5P18711500-14.0.22JW.3032 m 18 F m  m m N N N  N  N  N  N  N U  U  2
37 18:30 32A 1 4L19811400-13.9.11JW.1632 m  9 F m  m m N N N  N  N  N  N  N U  U  2
38 ClaSysA022679LTA UWY Sierra Co-op    S43CuOr5 U   U   U   U  m  Ua#1FWkCf       1
39 18:42Z33G 1 3L18712700-16.9.12JW.1532 m  9 F m  m m N N N  N  N  N  N  N U  U  2
40 18:43 34G.7 2L19512900-17.1.22JW.3232 m 19 F m  m m N N N  N  N  N  N  N U  U  2
41 18:44 35A 2 7L20012900-17.1.13JW.1930 m 13 F m  m m N N N  N  N  N  N  N U  U  2
42 ClaSysA022679LTA UWY Sierra Co-op    S43CuOr5 U   U   U   U  m  Ua#1FWkCf       1
43 18:58Z36A.8 3L19812900-17.0.10JW.2730 m 19 F m  m m N N N  N  N  N  N  N U  U  2
44 19:04 37G.5 1L19512900-17.3.26JW.3729 m 30 F m  m m N N N  N  N  N  N  N U  U  2
45 19:05 38A 1 3L20013000-17.0.15JW.2330 m 17 F m  m m N N N  N  N  N  N  N U  U  2
46 ClaSysA031879MCC UWY Sierra Co-op    S22CuOrC#45 +1   U   U  o? #1AFmCf         1
47 19:11Z 1E.9 2P161 7500 -5.9.41JW.5813 m482 F m  m m N N N  N  N  N  N  N U  U  2
48 19:12  2E.9 2P181 8500 -8.2.26JW.3113 m272 F m  m m N N N  N  N  N  N  N U  U  2
49 19:13  3E.4 1P185 9200 -9.4.61JW.7817 m328 F m  m m N N N  N  N  N  N  N U  U  2
50 19:14  4E 1 4P189 9800-10.6 X JW1.216 m546 F m  m m N N N  N  N  N  N  N U  U  2
51 19:15  5G 1 3L183 9800-10.9 X JW.4516 m195 F m  m m N N N  N  N  N  N  N U  U  2
52 19:16  6J 1 5L169 9900-10.5 X JW1.116 m557 F m  m m N N N  N  N  N  N  N U  U  2
53 19:19  7H 1 3L177 9900-10.8 X JW.6415 m389 F m  m m N N N  N  N  N  N  N U  U  2
54 19:20  8G.5 1L175 9800-10.7 X JW1.115 m829 F m  m m N N N  N  N  N  N  N U  U  2
55 19:21  9G 2 4L173 9800-10.9 X JW.4617 m168 F m  m m N N N  N  N  N  N  N U  U  2
56 19:22 10G 2 6L175 9800-10.8 X JW.2519 m97  F m  m m N N N  N  N  N  N  N U  U  2
            1111111111222222222233333333334444444444555555555566666666667777777777
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

Note: On type "2" records for U. Wyo. Sierra Co-op data (Files 28-31), columns 36-37 contain approximate MVDs estimated from MVD=mean dia.=100x(cube root of 6xLWC/(pi x conc)).

TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 31

```
   ---------------------------Card Column No.-------------------------------------------
            11111111112222222222333333333344444444445555555555666666666677777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                            Card (Record) Contents
 1 CldSysA031879MCC UWY Sierra Co-op   525CuOrB#45 +1    U    U   c? #1AFmCf               1
 2 19:29Z11G 2 6L169 9800-10.0 N N 1.315 m700 F m  m m N N N  N  N  N  N  N U  U  2
 3 19:31 12G.9 3L167 9800-10.6 N N .6115 m360 F m  m m N N N  N  N  N  N  N U  U  2
 4 19:32 13G.7 2P171 9900-10.6 N N 1.315 m719 F m  m m N N N  N  N  N  N  N U  U  2
 5 19:32 14J 1 4P16710300-11.1 N N .4714 m333 F m  m m N N N  N  N  N  N  N U  U  2
 6 19:36 15G.9 3P17710800-11.7 N N 1.416 m700 F m  m m N N N  N  N  N  N  N U  U  2
 7 CldSysA031879BLU UWY Sierra Co-op   519CuOrB#45 +1    U    U   c? #1AFmCf               1
 8 19:37Z16J.7 2L18910800-11.2 N N .5114 m377 F m  m m N N N  N  N  N  N  N U  U  2
 9 19:38 17E.9 3P18310800-12.6 N N .7816 m383 F m  m m N N N  N  N  N  N  N U  U  2
10 19:39 18J.4 1P18910400-11.9 N N 1.016 m488 F m  m m N N N  N  N  N  N  N U  U  2
11 19:41 19E.6 2P183 8400 -8.1 N N .5113 m442 F m  m m N N N  N  N  N  N  N U  U  2
12 19:42 20A.6 2P181 7500 -6.3 N N .4212 m427 F m  m m N N N  N  N  N  N  N U  U  2
13 19:58 21J.6 2L187 6900 -4.8.32JW.2811 m456 F m  m m N N N  N  N  N  N  N U  U  2
14 20:11 22E.8 2P173 9800-10.1.23JW.1813 m175 F m  m m N N N  N  N  N  N  N U  U  2
15 20:13 23E 2 7P18710800-12.6 X JW.3816 m184 F m  m m N N N  N  N  N  N  N U  U  2
16 20:16 24G.6 2L18310900-12.1 X JW.4216 m193 F m  m m N N N  N  N  N  N  N U  U  2
17 20:16 25G.4 1L18510900-12.4 X JW1.117 m408 F m  m m N N N  N  N  N  N  N U  U  2
18 20:17 26J.9 3L18310900-12.5 X JW.2815 m147 F m  m m N N N  N  N  N  N  N U  U  2
19 20:20 27E 2 5L19110000-10.5 X JW.1513 m133 F m  m m N N N  N  N  N  N  N U  U  2
20 20:23 28E.9 3P183 9700-10.0 X JW.5415 m292 F m  m m N N N  N  N  N  N  N U  U  2
21 20:24 29E.6 2P193 8900 -8.9 X JW.6114 m395 F m  m m N N N  N  N  N  N  N U  U  2
22 20:24 30J.8 3P187 8400 -7.8 X JW.5613 m487 F m  m m N N N  N  N  N  N  N U  U  2
23 20:29 31E 1 3P177 8300 -7.4 X JW.1611 m226 F m  m m N N N  N  N  N  N  N U  U  2
24 20:30 32J 1 3P183 7600 -6.6 X JW.2813 m259 F m  m m N N N  N  N  N  N  N U  U  2
25 CldSysA031879BLU UWY Sierra Co-op   519CuOrB#45 +1    U    U   c? .5-1AFmCf             1
26 20:52Z33G 2 6L18310700-11.4 N N .1815 m 88 F m  m m N N N  N  N  N  N  N U  U  2
27 20:57 34G.9 3L17710900-12.1 N N .1815 m110 F m  m m N N N  N  N  N  N  N U  U  2
28 20:58 35G.7 2L17710900-12.2 N N .6917 m263 F m  m m N N N  N  N  N  N  N U  U  2
29 20:59 36E 1 3P17710900-12.2 N N .1815 m100 F m  m m N N N  N  N  N  N  N U  U  2
30 21:02 37E 1 4P178 9500 -9.8 N N .3314 m233 F m  m m N N N  N  N  N  N  N U  U  2
31 21:03 38E.5 1P175 6900 -8.2 N N .3114 m224 F m  m m N N N  N  N  N  N  N U  U  2
32 21:12 39J.5 1L175 8500 -3.6 N N .3111 m511 F m  m m N N N  N  N  N  N  N U  U  2
33 CldSysA031879BLU UWY Sierra Co-op   518CuOrB#45 +1    U    U   c? .5-1AFmCf             1
34 21:29Z40J 1 4L187 8900-10.0.13JW.2414 m152 F m  m m N N N  N  N  N  N  N U  U  2
35 21:45 42G 1 3L185 8900 -8.0.19JW.3015 m179 F m  m m N N N  N  N  N  N  N U  U  2
36 22:08 48G 2 6L179 8800 -7.8.18JW.2114 m143 F m  m m N N N  N  N  N  N  N U  U  2
37 22:14 49G.7 2L175 6800 -3.2.44JW.3512 m375 F m  m m N N N  N  N  N  N  N U  U  2
38 CldSysA031879BLU UWY Sierra Co-op   526CuOrB#45 +1    U    U   c? .5-1AFmCf             1
39 21:43Z41G.9 3L191 9300 -9.0 X JW.3715 m181 F m  m m N N N  N  N  N  N  N U  U  2
40 21:47 43E 1 3P191 7700 -6.3 X JW.2312 m269 F m  m m N N N  N  N  N  N  N U  U  2
41 21:48 44G 1 3P179 7100 -4.8.58JW.3211 m402 F m  m m N N N  N  N  N  N  N U  U  2
42 CldSysA031879BLU UWY Sierra Co-op   537CuOrS#45 +1    U    U   c? .5-1AFmCf             1
43 22:00Z45E.5 1P175 6900 -4.5.26JW.2813 m258 F m  m m N N N  N  N  N  N  N U  U  2
44 22:02 46E 2 6P179 7800 -6.4 X JW.3014 m228 F m  m m N N N  N  N  N  N  N U  U  2
45 22:05 47E 1 4P181 8100 -6.4.35JW.3515 m200 F m  m m N N N  N  N  N  N  N U  U  2
46 22:16 50J.5 1L173 6800 -2.9 X JW.3814 m278 F m  m m N N N  N  N  N  N  N U  U  2
47 22:22 51G.8 2L175 7900 -6.4.26JW.2314 m173 F m  m m N N N  N  N  N  N  N U  U  2
48 22:29 52G.6 2L183 8900 -8.3.19JW.1513 m129 F m  m m N N N  N  N  N  N  N U  U  2
49 22:30 53J.5 1L181 8800 -8.1.16JW.2014 m142 F m  m m N N N  N  N  N  N  N U  U  2
50 22:36 54G 1 3L179 7800 -8.3.17JW.2014 m149 F m  m m N N N  N  N  N  N  N U  U  2
            11111111112222222222333333333344444444445555555555666666666677777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

Note: On type "2" records for U. Wyo. Sierra Co-op data (Files 26-31), columns 36-37 contain approximate MVDs estimated from MVD=mean dia.=100x(cube root of 6xLWC/(pi x conc)).

Data Files 32 to 34, 37 to 39, and 43

are blank

as of the date of this report.

TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 35

```
   --------------------------Card Column No.---------------------------------------
            1111111111222222222233333333334444444444555555555566666666667777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                          Card (Record) Contents
 1 CldGrp1032481W72 NRL                S 0 Cu V*34*-2.2 64 -7.0 McLeCvO GulfStream1
 2 1142   1A 1 4L217*5400*-6.0.56JW X 1931 X  A N  N  X NN U  *9CRO N  N   N 0 W  2
 3 1145   2A.7 2L215*5300 -4.6.15JW X 1728 X  A N  N  X NN U  *2CRO N  N   N 0 W  2
 4 1150   3J.1.4L220*6400 -6.3.82JW X 1928 X  A N  N  X NN*.8*30CRO N  N   N 0W   2
 5 1151   4A.1.3L220 6400 -5.71.2JW X 1928 X  A N  N  X NN*.8*30CRO N  N   N 0 W  2
 6 1153   5J.2.8L222 6500 -7.3.8 JW X 2031 X  A N  N  X NN*.6*23CRO N  N   N 0 W  2
 7 1154   6J.3 1L222 6600 -6.4 .5JW X 2031 X  A N  N  X NN*.5*18CRO N  N   N 0 W  2
 8 1154   7J.1.5L222 6600 -6.8 .6JW X 2031 X  A N  N  X NN*.3*10CRO N  N   N 0 W  2
 9 1154   8J.1.4L222 6600 -6.8.4 JW X 2031 X  A N  N  X NN*.6*23CRO N  N   N 0 W  2
10 1154  9 J.2.7L222 6600 -6.6 .6JW X 2031 X  A N  N  X NN*.2*10CRO N  N   N 0 W  2
11 CldGrp2032481W72 NRL                S 0 Cu V*34*-2.2*74*-7.0 McLeCvO GulfStream1
12 1200   1A.1.5L222*7100 -6.41.1JW X 2128 X  A N  N  X NN*.6*24CRO N  N   N 0 W  2
13 1202   2A.3 1L220*6200 -5.5.32JW X 1928 X  A N  N  X NN*.3*13CRO N  N   N 0 W  2
14 CldGrp3032481W72 NRL                S 0 Cu V 34 -2.2 68*-5.0 McLeCvO GulfStream1
15 1228   1J.2.7L210 3750 -3.7 .1JW X  9 U X  A N  N  X NN U *0 CRO N  N   N 0 W  2
16 1230   2J.2.6L210 3750 -3.3.20JW X  9 U X  A N  N  X NN U *0 CRO N  N   N 0 W  2
17 1232   3J.1.5L210 3750 -3.0.28JW X  9 U X  A N  N  X NN U *0 CRO N  N   N 0 W  2
18 1235   4A.2.6L216 5400 -5.0.35JW X 1425 X  A N  N  X NN U *0 CRO N  N   N 0 W  2
19 1240   5J.1.5L217 5600 -6.2.56JW X 1425 X  A N  N  X NN U *0 CRO N  N   N 0 W  2
20 1242   6A.1.4L218 6100 -6.4.7 JW X 1625 X  A N  N  X NN U *0 CRO N  N   N 0 W  2
21 1249   7J.2.6L218 6100 -6.5.30JW X 1628 X  A N  N  X NN U *0 CRO N  N   N 0 W  2
22 1254   8A.1.2L218 6400 -7.0 .8JW X U U  X  A N  N  X NN U *0 CRO N  N   N 0 W  2
23 1255   9A.1.2L218 6400 -7.01.0JW X  U U X  A N  N  X NN U *0 CRO N  N   N 0 W  2
24 1256  10A.1.2L218 6400 -7.0 .9JW X  U U X  A N  N  X NN U *0 CRO N  N   N 0 W  2
25 1256  11A.1.4L218 6400 -7.01.0JW X  U U X  A N  N  X NN U *0 CRO N  N   N 0 W  2
26 1300  12A.1.2L218 6400 -7.0 .9JW X  U U X  A N  N  X NN U *0 CRO N  N   N 0 W  2
27 1301  13A.1.4L218 6400 -7.0 .8JW X  U U X  A N  N  X NN U *0 CRO N  N   N 0 W  2
28 1301  14A.1.5L218 6500 -7.5 .8JW X  U U X  A N  N  X NN U  25CRO N  N   N 0 W  2
29 1305  15A.3 1L218 6200 -7.51.0JW X 1525 X  A N  N  X NN U  12CRO N  N   N 0 W  2
30 Cloud 1032681nIL NRL                P 6 Cu V*/0 U  *90*-10 cP <1ASmCf          1
31 1352   1A.2 1L244 8900 -9.4.52JW.371119560 A N  N  0 NN .4 18CRO N  N   N 0 W  2
32 CldGrp2032681GSH NRL                P 6 Cu V U  U    U  U   cP 0-.1ASmCf,MTb   1
33 1453   1J 2 9L26011000-13.5.13JW X  X X X  A N  N  U NN.12  5CRO N  N   N 0 W  2
34 1455   2G.1.4L26011000-13.1.21JW.141019360 A N  N  U NN.24 11CRO N  N   N 0 W  2
35 1455   3G.1.4L26011000-12.6.61JW.681422730 A N  N  U NN X  X  RO N  N   N 0 W  2
36 1455   4D.6 3L26011000-12.3.26JW.271119670 A N  N  U NN.36 15CRO N  N   N S WS 2
37 1456   5A.5 2L26011000-12.0.13JWsnow cntam A N  N  U NN.26 X  RO N  N   N S WS 2
38 1459   6D.2.7L25011000-10.8.37JW.391222680 A N  N  U NN.40 17CRO N  N   N 0 W  2
39 1459   7J.2.7L25011000-10.7.24JW.221022600 A N  N  U NN.22 13CRO N  N   N 0 W  2
40 1503   8J.3 1L23011000-10.4.30JWsnow cntam A N  N  U NN.52 24CRO N  N   N S WS 2
41 1508   9F.3 1L240 8900 -6.6.41JWsnow cntam A N  N  U NN.32 X  RO N  N   N S WS 2
42 1509  10J.3 1L230 8800 -6.6.20JWsnow cntam A N  N  U NN.21 9C RO N  N   N S WS 2
43 1510  11F.6 2L230 8100 -4.4.38JWsnow cntam A N  N  U NN.44 19CRO N  N   N S WS 2
44 1511  12J.5 2L230 8000 -4.0.22JWsnow cntam A N  N  U NN.23 12CRO N  N   N S WS 2
45 Cloud 3032681VWV NRL                P6 CuCbC U  U    U  U   cP *0-.2ASmCf,SrTb 1
46 1512   1A 2 7L226 8000 -5.1.52JW.301019610 A N  N  U NN.40 19CRO N  N   N S WS 2
47 Cloud 4032681nOH NRL                P 6 U  C U  U    U  U   cP 0-.3FSmCf,MTb   1
48 1547   1A 2 9L222*7000-10.6.22JW.421322650 A N  N  U NN.27 U  RO N  N   N 0 W  2
49 CldGrp1031981HGR NRL                S M Sc I*55-13.0100-23.0cP NyW*7W&FLc      1
50 1527   1A.3 1L230 7000-18.0.46JW N N N N  N  N  N X N N X  X  RO N  N  N  U*mW 2
51 1551   2A.5 2L230 6000-18.0*.2JW N N N N  N  N  N X N N.19 U CRO N  N  N  U*mW 2
52 CldGrp2031981JST NRL                S M Sc I*48-13.0 U   U  cP  NyW*7W&FLc     1
53 1558   1A 2 7L230 5800-16.0.25JW N N N N  N  N  N X N N.18 U CRO N  N  N  U*mW 2
54 1601   2A.5 2L230 5600-15.2.18JW N N N  N N  N  N X N N.18 U CRO N  N  N  0 W  2
55 1606   3F.5 2L230 5000-13.9.11JW N N N  N N  N  N X N N.12 .4CRO N  N  N S- WS 2
56 1607   4A 1 6L220 5000-13.2.28JW N N N  N N  N  N X N N.28  5CRO N  N  N S- WS 2
57 CldGrp3031981HGR NRL                S M Sc I*40*-13 *70-18.5cP  NyW*7W&FLc,ClLO1
58 1631   1A.3 1L230 5000-13.5.23JW N N N  N N  N  N X N N.25 U  RO N  N  N  5 WS 2
59 1643   2A.5 2L230 6900-16.9.48JW N N N  N N  N  N X N N.50 U  RO N  N  N 0  W  2
            1111111111222222222233333333334444444444555555555566666666667777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 36

```
   ---------------------------Card Column No.--------------------------------------
            111111111122222222223333333333444444444455555555556666666666777777777778
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                            Card (Record) Contents
 1 CldGrp4031981IAD NRL               S 3 Sc I*68*-15 *90*-22 cP  NyW*7W&FLc,UpCl1
 2 1705  1F.5 2L230 7000-15.6.24JW N N N  N N  N  N X N N.17 U  RO N  N  N S- WS 2
 3 1706  2A 2 8L230 7000-15.3.12JW N N N  N N  N  N X N N.10  4CRO N  N  N S- WS 2
 4 CldGrp1041781cME NRL               S 0 St C*90*-7.8120 U   McTSyW,W&FHc&R,ClLD1
 5 1430  1A 2 9L23011000-10.0 N JW N N N  N  N N  N N N N.249.6CRO N  N  N  0 W  2
 6 1439  2E N NP210 9700 -8.1 N JW.031641135 A N  N N N N.082.7CRO N  N  N  0 W  2
 7 1439  3E N NP21010200 -8.1 N JW.221728180 A N  N N N N.25 10CRO N  N  N  0 W  2
 8 1440  4D 1 4L21010700 -7.8 N JW.321828350 A N  N N N N.32 13CRO N  N  N  0 W  2
 9 1441  5D 2 5L21010700 -7.6 N JW.271422290 A N  N N N N.33 13CRO N  N  N  0 W  2
10 1442  6D.5 2L21010700 -7.5 N JW.03 716470 A N  N N N N.26 11CRO N  N  N  0 W  2
11 1443  7G 2 6L21010700 -7.4 N JWsnow cntam A N  N N N N.093.0CRO N  N  N S- WS 2
12 1445  8A 2 8L22010700 -7.3 N JWsnow cntam A N  N N N N.197.6CRO N  N  N S- WS 2
13 1502  9F.8 3L23511000 -8.6 N JWsnow cntam A N  N N N N.103.9CRO N  N  N S- WS 2
14 1503 10F 417L23511000 -7.7 N JWsnow cntam A N  N N N N.249.6CRO N  N  N S- WS 2
15 1507 11F 310L23511000 -6.2 N JW.081525320 A N  N N N N.177.0CRO N  N  N  0 W  2
16 1510 12A 624L23511000 -4.5 N JW.201322330 A N  N N N N.28 11CRO N  N  N  0 W  2
17 Cloud A121980cMA NRL               S 0 Sc 8*60 U   *80*-13 cP 1-2FSmDyCf        1
18 14:35  1J.3 1L218 7500*-12 .29JW X  X X X A  N  N  X NN.32 16cRO N  N  N  0 W  2
19 14:36  2F.4 1L218 7500*-12 .12JW X  X X X A  N  N  X NN.16 12cRO N  N  N  0 W  2
20 14:37  3J.2.7L218 7500*-12 .28JW X  X X X A  N  N  X NN.56 18cRO N  N  N  0 W  2
21 14:38  4J 1 4L218 7500*-12  X JW X  X X X A  N  N  X NN.35 16cRO N  N  N  0 W  2
22 14:41  5J.3 1L218 7500*-12  X JW X  X X X A  N  N  X NN.35 14cRO N  N  N  0 W  2
23 14:43  6J.3 1L218 7500*-12  X JW X  X X X A  N  N  X NN.196.7cRO N  N  N  0 W  2
24 14:47  7J.3 1L217 7000-11.5.23JW X  X X X A  N  N  X NN.23 10cRO N  N  N  0 W  2
25 14:49  8F.3 1L245 7000-11.5.12JW X  X X X A  N  N  X NN.197.1cRO N  N  N  0 W  2
26 14:50  9J.4 2L245 7000-11.5.20JW X  X X X A  N  N  X NN.27 14cRO N  N  N  0 W  2
27 14:50 10J.2 1L245 7000-11.5.14JW X  X X X A  N  N  X NN.198.5cRO N  N  N  0 W  2
            111111111122222222223333333333444444444455555555556666666666777777777778
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TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 40

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      ----------------------------Card Column No.--------------------------------------
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Rec.
No.                              Card (Record) Contents
 1 F298C1A121674OLMUWSH QJRMetSoc.v106 S 0 Cu C 30  U  200  U  mP 0-.1ACfSu@F1     1
 2 15:13L 1G 1 3L126 7000 -3  .3 JW N N N  m  A N  N N 10W N  N  N  N  N  N S- W+I2
 3 15:14  2G 1 3L130 7000 -3  .15JW N N N  m  A N  N N 30W N  N  N  N  N  N S  mI 2
 4 15:16  3G.2.4L130 7000 -3  .55JW N N N  m  A N  N N  2W N  N  N  N  N  N 0  mW 2
 5 15:16  4G.5 1L130 7000 -3  .7 JW N N N  m  A N  N N  5W N  N  N  N  N  N 0 mW+I2
 6 F298C1B121674OLMUWSH QJRMetSoc.v106 S 0 Ns C 45 *0  200  U  mP 0-.2FCfSu@F1     1
 7 15:17L 1G1022L130 7000 -4  .06JW N N N  m  A N  N N 10W N  N  N  N  N  N S- mI 2
 8 F298C1C121674SEAUWSH QJRMetSoc.v106 S 0 Cu C 30  U  200  U  mP 0-.1ACfSu@F1     1
 9 16:23L 1G.4 1L130 8000 -3  .3 JW N N N  m  A N  N N 15W N  N  N  N  N  N S  W+I2
10 16:24  2G.1.2L130 7500 -3  1.0JW N N N  m  A N  N N  3W N  N  N  N  N  N 0  mW 2
11 16:27  3G.2.4L130 7500 -2  .5 JW N N N  m  A N  N N  8W N  N  N  N  N  N S- W+I2
12 F298C1D121674SEAUWSH QJRMetSoc.v106 S 0 Cb C 30  U  200  U  mP 0-.1ACfSu@F1     1
13 16:42L 1G 2 4L124 7000 -2  .17JW N N N  m  A N  N N 15W N  N  N  N  N  N S  mI 2
14 16:44  2G 3 6L124 7000 -1  .45JW N N N  m  A N  N N  4W N  N  N  N  N  N 0 mW+I2
15 16:49  3G.5 1L124 7000 -1  .2 JW N N N  m  A N  N N  3W N  N  N  N  N  N 0 mW+I2
16 16:50  4G.4 1L124 7000 -1  1.1JW N N N  m  A N  N N  1W N  N  N  N  N  N 0  mW 2
17 F298C1E121674SEAUWSH QJRMetSoc.v106 S 0 Cu C 30  U  200  U  mP .2-.4ACfSu@F1    1
18 16:52L 1G 4 8L120 7000 -1  .2 JW N N N  m  A N  N N  5W N  N  N  N  N  N S- mI 2
19 16:57  2G 4 8L120 7000 -1  .1 JW N N N  m  A N  N N  5W N  N  N  N  N  N S- mI 2
20 F301C1A010275SEAUWSHQJRMetSoc106:p29S 0 Cu B 30  U  *95  U  mP CvOOcWf,<.2F4aRb1
21 14:48L 1G 3 7L122 5400 -2.4.17JW N 9 N 500 A N  N N .2W N  N  N  N  N  N 0  W  2
22 14:51  2G 2 3L122 5500 -2.7.23JW N 9 N 700 A N  N N .1W N  N  N  N  N  N 0  W  2
23 14:54  3G 3 7L122 5400 -2.4.14JW N 8 N 550 A N  N N .1W N  N  N  N  N  N 0  W  2
24 14:57  4G 2 3L112 5400 -2.6.08JW N 8 N 350 A N  N N .1W N  N  N  N  N  N 0  W  2
25 F301C1B010275OLMUWSHQJRMetSoc106:p29S 0 Cu I  U  U   U   U  mP CvOOcWf,.6ACf    1
26 15:40L 1G 2 3L120 7400 -1.3.21JW N 25N  25 A N  N N  1W N  N  N  N  N  N 0 mW+I2
27 15:42  2J 2 4L120 7400 -1.4.26JW N 20N  60 A N  N N  1W N  N  N  N  N  N 0 mW+I2
28 F301C1C010275HQMUWSHQJRMetSoc106:p29S 0 Cu C 30 *+1 >99 <-15mP Ud@CfSu@F1,&3aRb1
29 16:06L 1G 3 7L134 7600 -2.8.07JW N 10N 125 A N  N N 98W N  N  N  N  N  N S+ mI 2
30 16:09  2G 1 3L140 7800 -4.31.1JW N 16N 500 A N  N N 15W N  N  N  N  N  N S-mW+I2
31 16:11  3G 2 4L135 7800 -4.0.21JW N 11N 290 A N  N N 99W N  N  N  N  N  N S+mI+W2
32 16:25  4J 4 8P13010000 -7.5.14JW N 11N 200 A N  N N 30W N  N  N  N  N  N S- I+W2
33 F301C1D010275SEAUWSHQJRMetSoc106:p29S 0StScU U   U   U   U  mP *.6AWkCf         1
34 18:24L 1H 511L124 6500 -3.7.27JW N 10N 460 A N  N N .2W N  N  N  N  N  N 0  mW 2
35 18:30  2A 2 3L124 6400 -3.6.09JW N 8 N 320 A N  N N  0W N  N  N  N  N  N 0   W 2
36 F733C1A020279237UWSH Priv Comm 1982 S 0 Sc C*60 -2.8 79  U  mP 1W&ASf,&2-3E&ACf1
37 12:34L 1G 612L125 6445 -6.4.84JW.782734125 A2.1 0 36.1W N  N  N  N  N  N E-mW+I2
38 12:37  2K.5 1L119 6770 -4.5.98JW.822839109 A 11 0 31.1W N  N  N  N  N  N E-mW+I2
39 12:46  3E.6 1L119 6770 -4.3 X JW.382634 69 A 183.797.1W N  N  N  N  N  N *0 mW 2
40 12:48  4E1020L119 6290 -4.3.44JW.522540103 A X 1.298.1W N  N  N  N  N  N *0 mW 2
41 F733C1B020279237UWSH Priv Comm 1982 S 0 St C 24 +1.0 43 -1.2mP 1W&ASf,&2-3E&ACf1
42 13:02L 1E N NP120 4280 -1.3 X JW.322439 75 A X  .199.1W N  N  N  N  N  N E-mW+I2
43 13:03  2E N NP120 3760 -1.7 X JW.291832175 A X  .399.1W N  N  N  N  N  N E-mW+I2
44 13:03  3E N NP120 3270 -1.1 X JW.331624253 A X  .399.1W N  N  N  N  N  N E-mW+I2
45 13:04  4E N NP120 2725 -0.3 X JW.171434199 A X  .259.2W N  N  N  N  N  N E-mW+I2
46 13:04  5E N NP120 2450 -0.1 X JW.041035149 A X  .543.1W N  N  N  N  N  N E-mW+I2
47 F733C1C020279237UWSH Priv Comm 1982 S 0 St C 48 -0.6 62 -2.4mP 1W&ASf,&2-3E&ACf1
48 13:20L 1E N NP122 4930 -0.5 X JW.242025 95 A 59 .146.1W N  N  N  N  N  N E  W+I2
49 13:20  2E N NP121 5310 -1.0 X JW.202228 62 A 54 .199.1W N  N  N  N  N  N E  W+I2
50 13:37  3D 1 3L137 5370 -1.4 X JW.122040 63 A U  0  6 0W N  N  N  N  N  N  0 mW 2
51 13:39  4  2 4L123 5325 -1.3 X JW.242238 74 A .3 0 28.1W N  N  N  N  N  N  0 mW 2
52 13:41  5J.7 1L123 5350 -1.2 X JW.101740 67 A1.1 0 40.1W N  N  N  N  N  N 0  mW 2
53 13:43  6J.8 2L121 5350 -1.3 X JW.172240 62 A1.2 0 18.1W N  N  N  N  N  N 0  mW 2
54 F733C1D020279237UWSH Priv Comm 1982 S 0 St C 18 +0.8 35 -0.1mP 1W&ASf,&2-3E&ACf1
55 13:58L 1G 2 4L124 3380 -0.7.45JW.541840233 A X  .299.2W N  N  N  N  N  N E-mW+I2
56 14:01  2G.4.8L119 3360 -0.4 X JW.312139112 A X  .299.1W N  N  N  N  N  N *0 mW 2
57 14:02  3G.4.8L119 3325 -0.6 X JW.431732313 A X  .388.1W N  N  N  N  N  N 0  mW 2
58 14:02  4G 1 2L114 3405 -0.2 X JW.282139 99 A X  .199.3W N  N  N  N  N  N 0  mW 2
59 14:03  5E.5 1L116 3385 -0.6.5 JW.581833230 A X  0 99.1W N  N  N  N  N  N 0  mW 2
60 14:04  6E 4 8L111 2890 -0.2.43JW.481539358 A X  .199.3W N  N  N  N  N  N 0  mW 2

               1111111111222222222233333333334444444444555555555566666666667777777778
      12345678901234567890123456789012345678901234567890123456789012345678901234567890
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TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 41

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    -------------------------Card Column No.----------------------------------------
             11111111112222222222333333333344444444445555555555666666666677777777778
    12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                          Card (Record) Contents
 1  F733C1E020279237UWSH Priv Comm 1982 S 0 Sc B 22 +0.6  U  U  mP 1W&ASf,&2-3E&ACf1
 2  15:15L 1G 1 2L123 2640 -0.1.25JW.16 921362 A X 1.1444.W N  N  N  N  N  N SP W+I2
 3  15:17  2J 1 2L127 2580 -0.9.19JW.08 7 X347 A X  0 66.7W N  N  N  N  N  N SP W+I2
 4  F733C1F020279HQMUWSH Priv Comm 1982 S 0 Sc B 28 -0.5  U  U  mP 1W&ASf,&2-3E&ACf1
 5  15:25L 1J 2 4L125 3085 -0.7.37JW.201030382 A X  .8302.W N  N  N  N  N  N E-mW+I2
 6  15:30  2E 3 5L118 3090 -1.6.35JW.251018530 A X  .5572.W N  N  N  N  N  N E-mW+I2
 7  15:33  3E N NP111 3595 -2.2.55JW.521725330 A X  .6873.W N  N  N  N  N  N E-mW+I2
 8  15:35  4D 1 2L116 4040 -2.8.40JW.361527290 A X  .4905.W N  N  N  N  N  N E-mW+I2
 9  15:36  5G 1 2L119 4055 -2.6.21JW.1410 X285 A X  .69911W N  N  N  N  N  N E  W+I2
10  15:37  6G 2 4L117 4070 -2.1.09JW.0710 X165 A X  .58011W N  N  N  N  N  N E  W+I2
11  15:39  7E 2 5L117 4070 -2.1.58JW.331732175 A X  .299.6W N  N  N  N  N  N E-mW+I2
12  15:41  8K.6 1L112 4260 -1.9.75JW.661828230 A X  .322.1W N  N  N  N  N  N *0 mW 2
13  15:43  9K.2.4P115 4615 -2.21.1JW1.02230234 A X  .3 2.2W N  N  N  N  N  N *0 mW 2
14  F857C1A021480OLMUWSH Priv Comm 1982 S 0 Ac C125-17.8135-21.5cP EyW,NE-SWPg6SWHc1
15  12:12L 1E N NP14712150-17.8.05JW.0213 X 33 A X  X 1..3W N  N  N  N  N  N *0 mW 2
16  12:13  2E N NP14112700-19.1.07JW.061116153 A X  X .2.3W N  N  N  N  N  N *0 mW 2
17  12:15  3E N NP14313250-20.6.07JW.091215190 A X  X .6.1W N  N  N  N  N  N *0 mW 2
18  12:16  4E N NP14013735-21.5.1?JW.292027122 A X  X 2..1W N  N  N  N  N  N *0 mW 2
19  F857C1B021480HQMUWSH Priv Comm 1982 S 0 Sc C 33 -4.1 58 -6.1cP EyW,NE-SWPg6SWHc1
20  12:47L 1E N NS145 5505 -5.3.07JW.111525113 A 0? X .6.1W N  N  N  N  N  N 0  W  2
21  12:48  2E N NS146 5000 -4.5.0?JW.151014443 A 0? X 0 .1W N  N  N  N  N  N 0  W  2
22  12:49  3E N NS145 4520 -3.7.0?JW.201324285 A X .1?0 .1W N  N  N  N  N  N 0  W  2
23  12:50  4E N NS138 4025 -4.4.1?JW.221021780 A.1? X .4.1W N  N  N  N  N  N 0  W  2
24  12:51  5A N NS133 3480 -4.3.04JW.071229125 A.2? X 2..2W N  N  N  N  N  N 0  W  2
25  F857C1C021480HQMUWSH Priv Comm 1982 S 0 Sc C 37 -2.8 46 -3.3cP EyW,NE-SWPg6SWHc1
26  12:56L 1E N NP115 3805 -2.6.04JW.031031104 A X  X 2..2W N  N  N  N  N  N *0 mW 2
27  12:57  2A N NP121 4300 -3.8.1?JW.211229450 A X  X 1..3W N  N  N  N  N  N *0 mW 2
28  F857C1D021480HQMUWSH Priv Comm 1982 S 0 St C 49 -3.4 59 -5.0cP EyW,NE-SWPg6SWHc1
29  12:58L 1E N NP123 4940 -3.4.05JW.021020 76 A X  X 0 .1W N  N  N  N  N  N 0  W  2
30  12:59  2E N NP123 5455 -4.4.0?JW.121422136 A X  X 0 .1W N  N  N  N  N  N 0  W  2
31  13:00  3A N NP121 5825 -5.0.1?JW.211423270 A X  X 0 .1W N  N  N  N  N  N 0  W  2
32  13:01  4J.4.9L128 5900 -5.5.1?JW.261221327 A X  X .1.1W N  N  N  N  N  N 0  W  2
33  13:06  5J 2 5L131 5760 -5.7.1?JW.271322300 A X  X 0 .1W N  N  N  N  N  N 0  W  2
34  13:09  6J 2 6L132 5435 -5.3.1?JW.231221294 A X  X 0 .1W N  N  N  N  N  N 0  W  2
35  13:12  7J 1 3L133 5280 -4.4.06JW.10 821283 A X  X 5..1W N  N  N  N  N  N 0  W  2
36  F857C1E021480HQMUWSH Priv Comm 1982 S 0 St C U   U   58 -5.0cP EyW,NE-SWPg6SWHc1
37  13:15L 1G 1 3L129 4965 -4.2.09JW.191228304 A X  X .9.2W N  N  N  N  N  N 0  W  2
38  13:17  2D 2 3L124 4965 -4.0.1?JW.251224363 A X  X 6.1.W N  N  N  N  N  N 0  W  2
39  13:19  3G 511L117 4985 -4.1.2?JW.411526310 A X  X 1..1W N  N  N  N  N  N 0  W  2
40  13:25  4G.4.8L123 5005 -3.9.09JW.151222227 A X  X 3..2W N  N  N  N  N  N 0  W  2
41  13:29  5J.7 1L122 5850 -5.2.13JW.241424189 A X  X .3.1W N  N  N  N  N  N 0  W  2
42  13:31  6J 2 5L117 5845 -5.6.2?JW.431624270 A X  X .4.1W N  N  N  N  N  N 0  W  2
43  13:34  7G.6 1L123 5860 -6.0.2?JW.401522308 A X  X 0 .1W N  N  N  N  N  N 0 W   2
44  13:35  8J 1 2L126 5805 -5.9.2?JW.431524287 A X  X .2.1W N  N  N  N  N  N 0  W  2
45  13:36  9J.3.6L127 5750 -5.6.1?JW.371527293 A X  X .5.1W N  N  N  N  N  N 0  W  2
46  F857C1F021480HQMUWSH Priv Comm 1982 S 0 St B U   U   53 -4.0cP EyW,NE-SWPg6SWHc1
47  13:41L 1E N NP129 5190 -4.1.1?JW.251519267 A X  X 51.2W N  N  N  N  N  N 0  W  2
48  13:42  2G 1 2L128 4955 -3.8.09JW.161322203 A X  X 22.3W N  N  N  N  N  N 0  W  2
49  13:43  3G 1 2L118 4985 -3.7.06JW.041223 68 A X  X .4.1W N  N  N  N  N  N 0  W  2
50  13:44  4D 1 3L118 5000 -3.8.06JW.07 926208 A X  X 13.1W N  N  N  N  N  N 0  W  2
51  13:46  5G 1 3L115 5005 -3.8.09JW.171128305 A X  X 2. XW N  N  N  N  N  N 0  W  2
52  13:47  6G.7 1L112 5000 -3.7.08JW.061229135 A X  X 11 XW N  N  N  N  N  N 0  W  2
53  13:49  7D.5 1L116 4980 -3.5.08JW.05 922170 A X  X 1. XW N  N  N  N  N  N 0  W  2
54  13:50  8G 1 2L123 5015 -3.7.08JW.141323194 A X  X 11 XW N  N  N  N  N  N E-mW+I2
55  13:52  9G 2 4L124 4995 -3.8.06JW.091124173 A X  X 22 XW N  N  N  N  N  N E-mW+I2
56  13:54 10J 4 8L122 5005 -4.1.09JW.181020346 A X  X .5 XW N  N  N  N  N  N 0  W  2
             11111111112222222222333333333344444444445555555555666666666677777777778
    12345678901234567890123456789012345678901234567890123456789012345678901234567890
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TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 42

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    --------------------------Card Column No.---------------------------------------
             111111111122222222223333333333444444444455555555556666666666777777777778
    12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                            Card (Record) Contents
  1 F857C1G021480HQMUWSH Priv Comm 1982 S 0 Sc B 47 -4.0 58 -5.0cP EyW,NE-SWPg6SWHc1
  2 14:08L 1J.7 1L120 5845 -5.1.08JW.171428154 A X  X 50 XW N  N  N  N  N  N 0  W  2
  3 14:17  2E N NP134 5685 -5.5.1?JW.361622317 A.1? X  0 XW N  N  N  N  N  N 0  W  2
  4 14:18  3E N NP120 5190 -4.8.1?JW.231318380 A.1? X  0 XW N  N  N  N  N  N 0  W  2
  5 14:19  4E N NP121 4765 -4.0.04JW.091016276 A.2? X 4.  XW N  N  N  N  N  N 0  W  2
  6 F857C1H021480HQMUWSH Priv Comm 1982 S 0 Sc B 34 -2.9 42 -3.1cP EyW,NE-SWPg6SWHc1
  7 14:20L 1E N NP123 3940 -2.9.1?JW.231628170 A 1? X 6.  XW N  N  N  N  N  N S-mW+12
  8 14:21  2E N NP131 3400 -2.7.0?JW.151829 88 A 5? X 23 XW N  N  N  N  N  N S-mW+12
  9 14:39  3E N NP124 3365 -3.2 X JW.048  8260 A X  X 3.1.W N  N  N  N  N  N E-mW+12
 10 14:40  4E N NP117 3955 -2.6 X JW.121013423 A X  X 1..4W N  N  N  N  N  N *0 mW 2
 11 F857C1I021480HQMUWSH Priv Comm 1982 S 0 Sc B 49 -3.8*57 -6.0cP EyW,NE-SWPg6SWHc1
 12 14:50L 1J.9 2L134 5620 -5.8.1?JW.231323250 A X  X 0 .1W N  N  N  N  N  N 0  W  2
 13 14:55  2J.4.9L138 4835 -3.8.0?JW.08 715288 A X  X 4..6W N  N  N  N  N  N S-mW+12
 14 15:02  3A.9 2L132 5325 -4.7.05JW.08 816233 A X  X 2..9W N  N  N  N  N  N S-mW+12
 15 15:10  4J.8 2L135 4925 -4.5.06JW.06 815181 A X  X .3.2W N  N  N  N  N  N 0  W  2
 16 15:12  5J 3 7L133 4935 -4.6.08JW.09 815245 A X  X .1.1W N  N  N  N  N  N 0  W  2
 17 15:21  6J 2 5L131 4925 -4.3.08JW.11 921261 A X  X 3.1.W N  N  N  N  N  N 0 mW+12
 18 15:39  7J 2 4L129 4930 -4.1.08JW.10 915253 A X  X .5.3W N  N  N  N  N  N S-mW+12
 19 15:51  8A 1 2L127 4345 -3.2.07JW.07 815203 A X  X .9.4W N  N  N  N  N  N 0  mW 2
 20 F881C1A0409800LMUWSH Priv Comm 1982 S 0CuCbl 34 -0.4 75 -5.8mP Um2-3FFmCf@0f   1
 21 11:13L 1A.6 1L136 8460 -8.7 X JW.932733147 A13 2.2733.W N  N  N  N  N  N SPmW+12
 22 11:23  2A 1 3L142 6305 -4.8 X JW1.22833183 A  71.3314.W N  N  N  N  N  N E-mW+12
 23 11:31  3A.2.4L126 4935 -1.7 X JW.912432209 A 0  X  3.1W N  N  N  N  N  N 0  mW 2
 24 11:36  4A.4.9L128 4810 -1.5 X JW.852431151 A 161.7133.W N  N  N  N  N  N RW W  2
 25 F881C1B040980HQMUWSH Priv Comm 1982 S 0 Cu B 34 +1.0 U   U  mP Um2-3FFmCf@0f   1
 26 11:43L 1J.6 1L127 4035 *-.5 X JW.712029210 A  2 .8 51.W N  N  N  N  N  N 0  mW 2
 27 11:44  2A.4.9L128 3900 *-.5 X JW.581828241 A  8 .5 52.W N  N  N  N  N  N 0  mW 2
 28 11:58  3A.8 2L131 4085 *-.1 X JW.942230224 A X  X  3.1W N  N  N  N  N  N 0  W  2
 29 12:03  4D.2.4L133 5140 -2.1 X JW.582030200 A 11 .7114.W N  N  N  N  N  N SPmW+12
 30 12:03  5A.3.6L144 5170 -2.5 X JW.551728290 A  5 .6 62.W N  N  N  N  N  N SPmW+12
 31 12:05  6J.2.4L137 5565 -3.1 X JW.602029208 A X  X  2.1W N  N  N  N  N  N 0  W  2
             111111111122222222223333333333444444444455555555556666666666777777777778
    12345678901234567890123456789012345678901234567890123456789012345678901234567890
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TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 44

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    ----------------------------Card Column No.--------------------------------------------
             1111111111222222222233333333334444444444555555555566666666667777777778
    12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                               Card (Record) Contents
 1 Pass 1 120679HTSAFGL AFGL-TR-810192 P 8St  B U   U  *52*-.8 c  .6-1FSuCf,Cf152 1
 2 22:57Z 1D 1 3L167 5195 -1.8.25JW.271531300 A N  N 2c NN U  U  RO N   N   N S-  I+W2
 3 22:58  2G 2 5L162 5155 -0.9.16JW.171228370 A N  N 1c NN U  U  RO N   N   N S-  I+W2
 4 Pass 2 120679HTSAFGL AFGL-TR-810192 P 8AsAcB 64 -0.6 U   U  c  .6-1FSuCf,Cf152 1
 5 23:01  1H 1 4L177 7185 -1.0.48JW.501734440 A N  N 1c NN U  U  RO N   N   N S-  I+W2
 6 23:03Z 20.7 2L173 7175 -1.5.22JW.151231350 A N  N 1c NN U  U  RO N   N   N S-  I+W2
 7 23:04  3G 1 3L169 7175 -1.6.13JW.051133145 A N  N 1c NN U  U, RO N   N   N S-I+W 2
 8 23:05  4D.3.8L175 7200 -2.0.25JW.161231380 A N  N 2c NN U  U  RU N   N   N S-  I+W2
 9 23:06  5G.4 1L174 7200 -2.0.18JW.07 832300 A N  N 1c NN U  U  RO N   N   N S-  I+W2
10 23:09  6H.8 2L182 7980 -2.7.21JW.101030310 A N  N 1c NN U  U  RO N   N   N S-  I+W2
11 Pass 3 120679HTSAFGL AFGL-TR-810192 P 8AsAcB U   U    U    U  c  .6-1FSuCf,Cf152 1
12 23:14Z 1H 1 3L177 9250 -3.9.16JWsnow cntam A N  N 4c NN U  U  RO N   N   N S   I+W2
13 23:15  2H 1 4L178 9260 -3.7.08JWsnow cntam A N  N 3c NN U  U  RO N   N   N S   I+W2
14 23:17  3H 2 7L176 9250 -3.6.18JWsnow cntam A N  N 3c NN U  U  RO N   N   N S   I+W2
15 Pass 4 120679HTSAFGL AFGL-TR-810192 P 8AsAcB U   U  130*-10 c  .6-1FSuCf,Cf152 1
16 23:23Z 1J 1 5L18511340 -6.4.28JW.331632340A  N  N 55 NN U  U  RO N   N   N U   mW 2
17 23:26  2J.4 1L18411320 -6.3.31JW.351633365 A N  N 56 NN U  U  RO N   N   N U   mW 2
18 23:26  3J.5 2L18611320 -6.5.34JW.401634335 A N  N 55 NN U  U  RO N   N   N U   mW 2
19 23:27  4J.3 1L18511325 -6.6.44JW.551734410 A N  N 55 NN U  U  RO N   N   N U   mW 2
20 23:27  5J.4 1L18311320 -6.4.28JW.321734270 A N  N 56 NN U  U  RO N   N   N U   mW 2
21 Pass 6 120679HTSAFGL AFGL-TR-810192 P 8AsAcB140-11.5170-18.5c  .6-1FSuCf,Cf152 1
22 23:41Z 1D 1 5L18615260-14.5.43JW.451633380 A N  N 27 NN U  U  RO N   N   N U   mW 2
23 23:43  2D.6 2L20015330-15.0.37JW.331532345 A N  N 26 NN U  U  RO N   N   N U   mW 2
24 23:43  3H.4 1L18815270-14.8.16JW.101231240 A N  N 27 NN U  U  RO N   N   N U   mW 2
25 Pass 7 120679HTSAFGL AFGL-TR-810192 P 8AsAcB140-11.5170-18.5c  .6-1FSuCf,Cf152 1
26 23:47Z 1A.4 1L20716915-18.5.28JW.241734255 A N  N 25 NN U  U  RO N   N   N U   mW 2
27 Pass 9 120679HTSAFGL AFGL-TR-810192 P 8AsAcB140-11.5170-18.5c  .6-1FSuCf,Cf152 1
28 24:09Z 1J.3 1L18714400-13.3.27JW.251634255 A N  N  0 NN U  U  RO N   N   N U   mW 2
29 24:12  2J.3 1L18114390-13.5.21JW.251534355 A N  N  0 NN U  U  RO N   N   N U   mW 2
30 24:13  3H.7 2L18614420-13.6.25JW.351735345 A N  N 38 NN U  U  RO N   N   N U   mW 2
31 Pass10 120679HTSAFGL AFGL-TR-810192 P 8AsAcB U   U  130*-10 c  .6-1FSuCf,Cf152 1
32 24:17Z 1D 412L17712285 -8.6.39JW.361634300 A N  N 29 NN U  U  RO N   N   N U   mW 2
33 24:23  2H 1 4L17312260 -8.3.56JW.662235325 A N  N 1c NN U  U  RO N   N   N U   mW 2
34 Pass11 120679HTSAFGL AFGL-TR-810192 P 8AsAcB U   U    U    U  c  .6-1FSuCf,Cf152 1
35 24:28Z 1D 1 5L16710285 -5.3.35JW.261219485 A N  N 48 NN U  U  RO N   N   N S-  I+W2
36 24:30  2H 1 3L17110300 -5.9.46JW.451734345 A N  N 86 NN U  U  RU N   N   N S-  I+W2
37 24:32  3H 1 4L16910300 -5.6.17JWsnow cntam A N  N 2c NN U  U  RO N   N   N S   mI 2
38 Pass12 120679HTSAFGL AFGL-TR-810192 P 8AsAcB U   U    U    U  c  .6-1FSuCf,Cf152 1
39 24:35Z 1H 3 7L165 8230 -4.7.07JWsnow cntam A N  N 1c NN U  U  RO N   N   N S   mI 2
             1111111111222222222233333333334444444444555555555566666666667777777778
    12345678901234567890123456789012345678901234567890123456789012345678901234567890
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TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 45

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       ---------------------------Card Column No.-----------------------------------------
                1111111111222222222233333333334444444444555555555566666666667777777778
       12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                           Card (Record) Contents
 1 F3 SysA032779VLLLAMP Priv Comm 5/82 S27 Sc I*44 +1  *64 -4  MmP*2AWkWf8SLc     1
 2 11:12Z 1J.2.8L200 6300 -3  .07JW.08 8 U360 F 0  0  M NN N  N  N  N  N  N 0  W  2
 3 11:30  2J.2.8L195 6310 -3  .54JW.7313 U702 F .4 .3 N NN N  N  N  N  N  N 0  W  2
 4 F3 Cld8032779VLLLAMP Priv Comm 5/82 S22 As 1102 *-9 114*-10 MmP*2AWkWf8SLc     1
 5 11:37Z 1J.4 1L20810020 -10 .09JW.09 8 U325 F 0  0  N NN N  N  N  N  N  N U *W 2
 6 11:40  2G.3 1L23411080 -11 .33JW.4013 U470 F .2 .1 N NN N  N  N  N  N  N U *W 2
 7 11:42  3G.3 1L23711090 -12 .35JW.3511 U565 F .1 .1 N NN N  N  N  N  N  N U *W 2
 8 F3 CldC032779SCQLAMP Priv Comm 5/82 S17 Cu I 26 +6   98 -8   mP WkWf8SLc       1
 9 12:22Z 1E.7 3L242 6260 -2  1.0JW.6415 U395 F 4  2  N NN N  N  N  N  N  N U  W  2
10 12:23  2C.2 1L236 5460  0  .41JW.3414 U360 F 8  4  N NN N  N  N  N  N  N U  W  2
11 F4 CldA032779SCQLAMP Priv Comm 5/82 S 0 Sc C 23 +7   84 -8   mP *1-2FWkWf8SLc  1
12 15:08Z 1G.1.4P187 6160 -1  .79JW1.118 U715 F 2  1  N NN N  N  N  N  N  N U  W  2
13 15:09  2G.4 1P195 6710 -2  .50JW.9116 U650 F 2  .6 N NN N  N  N  N  N  N U  W  2
14 15:10  3G.7 2P193 7150 -3  .31JW.5717 U385 F 3  1  N NN N  N  N  N  N  N U  W  2
15 15:10  4G.8 3P198 7380 -4  .70JW1.218 U600 F 4  2  N NN N  N  N  N  N  N U  W  2
16 15:11  5D 1 4P197 7630 -5  .75JW.8319 U275 F 4  1  N NN N  N  N  N  N  N U  W  2
17 15:12  6E 1 3P196 8030 -6  .23JW.3716 U220 F .2 .1 N NN N  N  N  N  N  N U  W  2
18 15:13  7A.5 2P188 8360 -7  .49JW.6616 U285 F .2 .1 N NN N  N  N  N  N  N U  W  2
19 F4 Cld8032779VLLLAMP Priv Comm 5/82 S27 As b 80 -3   87 -6  MmP *0-1AWkWf8SLc  1
20 16:14Z 1G.4 1L201 8360 -5  .38JW.3315 U188 F .7 .3 N NN N  N  N  N  N  N U  W  2
21 16:15  2J.4 1L203 8350 -5  .10JW.07 8 U190 F .1 0  N NN N  N  N  N  N  N U  W  2
22 16:18  3J.5 2L193 7980 -4  .06JW.05 7 U210 F .1 0  N NN N  N  N  N  N  N U  W  2
23 F4 CldC032779VLLLAMP Priv Comm 5/82 S27 Sc 8 44 +3   75 -2  MmP *0-1AWkWf8SLc  1
24 16:24Z 1G.3 1L209 7320 -2  .22JW.1713 U180 F 4  2  N NN N  N  N  N  N  N U  W  2
25 16:25  2G.2.8L207 7480 -3  .32JW.2515 U180 F 1  .6 N NN N  N  N  N  N  N U  W  2
26 16:31  3J.4 1L194 7490 -3  .45JW.4116 U205 F 1  .6 N NN N  N  N  N  N  N U  W  2
27 16:33  4G.8 3L197 6990 -2  .17JW.1914 U150 F 11 6  N NN N  N  N  N' N  N U  W  2
28 16:34  5G.5 2L192 6990 -2  .13JW.1815 U120 F 13 6  N NN N  N  N  N  N  N U  W  2
29 16:38  6G.3 1L189 6320 -1  .14JW.1312 U165 F 6  3  N NN N  N  N  N  N  N U  W  2
30 16:39  7G.3.9L192 6440 -2  .49JW.4616 U250 F 4  2  N NN N  N  N  N  N  N U  W  2
31 16:39  8D.4 1L189 6440 -1  .18JW.1614 U150 F 4  2  N NN N  N  N  N  N  N U  W  2
32 16:39  9G.4 1L188 6400 -1  .15JW.1316 U110 F 10 5  N NN N  N  N  N  N  N U  W  2
33 F5 CldA032879VLLLAMP Priv Comm 5/82 S2: Sc 8 62 -4  *99 *-11MmPUa*2FCf&8SWLc   1
34 10:56Z 1J.3.9L192 9750 -12 .54JW.7118 U275 F .2 .2 N NN N  N  N  N  N  N 0 *mW 2
35 11:17  2G.1.5L216 8940 -11 .59JW.8315 U615 F  0  0 N NN N  N  N  N  N  N 0 *mW 2
36 11:20  3G.1.4L199 9650 -12 .52JW.6017 U345 F .1  0 N NN N  N  N  N  N  N 0 *mW 2
37 11:22  4G.2.6L193 9650 -12 .43JW.6115 U435 F .1  0 N NN N  N  N  N  N  N 0 *mW 2
38 11:24  5J.62 L205 8980 -11 .90JW.8517 U390 F  0  0 N NN N  N  N  N  N  N 0 *mW 2
39 11:25  6D.2.6P207 8770 -11 .37JW.4215 U320 F .1  0 N NN N  N  N  N  N  N 0 *mW 2
40 11:25  7D.2.6P210 8430 -11 .33JW.3514 U330 F  0  0 N NN N  N  N  N  N  N 0 *mW 2
41 11:26  8D.2.6P210 8040 -10 .34JW.3514 U325 F .1 .1 N NN N  N  N  N  N  N 0 *mW 2
42 11:28  9J.2.7P199 7740  -9 .58JW.5615 U390 F .1 .1 N NN N  N  N  N  N  N 0 *mW 2
43 F6 Cld8032879VLLLAMP Priv Comm 5/82 S27 Cu I 57 -1  122 -16 MmPUa*2FCf&8SWLc    1
44 16:15Z 1G.1.5L23911570 -15 .85JW.8220 U240 F  0  0 N NN N  N  N  N  N  N U *mW 2
45 16:18  2A.2.7L21611760 -15 .61JW.5220 U160 F .1  0 N NN N  N  N  N  N  N U *mW 2
46 16:27  3D.6 2L20210820 -13 .22JW.2112 U278 F .5 .4 N NN N  N  N  N  N  N U *mW 2
47 16:27  4G.4 1L20110810 -14 .39JW.4616 U330 F  1  1 N NN N  N  N  N  N  N U *mW 2
48 16:30  5G.4 1L19910620 -13 .68JW.7616 U410 F .7 .5 N NN N  N  N  N  N  N U *mW 2
49 16:30  6D.9 3L19010840 -14 .28JW.3417 U230 F 20 13 N NN N  N  N  N  N  N U  U  2
50 16:31  7D.5 2L19010960 -14 .34JW.4116 U295 F  1 .9 N NN N  N  N  N  N  N U *mW 2
51 16:32  8D.2.7L18911000 -14 .13JW.1414 U175 F .3 .3 N NN N  N  N  N  N  N U *mW 2
52 16:33  9G.1.4L20110770 -14 .64JW.7016 U390 F  0  0 N NN N  N  N  N  N  N U *mW 2
53 16:41 10K.1.5L205 9940  -9 .68JW.6114 U545 F 22 11 N NN N  N  N  N  N  N U  U  2
54 16:42 11G.3 1L207 9900 -11 .18JW.2010 U495 F  2  2 N NN N  N  N  N  N  N U  U  2
55 16:55 12G.4 1L19810860 -13 1.1JW1.015 U655 F  5  3 N NN N  N  N  N  N  N U  U  2
56 16:56 13K.4 1L20510860 -14 .67JW.5117 U360 F 32 20 N NN N  N  N  N  N  N U  U  2
57 16:57 14K.2.8L21710550 -12 1? JW.5515 U385 F 34 13 N NN N  N  N  N  N  N U  U  2
58 16:58 16K.3 1L220 9770 -11 .9?JW.3415 U290 F 29 14 N NN N  N  N  N  N  N U  U  2
                1111111111222222222233333333334444444444555555555566666666667777777778
       12345678901234567890123456789012345678901234567890123456789012345678901234567890
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TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 46

```
 ---------------------------Card Column No.---------------------------------------------
              1111111111222222222233333333334444444444555555555566666666667777777777778
     12345678901234567890123456789012345678901234567890123456789012345678901234567890
Rec.
No.                             Card (Record) Contents
  1 F6 CldA032879SCQLAMP Priv Comm 5/82 S1/*Sc I 36 +2  130 -18  mP Ua*3FCf&8SWLc  1
  2 15:56  1A.6 2L22112140 -16 .02JW.0210 U 44 F .2 .2 N NN N  N  N  N  N  N S-*W+12
  3 16:00  2A.2.8L21211960 -16 .08JW.0510 U 90 F .1 .1 N NN N  N  N  N  N  N S-*W+12
  4 16:03  3A.5 2L21612150 -16 .07JW.0713 U 74 F .3 .2 N NN N  N  N  N  N  N S-*W+12
  5 F7 CldA032979VLLLAMP Priv Comm 5/82 S27 Sc B 67 -3  100 *-12MmPUpUaFFw&6FCf    1
  6 13:23  1J.4 1L208 9810 -13 .43JW.4812 U601 F .4 .3 N NN N  N  N  N  N  N U *mW 2
  7 13:25  2J.4 1L19910100 -14 .52JW.6813 U693 F .1 .1 N NN N  N  N  N  N  N U *mW 2
  8 F7 CldB032979VLLLAMP Priv Comm 5/82 S27*Sc B 77 -8  122 *-19MmPUpUaFFw&6FCf    1
  9 13:27  1E.4 1L18810700 -16 .24JW.4113 U582 F  1 .9 N NN N  N  N  N  N  N SP*W+12
 10 13.28  2J.2.8L20010820 -18 .52JW.8614 U706 F .6 .5 N NN N  N  N  N  N  N U *mW 2
 11 13:28  3G.2.8L19911130 -16 .32JW.3114 U227 F  2  1 N NN N  N  N  N  N  N SP*W+12
 12 13:28  4E.4 1L20311160 -16 .95JW.8216 U365 F  2  1 N NN N  N  N  N  N  N SP*W+12
 13 13:29  5G.4 1L20011720 -18 .83JW.8817 U364 F  3  2 N NN N  N  N  N  N  N SP*W+12
 14 13:30  6D.4 1L20612010 -18 .82JW.7017 U277 F .7 .6 N NN N  N  N  N  N  N U *mW 2
 15 13:30  7D.3 1L21411940 -20 .88JW.7716 U319 F  1  1 N NN N  N  N  N  N  N SP*W+12
 16 13:31  8J.4 1L20711990 -20 .10JW.1512 U153 F .2 .2 N NN N  N  N  N  N  N U *mW 2
 17 13:32  9D.4 1L20611900 -19 .14JW.1211 U188 F .3 .3 N NN N  N  N  N  N  N U *mW 2
 18 13:33 10J.2 1L20212010 -19 .58JW.6018 U228 F  5  4 N NN N  N  N  N  N  N SP*W+12
 19 13:43 11J.2.8L21512080 -19 .17JW.1716 U125 F  4  3 N NN N  N  N  N  N  N SP*W+12
 20 13:45 12D.3 1L20912250 -19 .23JW.1713 U154 F .5 .3 N NN N  N  N  N  N  N U *mW 2
 21 13:45 13J.3 1L20912040 -20 .13JW.07 9 U152 F .1  0 N NN N  N  N  N  N  N U *mW 2
 22 13:46 14G.4 1L21311570 -19 .17JW.1010 U192 F .9 .7 N NN N  N  N  N  N  N U *mW 2
 23 13:46 15G.5 2L22411180 -18 .34JW.2313 U211 F .2 .2 N NN N  N  N  N  N  N U *mW 2
 24 13:49 16J.3 1L20110950 -17 .11JW.08 9 U180 F .3 .2 N NN N  N  N  N  N  N U *mW 2
 25 13:49 17G.4 1L20210920 -17 .09JW.07 9 U156 F .6 .4 N NN N  N  N  N  N  N U *mW 2
 26 13:50 18J.4 1L20210870 -17 .06JW.0410 U 78 F .3 .3 N NN N  N  N  N  N  N U *mW 2
 27 13:51 19G.3 1L20010910 -17 .24JW.1912 U207 F  2  1 N NN N  N  N  N  N  N SP*W+12
 28 F7 CldC032979VLLLAMP Priv Comm 5/82 S27 Sc I 67 -3  106 *-14MmP UpUaFFw&6FCf    1
 29 13:55  1J.2.9L211 9820 -15 .45JW.2312 U241 F .3 .1 N NN N  N  N  N  N  N U *mW 2
 30 14:00  2J.3 1L20510030 -15 .19JW.2712 U263 F .3 .3 N NN N  N  N  N  N  N U *mW 2
 31 14:01  3G.2.8L20410020 -15 .42JW.3413 U282 F .2 .2 N NN N  N  N  N  N  N U *mW 2
 32 14:08  4G.4 1L205 9120 -12 .13JW.1111 U238 F  3  2 N NN N  N  N  N  N  N U  U  2
 33 14:10  5J.8 3L202 8860 -11 .46JW.3212 U315 F .5 .3 N NN N  N  N  N  N  N U *mW 2
 34 14:15  6J.4 1L194 8010  -8 .28JW.2311 U308 F .2 .1 N NN N  N  N  N  N  N U FmW 2
 35 F7 CldD032979VLLLAMP Priv Comm 5/82 S27*Sc I 77 -8  142 *-21MmP UpUaFFw&6FCf    1
 36 14:39  1A.4 1L19211570 -18 .27JW.2313 U219 F  2  1 N NN N  N  N  N  N  N U  U  2
 37 14:43  2A.5 2L18913980 -23 .58JW.5218 U163 F  9  7 N NN N  N  N  N  N  N U  U  2
 38 F8 CldA033079SCQLAMP Priv Comm 5/82 S 0 Cu I*47 *-1 *84 *-10 m  pUa&WkEWPg      1
 39 11:45  1J.2.6S199 8390 -9  1.6JW1.818 U536 F 18  9 N NN N  N  N  N  N  N U *mW 2
 40 11:48  2D.3.8S178 6480 -6  .17JW.1913 U210 F .2 .2 N NN N  N  N  N  N  N U *mW 2
 41 11:49  3G.3.8S178 6330 -5  .08JW.10 9 U291 F  1 .7 N NN N  N  N  N  N  N U *mW 2
 42 11:51  4G.3.9S191 4800 -2  .50JW.4415 U298 F 30 14 N NN N  N  N  N  N  N U *mW 2
 43 11:51  5D.2.6S192 4820 -2  1.4JW1.116 U502 F 19  9 N NN N  N  N  N  N  N U *mW 2
 44 11:52  6E.6 2S187 4590 -2  .56JW.2613 U253 F 10  4 N NN N  N  N  N  N  N U *mW 2
 45 11:52  7D.5 2S188 4210 -1  .57JW.1511 U226 F  1 .6 N NN N  N  N  N  N  N U *mW 2
 46 F8 CldB033079SCQLAMP Priv Comm 5/82 S 0 Sc B*47  -1 *82  -9  m  pUa&WkEWPg      1
 47 12:08  1E.3 1P220 8010 -9  .25JW.2013 U203 F .4 .3 N NN N  N  N  N  N  N 0 *mW 2
 48 12:13  2J.3 1P203 4790 -1  .87JW.3813 U286 F .7 .5 N NN N  N  N  N  N  N 0  W  2
 49 F9 Sy*A033079nSPLAMP Priv Comm 5/82 S MOrCuB*19 *+8 139 *-22 m OrCv&NyWiONSpain1
 50 14:39  1E 1 3P189 6300 -5  .90JW.5914 U420 F  1 .8 N NN N  N  N  N  N  N U *mW 2
 51 14:41  2D.3.8P191 6800 -7  .08JW.0812 U197 F  5  3 N NN N  N  N  N  N  N U *mW 2
 52 14:44  3E.6 2P191 8570 -9  .53JW.4414 U313 F  3  2 N NN N  N  N  N  N  N U *mW 2
 53 14:45  4J.3 1P190 9090 -10 .09JW.0711 U249 F  2  2 N NN N  N  N  N  N  N U  U  2
 54 14:56  5G.3 1P22313070 -19 .75JW.6317 U280 F 18 13 N NN N  N  N  N  N  N U  U  2
 55 15:05  6G.2.8L21013070 -19 .76JW1.217 U685 F 88 45 N NN N  N  N  N  N  N U  U  2
 56 15:10  7G.6 2L21713100 -19 .59JW.5616 U518 F 17 12 N NN N  N  N  N  N  N U  U  2
 57 15:17  8D.1.5L21113070 -20 1.8JW1.318 U486 F  5  4 N NN N  N  N  N  N  N U  U  2
 58 15:18  9J.3 1L20713070 -20 1.0JW.6515 U470 F  4  3 N NN N  N  N  N  N  N U  U  2
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TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 47

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Rec.
No.                          Card (Record) Contents
  1 F9 SysB033079VLLLAMP Priv Comm 5/82 S27 Cu S■46 ■+1 131 ■-20Mm  pU■&WkEWPg       1
  2 16:02  1G.1.5L20713050 -19 1.0JW1.016 U600 F 51 29 N NN N  N  N  N  N  N U  U  2
  3 16:46  2A.3 1L197 9360 -11 .75JW.2712 U356 F .1 .1 N NN N  N  N  N  N  N U  U  2
  4 F10SysA033179VLLLAMP Priv Comm 5/82 S27 Sc B■49 -1  103 ■-11 c pU■,NEW,1100WkPg1
  5 11:23  1A.2.8L20310120 -11 .07JW.10 7 U673 F  U  0 N NN N  N  N  N  N  N U ■mW 2
  6 11:26  2J.2.8L19910120 -11 .60JW.8218 U562 F  2 .6 N NN N  N  N  N  N  N U  U  2
  7 11:26  3G.2.8L19910150 -12 1.2JW1.617 U694 F  2  1 N NN N  N  N  N  N  N U  U  2
  8 11:27  4E 1 4L19810030 -12 .77JW1.217 U611 F  2  1 N NN N  N  N  N  N  N U  U  2
  9 11:32  5G 2 5L199 8160  -6 .37JW.6313 U802 F  3  2 N NN N  N  N  N  N  N U  U  2
 10 11:34  6D.3 1L186 8160  -9 .39JW.6713 U886 F  1 .7 N NN N  N  N  N  N  N U  U  2
 11 11:35  7J.7 2L186 8110  -9 .95JW1.415 U992 F  3  2 N NN N  N  N  N  N  N U  U  2
 12 11:39  9D 1 3L184 7970  -7 .70JW.9114 U737 F  6  2 N NN N  N  N  N  N  N U  U  2
 13 11:40 10G.3 1L191 7980  -7 .29JW.3512 U606 F  3  1 N NN N  N  N  N  N  N U  U  2
 14 11:41 11G.2.6L192 7990  -7 .74JW1.115 U737 F  7  2 N NN N  N  N  N  N  N U  U  2
 15 11:42 12G.3 1L187 7540  -6 .20JW.2111 U423 F  1 .4 N NN N  N  N  N  N  N U  U  2
 16 11:45 13D.7 2L194 6160  -3 .40JW.1712 U291 F  4  1 N NN N  N  N  N  N  N U  U  2
 17 11:46 14G.7 2L190 6150  -4 .19JW.11 9 U334 F .6 .3 N NN N  N  N  N  N  N U ■mW 2
 18 11:47 15D.3.9L188 6150  -3 .20JW.1010 U246 F .6 .3 N NN N  N  N  N  N  N U ■mW 2
 19 11:48 16A.2.7L181 6080  -3 .12JW.05 8 U240 F .2 .1 N NN N  N  N  N  N  N U ■mW 2
 20 12:16 17G.3 1L189 7790  -6 .43JW.4114 U514 F  9  6 N NN N  N  N  N  N  N U  U  2
 21 12:19 18E.7 2L19810010 -11 .38JW.3613 U424 F  3  2 N NN N  N  N  N  N  N U  U  2
 22 12:43 19G.3.9L23710780 -12 .21JW.2513 U460 F .9 .7 N NN N  N  N  N  N  N U ■mW 2
 23 12:45 20G.2.6L20810190 -11 .90JW.7414 U632 F  1 .9 N NN N  N  N  N  N  N U ■mW 2
 24 12:45 21D.7 2L20910250 -11 .14JW.17 9 U822 F .6 .4 N NN N  N  N  N  N  N U ■mW 2
 25 12:46 22D.3 1L21110190 -11 .21JW.2513 U473 F  1 .8 N NN N  N  N  N  N  N U ■mW 2
 26 12:48 23D.5 2L214 9960 -10 .48JW.6614 U555 F  2  2 N NN N  N  N  N  N  N U  U  2
 27 12:48 24G.3 1L212 9940 -11 .49JW.4312 U508 F  1  1 N NN N  N  N  N  N  N U ■mW 2
 28 12:48 25E 1 5S206 9850 -11 .78JW.7815 U581 F  2  1 N NN N  N  N  N  N  N U U   2
 29 12:50 26D.3 1S199 9340 -10 .79JW.7414 U694 F  1  1 N NN N  N  N  N  N  N U ■mW 2
 30 12:50 27J.2.6S200 9080 -10 .18JW.3510 U895 F .7 .5 N NN N  N  N  N  N  N U ■mW 2
 31 12:51 28J.2.8S201 8680  -9 .79JW.6613 U672 F .6 .3 N NN N  N  N  N  N  N U ■mW 2
 32 12:51 29J.2.6S204 8190  -8 .79JW.7014 U653 F .8 .5 N NN N  N  N  N  N  N U ■mW 2
 33 12:53 30G.3 1S190 8010  -7 .32JW.7415 U900 F  3  1 N NN N  N  N  N  N  N U  U  2
 34 12:53 31J.3.9L109 8000  -7 .22JW.5212 U801 F  2  1 N NN N  N  N  N  N  N U  U  2
 35 12:58 32G.2.6L192 8030  -8 .96JW1.014 U803 F  1 .6 N NN N  N  N  N  N  N U ■mW 2
 36 13:08 33A.3 1S187 6130  -2 .33JW.2612 U365 F .8 .3 N NN N  N  N  N  N  N U ■mW 2
 37 F11SysA040279VLLLAMPPriv Comm 5/82  S27 Sc B■75 ■-6 ■89 ■-7 Mm HpBA&EHc,Wk1100 1
 38 09:16  1D.3 1L195 8030 -7  .17JW.1612 U248 F .1 .1 N NN N  N  N  N  N  N 0  mW 2
 39 09:16  2D.4 1L195 8360 -7  .24JW.2414 U252 F .2 .1 N NN N  N  N  N  N  N 0  mW 2
 40 09:45  3J.2.8L205 8720 -8  .25JW.2313 U211 F .2 .1 N NN N  N  N  N  N  N 0  mW 2
 41 09:52  4D.2.8L204 8540 -7  .14JW.4417 U230 F .1 .1 N NN N  N  N  N  N  N 0  mW 2
 42 09:53  5G.5 2L205 8540 -6  .12JW 1211 U201 F  U  0 N NN N  N  N  N  N  N 0  mW 2
 43 F13SysB040379VLLLAMP Priv Comm 5/82 S35UrCuU■61 ■-1 139■-15 Mm  0-1FWkCf       1
 44 09:31  1K.3 1L195 6910  -3 .58JW.7820 U261 F  6  2 N NN N  N  N  N  N  N S ■mW 2
 45 10:49  2G.3 1L21712060 -13 .29JW.2920 U140 F  1 .8 N NN N  N  N  N  N  N S  U  2
 46 10:50  3G.3 1L21712070 -13 .19JW.2119 U115 F  6  4 N NN N  N  N  N  N  N S  U  2
 47 11:10  4G.3 1L201 8010  -4 .47JW.5918 U304 F 13  7 N NN N  N  N  N  N  N S ■mW 2
 48 11:11  5A.2.6L193 8010  -5 .39JW.4522 U169 F .2 .2 N NN N  N  N  N  N  N S ■mW 2
 49 11:12  6E.4.9L196 7800  -3 .48JW.5420 U185 F .2 .2 N NN N  N  N  N  N  N S ■mW 2
 50 F13SysC040379VLLLAMP Priv Comm 5/82 S27 Cu S■61 ■-1 139■-15 Mm  0-1FWkCf       1
 51 11:27  1A.3 1L199 6010  -2 .21JW.2311 U382 F .1 .1 N NN N  N  N  M  N  N U ■mW 2
 52 11:30  2J.7 2L199 6010  -2 .46JW.6316 U388 F  2  1 N NN N  N  N  N  N  N U ■mW 2
 53 11:31  3K.3 1L203 6030  -2 .20JW.2717 U136 F 23 10 N NN N  N  N  N  N  N U  U  2
 54 11:34  4G.4 1L200 6030  -3 .14JW.1810 U402 F .1 .1 N NN N  N  N  N  N  N U ■mW 2
 55 11:34  5G.2.7L203 6080  -2 .32JW.4312 U557 F .2 .1 N NN N  N  N  N  N  N U ■mW 2
 56 11:52  6A.2.6L189 9950 -10 1.3JW1.719 U607 F .2 .2 N NN N  N  N  N  N  N U ■mW 2
 57 11:57  7D.4 1L200 8350  -6 1.3JW1.918 U667 F .6 .4 N NN N  N  N  N  N  N U ■mW 2
             1111111111222222222233333333334444444444555555555566666666667777777778
    12345678901234567890123456789012345678901234567890123456789012345678901234567890
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TABLE A-4. THE NEW SUPERCOOLED CLOUD DATA BASE (Continued)
Data File No. 48

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    ---------------------------Card Column No.--------------------------------------
             11111111112222222222333333333344444444445555555555666666666677777777778
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Rec.
No.                                 Card (Record) Contents
  1 F13SysA040379VLLLAMP Priv Comm 5/82 527 Sc 1*39 *+4 118*-11 Mm  0-1FWkCf       1
  2 09:29  1G.2.6P189 5900   0 .51JW.7817 U390 F .2  0 N NN N  N  N  N  N  N 0   W 2
  3 09:29  2J.6 1P186 6230  -1 .37JW.5016 U302 F .2 .1 N NN N  N  N  N  N  N 0   W 2
  4 F14SysA040479VLLLAMP Priv Comm 5/82 527 Sc 8*37 *+3 *98*-10 Mm  0-1FWkSf       1
  5 09:02  1K.3 1L199 8450  -7 .41JW.3422 U111 F  4  1 N NN N  N  N  N  N  N 0 *mW 2
  6 09:08  2D.8 3L208 9780 -11 .12JW.1013 U113 F .1 .1 N NN N  N  N  N  N  N 0 *mW 2
  7 09:10  3A.2.8L200 9740 -10 .08JW.2824 U 78 F .1 .1 N NN N  N  N  N  N  N 0 *mW 2
  8 10:41  4A.2.5L149 6930  -4 .33JW.5018 U252 F  2 .8 N NN N  N  N  N  N  N U *mW 2
  9 F14SysB040479VLLLAMP Priv Comm 5/82 527 As 8121*-15 127*-16 Mm  0-1FWkSf       1
 10 09:16  1G.3 1L21512230 -16 .17JW.6221 U215 F .2 .1 N NN N  N  N  N  N  N 0  U  2
 11 F14SysC040479SCQLAMP Priv Comm 5/82 5 0 Sc 0*37 *+3 *98*-10  mP 0-1FWkSf       1
 12 11:55  1G.3 1L209 4830  -2 .28JW.6316 U366 F  6  3 N NN N  N  N  N  N  N U *mW 2
 13 11:56  2A.2.6L207 4830  -2 .44JW1.018 U458 F  5  2 N NN N  N  N  N  N  N U *mW 2
             11111111112222222222333333333344444444445555555555666666666677777777778
    12345678901234567890123456789012345678901234567890123456789012345678901234567890
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APPENDIX B

HOW MUCH DATA IS ENOUGH? COVERAGE OF CLOUD TYPES, WEATHER CATEGORIES AND GEOGRAPHIC REGIONS

The purpose of the analyses in this Appendix is threefold. One purpose is to decide whether the various, major weather factors are all adequately represented in the data base. The second is to determine which weather factors have produced the extreme values of supercooled LWC and cloud temperatures that have been recorded. The third is to attempt to answer the question "how much data is enough?"

In Table B-1 the NACA and modern data are separately analyzed in terms of synoptic category and airmass. The major synoptic categories are listed and the first column of each data set gives the number of data miles recorded in each category. The second column of figures gives the same information as percentages of the total number of data miles recorded in the data set. It is seen that the largest single portion of the NACA data is from low pressure systems but not in the immediate neighborhood of any fronts. Cold fronts are fairly well represented, as are high pressure regions, but the other categories listed are poorly sampled in the NACA data. The 3rd and 4th columns show that the greatest LWCs in the NACA flights were found in Cu or Cb clouds in both high and low pressure regions and also in connection with cold fronts. The modern data are in general agreement except that they also point out lake effect cumulus and orographic (strong upslope) induced cumulus as additional sources of large LWCs. In both the NACA and modern data, maritime airmasses appear to produce the largest values of supercooled LWC.

In an attempt to answer the question "how much data is enough?" an arbitrary but reasonable and workable quantitative rule was devised. The rule states that a minimum of 100 data miles should first be logged in each of the synoptic weather categories listed in Table B-1. Then the maximum observed value of LWC in each category is used to determine how many additional data miles may be required for that category. The reasoning followed here is that the more severe the possible icing conditions can be, the more the host weather category should be studied. Using supercooled LWC as an indicator of icing severity, we establish the rule that each increment of 0.1 g/m^3 in the maximum observed LWC, Wmax, requires 50 data miles to be logged in the given weather category. Thus, for Wmax = 0.8 g/m^3, for example, a total of 400 data miles is required to establish that "enough" data have been obtained for that particular weather category. If the original value of Wmax is exceeded while collecting the required number of data miles, then the new and larger value of Wmax establishes a new and larger requirement for data miles in that category. Finally, a further assessment of 100 data miles is required, in addition to the requirement derived from Wmax, for any weather category in which there has been a recent, icing-related, fatal air crash.

The resulting data mileage requirements are listed in the 5th column for each data set in Table B-1. The 6th column gives the percentage to which the goal in each category has been fulfilled by the existing data sets. It is seen that, according to the aforementioned rule, only nonfrontal low pressure systems have been sampled sufficiently by the NACA data. It appears that orographic and low ceiling cases were not sampled at all. In the modern data set, the categories which appear to be adequately sampled are nonfrontal high pressure systems, clouds 100 nmi or farther from surface cold fronts, upslope flow situations and low ceiling cases. Categories still seriously undersampled by modern data are warm fronts, occluded fronts and lake effect clouds.

As with any simple set of rules for complex situations there are bound to be some deficiencies and shortcomings. One difficulty in this case is that although the modern data seem to adequately cover upslope flow and low ceiling cases, the data available for these cases are mostly from one long flight which satisfied both categories at once. In order to insure that at least several different occurrences in each category are sampled, perhaps the foregoing rule should be amended. For example, perhaps no more than 50 data miles from any one cloud system should contribute to any of the synoptic categories, and each data mile should contribute to only one category.

In general, however, this approach seems to be satisfactory and workable. It also appears to be the first documented attempt to devise a logical and quantitative formula for answering the important but elusive question, "how much data is enough?"

In Table B-2, the extreme and average values of LWC, MVD and outside air temperature (OAT) are analyzed by cloud category and geographic region. The geographic regions are those originally used by NACA (Lewis and Bergrun, 1952) and are used here so that geographical coverage by the NACA and modern data may be compared. It is seen that the two data sets compare well in all aspects except for the maximum MVDs of 45-50 μm in the NACA data in three of the categories, and the difference in minimum OATs observed for layer clouds in the Pacific Region.

TABLE B-1. DISTRIBUTION OF AVAILABLE DATA AND MAXIMUM LWCs OBSERVED IN MAJOR AIRMASS AND WEATHER CATEGORIES FOR SUPERCOOLED CLOUDS AT ALTITUDES UP TO 10,000 FEET AGL OVER THE CONTERMINOUS UNITED STATES.

	NACA CONUS Data						Modern CONUS Data					
	Data Miles (nmi)	Percent of Total	Max LWC, g/m^3	Assoc. Cloud Type	Data Miles Required[a]	Percent of Req'd on hand	Data Miles (nmi)	Percent of Total	Max LWC, g/m^3	Assoc. Cloud Type	Data Miles Required[a]	Percent of Req'd on hand
Major Weather Categories												
Nonfrontal, high pressure regions	301	9%	1.0	CuCb	500	60%	796	23%	.4	St.Sc	200	395%
Nonfrontal, low pressure regions	1301	41%	1.0	Cu	500	260%	204	6%	.7	Cu	350	58%
Cold front (definite involvement)[b]	467	15%	1.0	CbCu	600[d]	78%	508	15%	1.4	Cu/Or	800[d]	63%
Cold front (uncertain involvement)[c]	507	16%	1.5	CuCb	750	68%	926	27%	1.7	Or/Cu	850	109%
Warm front (definite involvement)[b]	95	3%	.7	CuCb	350	28%	0	0%	-	-	100	0%
Warm front (uncertain involvement)[c]	29	1%	.3	As	150	19%	35	1%	.2	St	100	35%
Occluded fronts	30	1%	.6	Sc,St	300	10%	27	1%	.3	Cu	150	18%
Lake effect clouds	(36)[e]	-	.5	Sc	250	14%	182+(84)[e]	5%	1.2	Cu	600	44%
Upslope flow situations	37+(27)[e]	1%	.5	St, Sc	250	26%	(317)[e]	-	.3	St	150	211%
Orographic clouds	0	0%	-	-	200[d]	0%	(671)[e]	-	1.7	Or/Cu	950[d]	71%
Low ceiling (IFR) cases	?	?	-	-	100	0%	(315)[e]	-	.3	St	150	211%
Undetermined	436	14%	.6	Sc	300	145%	784	23%	1.1	Cu	550	144%
Totals	3206	100%			4250	-	3460	100%			4950	-
Cases definitely involving fronts	595	19%					536	15%				
Airmass Categories												
Maritime	759	24%	1.5	Cu,Cb			956	28%	1.7	Or/Cu		
Modified maritime	83	3%	.9	Cu			0	0%	-	-		
Continental	2364	74%	1.3	Cu			2484	71%	1.4	Cu/Or		
Modified continental	0	0%	-	-			20	1%	1.2	Cu		
Totals	3206	100%					3460	100%				

[a] For each weather category the required number of data miles (M) is determined from the formula $M = b W_{max}$, where W_{max} is the maximum LWC observed to date for the weather category in question, and $b = 500 nmi/gm^{-3}$. A minimum of 100nmi is required for each category, and another 100nmi is required in addition to all other mileage requirements for weather categories associated with a recent, icing-related, fatal air crash.

[b] Measurements were within ±100nmi of a cold frontal surface, or within ±200nmi of a warm frontal surface.

[c] Measurements were more than 100nmi from a cold frontal surface or more than 200nmi from a warm frontal surface.

[d] These entries include 100nmi added because of a known, recent, icing-related, fatal air crash.

[e] Values in parentheses are already included in other categories above.

TABLE B-2. GEOGRAPHICAL DISTRIBUTION [a] OF AVAILABLE DATA OVER THE CONTERMINOUS UNITED STATES.

Layer Clouds (St, Sc, Ns, As, Ac)

		Pacific Region		Plateau Region		"Eastern" Region	
		NACA Data	Modern Data	NACA Data	Modern Data	NACA Data	Modern Data
Data Miles	(nmi)	346(11%)	329(10%)	178(6%)	245(7%)	2085(65%)	1948(56%)
Events		53	93	24	41	251	427
Max LWC	(g/m³)	0.7	1.1	0.7	0.3	0.9	0.6
Avg LWC	(g/m³)	0.2	0.2	0.3	0.1	0.2	0.2
Max MVD	(μm)	50	32	29	19	50	30
Avg MVD	(μm)	23	18	12	13	13	12
Min MVD	(μm)	8	7	7	6	5	3
Avg OAT	(deg C)	-9	-4	-6	-12	-6	-11
Min OAT	(deg C)	-14	-6	-10	-15	-23	-25

Convective Clouds (Cu, Cb)

		Pacific Region		Plateau Region		"Eastern" Region	
		NACA Data	Modern Data	NACA Data	Modern Data	NACA Data	Modern Data
Data Miles	(nmi)	484(15%)	897(26%)	9(.3%)	0(0%)	104(3%)	33(1%)
Events		97	343	3	-	21	32
Max LWC	(g/m³)	1.5	1.7	0.2	-	1.3	1.2
Avg LWC	(g/m³)	0.5	0.4	0.1	-	0.6	0.5
Max MVD	(μm)	45	32	11	-	26	21
Avg MVD	(μm)	20	19	11	-	13	15
Min MVD	(μm)	10	13	11	-	5	9
Avg OAT	(deg C)	-10	-8	-8	-	-9	-6
Min OAT	(deg C)	-17	-17	-9	-	-15	-9

[a] Geographical regions are shown in Figure B-1.

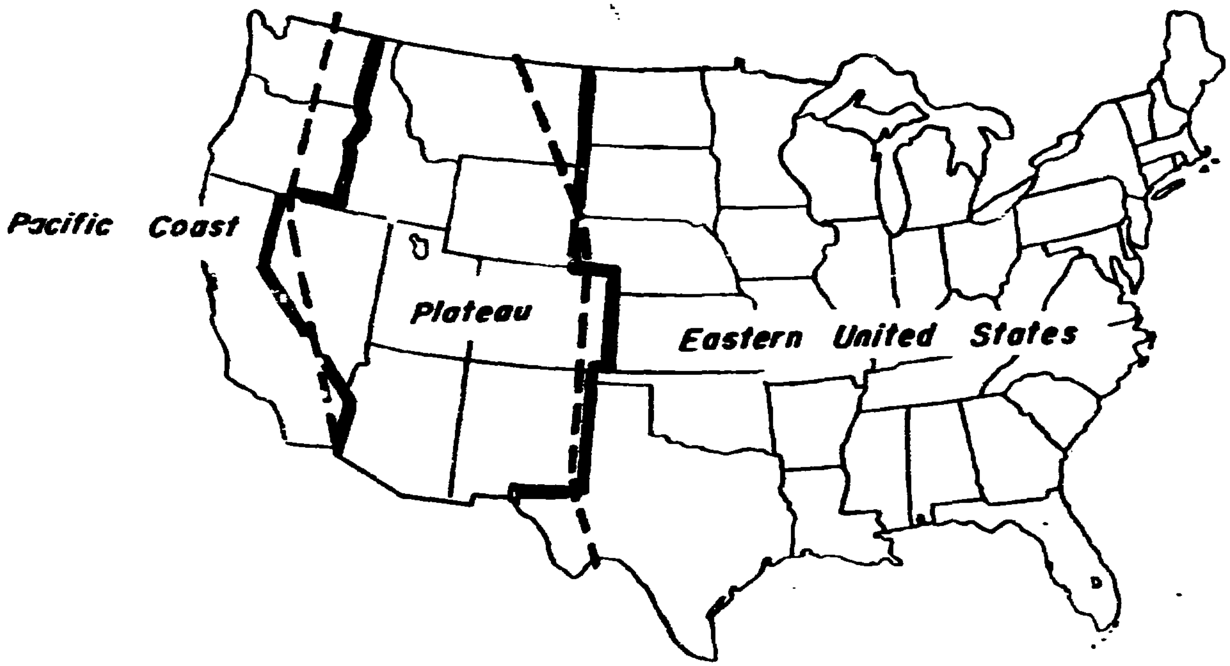


FIGURE B-1. *Map of the United States showing approximate boundaries of areas used in the geographical classification of icing data.*

— — — — Boundaries formerly used by NACA.

——— Boundaries selected for use in Table B-2.

APPENDIX C

APPLICATION OF THE NEW DATA BASE TO THE ARMY ICING TEST MATRIX

The U.S. Army Aviation Research and Development Command (AVRADCOM) has selected a "matrix" of LWC and OAT combinations to use as test points for qualifying Army aircraft to fly into icing conditions. This matrix is reproduced here in Figure C-1, where the "X" symbols mark the desired combinations of LWC and OAT. At the present time, these test points are used primarily for flight tests behind airborne spray rigs, but they are intended for tests in natural icing conditions as well.

The question that arises at this point is, what is the probability of meeting any given test point in natural icing conditions at altitudes below 10,000 ft AGL, or even below 5000 ft AGL? Such information is needed in order to specify which test points are realistically achievable, or even necessary, in the natural environment.

A second question is, what cloud types, synoptic conditions, geographic locations or air mass types are associated with the difficult-to-find test points?

The new Data Base has been employed in the following ways to answer these questions.

a) The "X" symbols in the matrix (Figure C-1) are interpreted as representing the centers of "boxes," i.e., small, permissible ranges of LWC and OAT about each "X". Thus for example, any value of LWC within the range of 0.25 ±.125 g/m^3 combined with any value of OAT within the range -5 ±2.5°C satisfies the test point indicated by the "X" at OAT = -5°C and LWC = 0.25 g/m^3.

b) The Data Base is searched by computer for icing events with values of OAT and LWC within each of these boxes for each of the two altitude intervals 0-5000 ft and 0-10,000 ft AGL.

c) The results are printed out in terms of total number of data miles found to occur in each box. Also printed is the percentage that each of these totals represents compared to the overall number of data miles recorded for all icing events within the altitude interval in question.

These results are shown in Figures C-2 and C-3 for the 0-5000 ft and 0-10,000 ft AGL intervals, respectively.

There are several interesting conclusions to be drawn from these results:

a) About 33% of the icing events fall outside the limits of the test matrix, mostly on the small LWC side.

b) Test points in the lower half of the second column and in the entire third and fourth columns of the matrix are nearly impossible to achieve at altitudes below 5000 ft AGL. Even at altitudes up to 10,000 ft AGL test points will rarely be found anywhere in the fourth column and, except for the lower left hand box, the bottom row is practically impossible to achieve.

For the few, hard-to-find cases corresponding to test points in column 4 and row 4 of the matrix, the associated cloud types and weather conditions recorded in the Data Base are summarized in Tables C-1 through C-4.

It is rather obvious that Cu or Cb clouds are required in order to find LWCs represented by column 4. In addition, most of these events were recorded in maritime air masses along the Pacific coast or in ocean-modified, continental air masses offshore along the Atlantic seaboard. Most of the convective cloud events also occurred within 100 to 300 miles behind a cold front. A large percentage of the modern cases were also observed over the windward slopes of the Sierra Nevada mountains in California. These emphasize the fact that windward slopes of mountains, particularly in combination with frontal passages or advection of moist maritime air, are locations where larger than average LWCs can be expected most frequently. However, it is usually necessary to ascend above 5000 ft AGL to find values of LWC that correspond to column 4 of the test matrix.

Concerning the low temperature test points (row 4 of the matrix), it is quite evident from Tables C-2 and C-4 that these events have been recorded so far in stratus or stratocumulus and almost exclusively in the Great Lakes area. Also note that, contrary to the LWC case, altitudes above 5000 ft AGL are not required in order to find clouds at these lowest temperatures, at least in the vicinity of the Great Lakes in January.

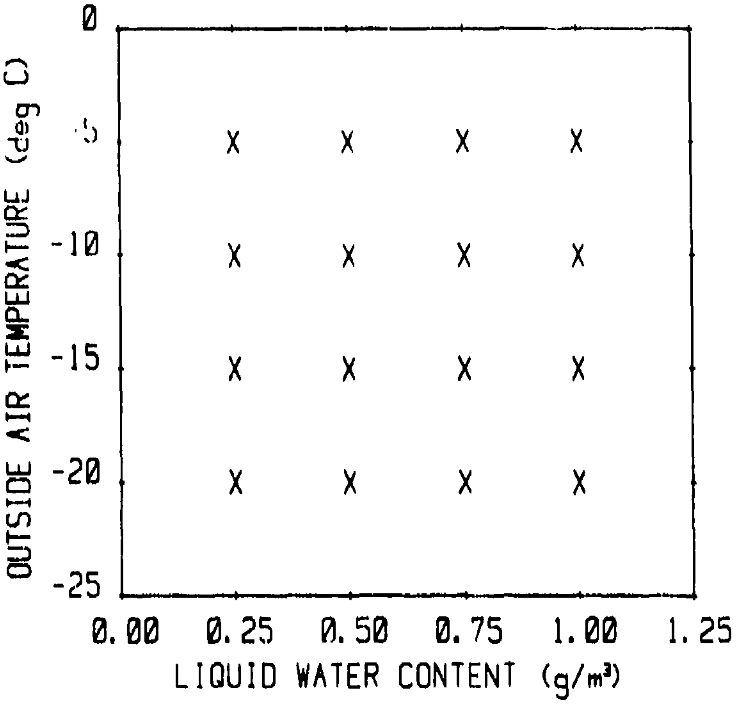
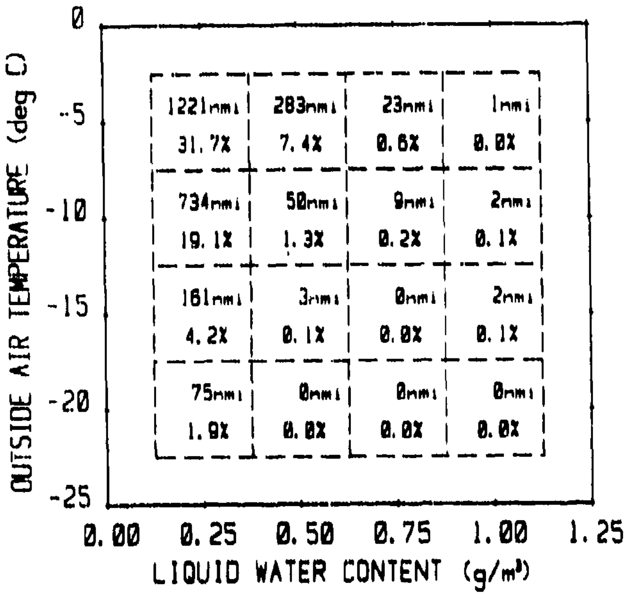


FIGURE C-1. ARMY TEST MATRIX FOR AIRCRAFT ICING TEST FLIGHTS.



	0.25	0.50	0.75	1.00
-5	1221nmi 31.7%	283nmi 7.4%	23nmi 0.6%	1nmi 0.0%
-10	734nmi 19.1%	50nmi 1.3%	9nmi 0.2%	2nmi 0.1%
-15	161nmi 4.2%	3nmi 0.1%	0nmi 0.0%	2nmi 0.1%
-20	75nmi 1.9%	0nmi 0.0%	0nmi 0.0%	0nmi 0.0%

FIGURE C-2. DATA MILES NOTED IN THE NEW DATA BASE FOR INDICATED INTERVALS IN THE VICINITY OF EACH TEST POINT IN THE ARMY ICING MATRIX. Results apply to the altitude range 0-5000 ft AGL. The percentages indicate the fraction of all data miles below 5000 ft AGL that were found in the Data Base for each of the ±2.5°C and ±0.125 gm/m³ intervals centered on the test "points" shown in Fig. C-1. Of 3850 data miles, 2565 (67%) fell somewhere within the 4x4 boxed area. Of the 1285 (33%) data miles which fell outside, 1175 (30.5%) were at lesser LWCs, 6 (0.2%) at greater LWCs, 104 (2.7%) at higher temperatures, and 14 (0.4%) were at lower temperatures.

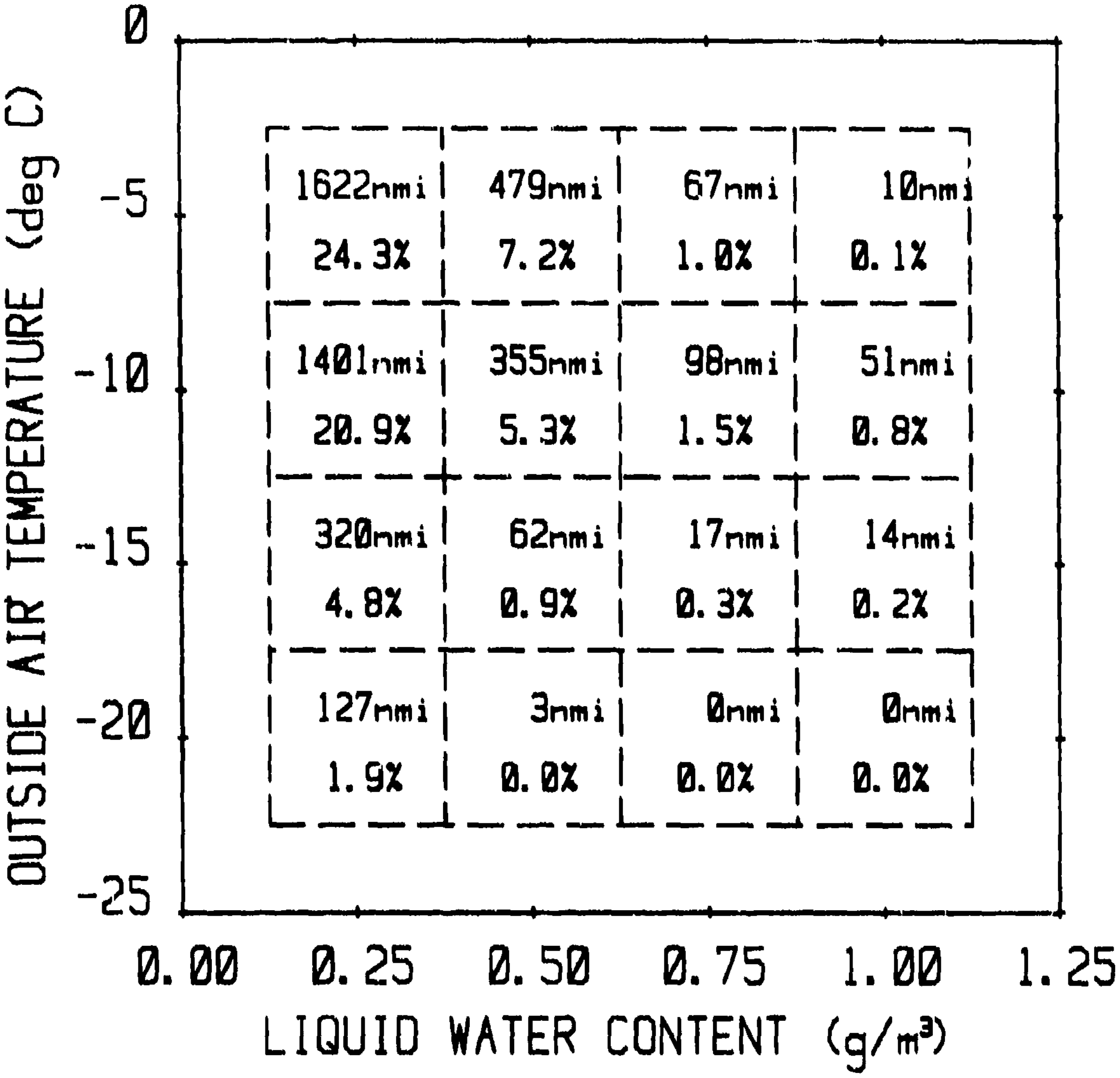


FIGURE C-3. DATA MILES NOTED IN THE NEW DATA BASE FOR INDICATED INTERVALS IN THE VICINITY OF EACH TEST POINT IN THE ARMY ICING MATRIX. Results apply to the altitude range 0-10,000 ft AGL. The percentages indicate the fraction of all data miles below 10,000 ft AGL that were found in the Data Base for each of the ±2.5°C and ±0.125 gm/m^3 intervals centered on the test "points" shown in Fig. C-1. Of 6685 data miles, 4625 (69%) fell somewhere within the 4x4 boxed area. Of the 2060 (31%) data miles which fell outside, 1840 (27.5%) were at lesser LWCs, 50 (0.9%) were at greater LWCs, 185 (2.7%) were at higher temperatures, and 24 (0.4%) were at lower temperatures.

TABLE C-1. NACA Data for LWC > .875 g/m³ (Column 4 of Army Icing Test Matrix)

For the Altitude Interval of 0-5000 Ft AGL

File/Rec	Cloud Type	Geog Loc.	Air Mass	Month of Yr	OAT degC	LWC g/m³	Data Miles	Data Source	Weather Situation
1 /21	Cu	cOR	MmP	03	-11.0	0.90	2.0	NACA	4FSmCf

For the Altitude Interval of 0-10,000 Ft AGL
(Does not include entries already listed above for 0-5000 Ft)

File/Rec	Cloud Type	Geog Loc.	Air Mass	Month of Yr	OAT degC	LWC g/m³	Data Miles	Data Source	Weather Situation
1 /31	CuCb	cCA	mP	03	-9.0	0.80	2.0	NACA	*1-2FSmCf
1 /34	CuCb	cCA	mP	03	-8.0	1.00	2.0	NACA	WkHp
2 /30	CuCb	wOR	mP	04	-11.5	1.00	9.0	NACA	*2-3FFmCf
2 /31	CuCb	wOR	mP	04	-11.5	1.50	2.0	NACA	*2-3FFmCf
2 /33	CuCb	wOR	mP	04	-10.5	1.50	2.0	NACA	*2-3FFmCf
4 /15	Cu	NB	cP	04	-13.3	0.94	2.0	NACA	Ua,Hp
8 /18	CbCu	cOR	mP	03	-14.4	0.95	5.0	NACA	*<1FCf
10 /16	CuCb	SEA	mPk	05	-10.6	1.40	3.0	NACA	2FSmCf
11 /30	CuCb	wPA	cP	05	-13.3	1.00	5.0	NACA	Ny*5FCf
11 /32	CuCb	wPA	cP	05	-8.3	1.00	3.0	NACA	Ny*5FCf
11 /39	Sc	sLE	c	11	-8.3	0.88	6.0	NACA	*2-4FCf
13 /27	Cu	AUO	cP	04	-8.3	1.30	14.0	NACA	Wy*4FFmCf

TABLE C-2. NACA Data for OAT < -17.5 degC (Row 4 of Army Icing Test Matrix)

For the Altitude Interval of 0-5000 Ft AGL

File/Rec	Cloud Type	Geog Loc.	Air Mass	Month of Yr	OAT degC	LWC g/m³	Data Miles	Data Source	Weather Situation
4 /20	Sc	nOH	cP	12	-21.7	0.09	3.0	NACA	Hp,WkNyCy?
4 /37	StSc	MKG	c	01	-20.0	0.16	3.0	NACA	*1S&FWf
4 /39	StSc	EAU	cP	01	-22.8	0.10	9.0	NACA	FCf
4 /41	StSc	DLH	c	01	-17.5	0.13	6.0	NACA	*2-3AWkWf
4 /51	StSc	LE	cP	01	-20.0	0.18	3.0	NACA	NyCy6FFmLc

For the Altitude Interval of 0-10,000 Ft AGL
(Does not include entries already listed above for 0-5000 Ft)

File/Rec	Cloud Type	Geog Loc.	Air Mass	Month of Yr	OAT degC	LWC g/m³	Data Miles	Data Source	Weather Situation

No additional events beyond those listed for 0-5000 Ft

TABLE C-3. Modern Data for LWC > .875 g/m^3 (Column 4 of Army Icing Test Matrix)

For the Altitude Interval of 0-5000 Ft AGL

File/Rec	Cloud Type	Geog Loc.	Air Mass	Month of Yr	OAT degC	LWC, g/m^3	Data Miles	Data Source	Weather Situation
26 /28	OrCu	MCC	m	12	-3.4	1.30	3.0	UWYO	Ue#1-2FCf
26 /30	OrCu	MCC	m	12	-3.4	1.20	2.0	UWYO	Ue#1-2FCf
26 /31	OrCu	MCC	m	12	-3.4	1.30	0.8	UWYO	Ue#1-2FCf
29 /19	CuOr	MCC	mP	02	-6.2	1.05	0.9	UWY	Ue#2FWkCf
41 /13	Sc	HQM	mP	02	-2.2	1.05	0.4	UWSH	1W&ASf,&2-3E&ACf
42 /23	CuCb	OLM	mP	04	-1.7	0.91	0.4	UWSH	Ue2-3FFmCf&Of
42 /28	Cu	HQM	mP	04	-0.1	0.94	2.0	UWSH	Ue2-3FFmCf&Of

For the Altitude Interval of 0-10,000 Ft AGL
(Does not include entries already listed above for 0-5000 Ft)

File/Rec	Cloud Type	Geog Loc.	Air Mass	Month of Yr	OAT degC	LWC, g/m^3	Data Miles	Data Source	Weather Situation
17 /36	Cu	AST	mP	05	-4.6	0.90	1.0	MRI	EWPgAHc
26 / 6	CuOr	MCC	mP	02	-8.1	0.80	0.6	UWY	Ue2FCf&WkLc
26 /15	OrCu	BLU	m	12	-6.4	1.70	2.0	UWYO	Ue#1-2FCf;SrCv
26 /47	OrCu	BLU	m	12	-13.2	0.89	2.0	UWYO	Ue#1-2FCf
27 /25	CuOr	MCC	mP	02	-8.0	1.05	1.0	UWY	Ue2FCf&WkLc
27 /36	CuOr	MCC	mP	02	-8.6	0.88	0.8	UWY	Ue2FCf&WkLc
27 /39	CuOr	MCC	mP	02	-8.8	1.08	2.0	UWY	Ue2FCf&WkLc
27 /40	CuOr	MCC	mP	02	-8.6	1.30	0.6	UWY	Ue2FCf&WkLc
27 /42	CuOr	MCC	mP	02	-8.5	0.95	1.0	UWY	Ue2FCf&WkLc
27 /45	CuOr	MCC	mP	02	-8.9	1.02	2.0	UWY	Ue2FCf&WkLc
27 /54	CuOr	MCC	mP	02	-8.3	1.09	2.0	UWY	Ue2FCf&WkLc
28 / 3	CuOr	MCC	mP	02	-8.5	0.97	2.0	UWY	Ue2FCf&WkLc
28 / 6	CuOr	MCC	mP	02	-8.7	0.96	0.9	UWY	Ue2FCf&WkLc
28 /10	CuOr	MCC	mP	02	-6.5	0.91	0.9	UWY	Ue2FCf&WkLc
28 /22	CuOr	MCC	mP	02	-8.0	1.10	2.0	UWY	Ue2FCf&WkLc
29 /21	CuOr	MCC	mP	02	-7.9	1.25	1.0	UWY	Ue#2FWkCf
29 /27	CuOr	MCC	mP	02	-7.0	1.30	2.0	UWY	Ue#2FWkCf
29 /33	CuOr	MCC	mP	02	-7.7	1.10	1.0	UWY	Ue#2FWkCf
29 /35	CuOr	MCC	mP	02	-7.3	1.05	1.0	UWY	Ue#2FWkCf
30 /50	CuOr	MCC	c?	03	-10.6	1.20	4.0	UWY	#1AFmCf
30 /52	CuOr	MCC	c?	03	-10.5	1.10	5.0	UWY	#1AFmCf
30 /54	CuOr	MCC	c?	03	-10.7	1.10	1.0	UWY	#1AFmCf
31 / 2	CuOr	MCC	c?	03	-10.0	1.30	6.0	UWY	#1AFmCf
31 / 4	CuOr	MCC	c?	03	-10.6	1.30	2.0	UWY	#1AFmCf
31 / 6	CuOr	MCC	c?	03	-11.7	1.40	3.0	UWY	#1AFmCf
31 /10	CuOr	BLU	c?	03	-11.9	1.00	1.0	UWY	#1AFmCf
31 /17	CuOr	BLU	c?	03	-12.4	1.10	1.0	UWY	#1AFmCf
35 / 5	Cu	W72	Mc	03	-5.7	1.20	0.3	NRL	LeCvO GulfStream
35 /12	Cu	W72	Mc	03	-6.4	1.10	0.5	NRL	LeCvO GulfStream
35 /23	Cu	W72	Mc	03	-7.0	1.00	0.2	NRL	LeCvO GulfStream
35 /24	Cu	W72	Mc	03	-7.0	0.90	0.2	NRL	LeCvO GulfStream
35 /25	Cu	W72	Mc	03	-7.0	1.00	0.4	NRL	LeCvO GulfStream
35 /26	Cu	W72	Mc	03	-7.0	0.90	0.2	NRL	LeCvO GulfStream
35 /28	Cu	W72	Mc	03	-7.5	1.00	1.0	NRL	LeCvO GulfStream
40 /10	Cu	SEA	mP	12	-3.0	1.00	0.2	UWSH	0-.1ACfSu@Fl
40 /16	Cb	SEA	mP	12	-1.0	1.10	1.0	UWSH	0-.1ACfSu@Fl
40 /30	Cu	HQM	mP	01	-4.3	1.10	3.0	UWSH	Ud@CfSu@Fl,&3mRb
40 /38	Sc	237	mP	02	-4.5	0.91	1.0	UWSH	1W&ASf,&2-3E&ACf
42 /21	CuCb	OLM	mP	04	-8.7	0.93	1.0	UWSH	Ue2-3FFmCf&Of
42 /22	CuCb	OLM	mP	04	-4.8	1.20	3.0	UWSH	Ue2-3FFmCf&Of

TABLE C-4. Modern Data for OAT < -17.5 degC (Row 4 of Army Icing Test Matrix)

For the Altitude Interval of 0-5000 Ft AGL

File/Rec	Cloud Type	Geog Loc.	Air Mass	Month of Yr	OAT degC	LWC g/m^3	Data Miles	Data Source	Weather Situation
18 /49	Sc	MKG	cA	12	-17.6	0.12	1.0	UWY	HpmbFFmCf,I56
21 / 2	St	cLM	cA	01	-19.4	0.09	3.0	UWY	U,WkI55
21 / 3	St	cLM	cA	01	-18.5	0.10	5.0	UWY	U,WkI55
21 / 4	St	cLM	cA	01	-19.9	0.06	3.0	UWY	U,WkI55
21 / 5	St	cLM	cA	01	-20.8	0.12	1.0	UWY	U,WkI55
21 / 6	St	cLM	cA	01	-22.2	0.17	1.0	UWY	U,WkI55
21 / 7	St	cLM	cA	01	-23.1	0.17	1.0	UWY	U,WkI55
21 / 8	St	cLM	cA	01	-23.1	0.16	4.0	UWY	U,WkI55
21 / 9	St	cLM	cA	01	-21.8	0.14	17.0	UWY	U,WkI55
21 /10	St	cLM	cA	01	-21.6	0.11	20.0	UWY	U,WkI55
21 /11	St	cLM	cA	01	-22.1	0.10	5.0	UWY	U,WkI55
21 /12	St	cLM	cA	01	-22.4	0.13	6.0	UWY	U,WkI55
21 /13	St	cLM	cA	01	-22.0	0.23	2.0	UWY	U,WkI55
21 /14	St	cLM	cA	01	-22.4	0.13	2.0	UWY	U,WkI55
21 /15	St	cLM	cA	01	-22.4	0.13	18.0	UWY	U,WkI55
21 /17	Sc	cLM	cA	01	-20.3	0.07	2.0	UWY	U
21 /20	St	cLM	cA	01	-20.3	0.08	12.0	UWY	U,pCIO
21 /21	St	cLM	cA	01	-20.7	0.10	20.0	UWY	U,pCIO
21 /23	Sc	cLM	cA	01	-22.5	0.12	2.0	UWY	U
21 /24	Sc	cLM	cA	01	-22.2	0.08	2.0	UWY	U
21 /25	Sc	cLM	cA	01	-22.1	0.17	3.0	UWY	U
21 /26	Sc	cLM	cA	01	-21.7	0.09	2.0	UWY	U
21 /27	Sc	cLM	cA	01	-21.4	0.08	2.0	UWY	U
21 /28	Sc	cLM	cA	01	-21.3	0.10	3.0	UWY	U
21 /29	Sc	cLM	cA	01	-20.1	0.08	2.0	UWY	U
21 /34	Sc	cLM	cA	01	-18.1	0.06	1.0	UWY	U,I64
21 /35	Sc	cLM	cA	01	-19.0	0.07	1.0	UWY	U,I64
21 /44	Sc	cLM	cA	01	-18.8	0.07	6.0	UWY	U,I64
21 /45	Sc	cLM	cA	01	-18.5	0.12	7.0	UWY	U,I64
21 /46	Sc	cLM	cA	01	-18.4	0.17	6.0	UWY	U,I64
22 / 3	Sc	cLM	cA	01	-18.5	0.23	1.0	UWY	U,pCILO
22 / 6	St	cLM	cA	01	-19.4	0.10	3.0	UWY	U,WkI58,pCILO
22 / 7	St	cLM	cA	01	-19.8	0.08	4.0	UWY	U,WkI58,pCILO
22 / 8	St	cLM	cA	01	-19.9	0.10	3.0	UWY	U,WkI58,pCILO
22 / 9	St	cLM	cA	01	-19.2	0.05	1.0	UWY	U,WkI58,pCILO
22 /10	St	cLM	cA	01	-18.1	0.01	1.0	UWY	U,WkI58,pCILO
22 /12	St	cLM	cA	01	-19.4	0.06	2.0	UWY	U,pCILO
22 /13	St	cLM	cA	01	-18.8	0.06	2.0	UWY	U,pCILO
22 /14	St	cLM	cA	01	-18.3	0.06	3.0	UWY	U,pCILO
22 /15	St	cLM	cA	01	-17.9	0.11	2.0	UWY	U,pCILO
22 /16	St	cLM	cA	01	-18.4	0.14	1.0	UWY	U,pCILO
22 /18	St	eLM	cA	01	-19.4	0.07	3.0	UWY	U
22 /19	St	eLM	cA	01	-19.2	0.15	1.0	UWY	U
22 /20	St	eLM	cA	01	-20.2	0.09	2.0	UWY	U
22 /21	St	eLM	cA	01	-20.6	0.11	5.0	UWY	U
22 /22	St	eLM	cA	01	-19.9	0.16	2.0	UWY	U
22 /23	St	eLM	cA	01	-20.0	0.11	2.0	UWY	U
22 /24	St	eLM	cA	01	-20.1	0.20	2.0	UWY	U
22 /25	St	eLM	cA	01	-20.1	0.13	1.0	UWY	U

TABLE C-4. Modern Data for OAT < -17.5 deg C (Continued)

For the Altitude Interval of 0-10,000 Ft AGL
(Does not include entries already listed above for 0-5000 Ft)

File/Rec	Cloud Type	Geog Loc.	Air Mass	Month of Yr	OAT degC	LWC g/m^3	Data Miles	Data Source	Weather Situation
21 /30	Sc	cLM	cA	01	-25.0	0.03	5.0	UWY	U
21 /31	Sc	cLM	cA	01	-24.6	0.11	5.0	UWY	U
21 /36	Sc	cLM	cA	01	-20.3	0.26	1.0	UWY	U,I64
21 /37	Sc	cLM	cA	01	-21.3	0.38	1.0	UWY	U,I64
21 /38	Sc	cLM	cA	01	-20.9	0.14	2.0	UWY	U,I64
21 /39	Sc	cLM	cA	01	-21.2	0.24	3.0	UWY	U,I64
21 /40	Sc	cLM	cA	01	-20.9	0.32	13.0	UWY	U,I64
21 /41	Sc	cLM	cA	01	-19.7	0.29	19.0	UWY	U,I64
21 /42	Sc	cLM	cA	01	-19.9	0.17	7.0	UWY	U,I64
21 /43	Sc	cLM	cA	01	-19.7	0.06	5.0	UWY	U,I64
22 / 4	Sc	cLM	cA	01	-19.2	0.19	4.0	UWY	U,pCILO
24 / 2	St	cLM	cP	01	-19.0	0.38	1.0	UWY	U,WkI71
24 / 3	St	cLM	cP	01	-18.1	0.22	1.0	UWY	U,WkI71
24 /15	St	cLM	cP	01	-18.5	0.07	1.0	UWY	U,noI
24 /16	St	cLM	cP	01	-19.2	0.09	1.0	UWY	U,noI
35 /50	Sc	HGR	cP	03	-18.0	0.46	1.0	NRL	NyWm7WaFLc
35 /51	Sc	HGR	cP	03	-18.0	0.19	2.0	NRL	NyWm7WaFLc

APPENDIX D

APPLICATION OF THE NEW DATA BASE TO THE USAF/ETAC CLOUD LIQUID WATER MODEL (3DNEPH AND THE SMITH-FEDDES LWC MODEL)

The U.S. Air Force Global Weather Center (USAF/AFGWC) has been using an Automated Cloud Analysis Model operationally since 1970. Known as 3DNEPH (Three Dimensional Nephanalysis), this computer product provides global estimates of cloud amounts in 15 layers of varying thickness from the surface up to 55,000 ft (16 km) with a horizontal grid resolution of 25 nmi. Up to eight analyses are scheduled per day with additional limited area analyses available on request (Fye, 1978).

Subsequently, the USAF Environmental Technical Applications Center (USAF/ETAC) has begun using computerized procedures for determining LWCs and droplet size distributions in the clouds over limited regions using 3DNEPH data as input (Smith, 1974; Feddes, 1974). A recent application of the LWC computations is the compilation of an "Icing Climatology for Northern Europe" based on the probabilities of encountering supercooled LWCs of various magnitudes in the ten 3DNEPH layers up to 14,000 ft. (Jackson, 1980). In any application the accuracy of the LWC computations depends in part on the maximum LWC that the computer code authors consider possible for various cloud types as a function of temperature (Smith, 1974, Table 5, pg. 8; Feddes, 1974, Table 2, pg. 5). The maximum LWC values given in these referenced tables are apparently based primarily on the Russian work by Borovikov et al. (1963). It is not clear whether the stated maxima are instantaneous (extreme) values or are average sustained maxima at an optimum height in the cloud. In any case it is of interest to compare the maximum LWCs used by the "Smith-Feddes" model to those observed in the new Data Base of the present report.

The comparison is given in Table D-1 where the Smith-Feddes maximum LWC for each cloud type and 5°C temperature interval is ranked according to the percentage of the time equal or lesser LWCs are observed in the Data Base for the same cloud type and temperature range. Thus, for example, if a given value of LWC ranks in the 95th percentile of the Data Base sample, then 5% of the data miles recorded for that cloud type and temperature interval were at LWCs greater than the given LWC. Table D-1 shows that, except for Cu and Cb clouds, the Smith-Feddes maxima are generally smaller than the extreme values that have been observed in the Data Base. Most of the Smith-Feddes maxima fall within the 95th to 97th percentile range. However, this range is probably optimum for the purposes of the Smith-Feddes model because it represents more typical maximum values of LWC than do the higher percentiles. The latter represent extreme values which occur very infrequently.

The Smith-Feddes maxima should probably be increased in those cases where they rank only in the 80th or lower percentiles of the new Data Base. Thus, for example, the Smith-Feddes value of 0.15 g/m^3 for stratus clouds at -25° to -20°C ranks only in the 70th percentile and should therefore be increased to about the 95th percentile value of 0.20 g/m^3. Inspection of Table D-1 shows that only the stratus and stratocumulus cloud types have Smith-Feddes LWC maxima which need to be increased according to this analysis.

The orographic cloud type is included as a separate category in Table D-1 because this type has been studied specifically in the modern research flights. Orographic LWCs listed in the new Data Base represent altitudes up to 12,000 ft AGL and therefore would be suitable for use in the Smith-Feddes model for many mountainous regions. Any clouds uplifted orographically above 12,000 ft ASL (or 10,000 ft AGL) could be assigned to the cumulus category for maximum LWC determination.

The Smith-Feddes maxima for Cu and Cb clouds are much larger than the maxima in the new Data Base because the former apply to altitudes up to 55,000 ft while the new Data Base is limited to the lowest 10,000 ft AGL. This altitude limitation has no significant effect on maximum LWCs for layer clouds.

As a final comment, we suggest that the 3DNEPH and Smith-Feddes LWC model has great potential for improving the nowcasting and forecasting of aircraft icing conditions. Current procedures rely on infrequent and widely spaced upper air soundings analyzed with the aid of some statistical rules of thumb (ref. "Forecasters Guide on Aircraft Icing," 1980; "Aerographer's Mate 1 & C," 1974). The 3DNEPH draws on a much wider and more frequently updated data base (surface observations and weather satellite imagery in addition to the 12-hourly raobs) and provides readily available and greatly expanded information on the horizontal and vertical distribution of cloud amounts and types. In addition, the Smith-Feddes model ties LWC (and drop size) to temperature and position within the 3DNEPH clouds and allows icing conditions to be specified in terms of estimated amounts of supercooled LWC. This overall approach is clearly superior to the current raob techniques where the identification of clouds is difficult and spotty, and icing intensities can only be inferred from the indicated dewpoint depression or degree of stability or instability along the sounding.

TABLE D-1. COMPARISON OF MAXIMUM LWCs FROM USAF/ETAC (SMITH-FEDDES) CLOUD WATER MODEL WITH MAXIMUM OBSERVED LWCs IN THE NEW DATA BASE

	For Stratus (St) Clouds					For Stratocumulus (Sc) Clouds					For Nimbostratus (Ns) Clouds				
Temperature in Cloud at Flight Level:	-25 to -20°C	-20 to -15°C	-15 to -10°C	-10 to -5°C	-5 to 0°C	-25 to -20°C	-20 to -15°C	-15 to -10°C	-10 to -5°C	-5 to 0°C	-25 to -20°C	-20 to -15°C	-15 to -10°C	-10 to -5°C	-5 to 0°C
New CONUS LWC Data Base															
Maximum LWC observed below 10,000 ft AGL	.30	.50	.70	.60	.70	.50	.50	.70	.90	1.10	—	—	—	—	.20
99.9 percentile value of LWC	.30	.49	.64	.57	.68	.49	.50	.64	.89	.91	—	—	—	—	.20
99 - - - -	.27	.43	.49	.46	.57	.44	.46	.52	.85	.59	—	—	—	—	.19
95 - - - -	.20	.20	.36	.30	.47	.38	.30	.39	.51	.51	—	—	—	—	.17
90 - - - -	.19	.19	.32	.27	.42	.36	.28	.37	.41	.45	—	—	—	—	.15
No. of Data Miles represented in given temperature interval:	136	73	624	761	375	61	172	590	1248	842	0	0	0	0	27
USAF/ETAC Max. LWC for all Altitudes	.15	.20	.25	.30	.35	.30	.40	.45	.50	.55	.40	.45	.50	.60	.60
%ile ranking in new CONUS Data Base	(70%)	(95%)	(80%)	(95%)	(90%)	80%	98%	97%	95%	97%	-	-	-	-	[>Max]

	For Altostratus (As) Clouds					For Altocumulus (Ac) Clouds				
Temperature in Cloud at Flight Level:	-25 to -20°C	-20 to -15°C	-15 to -10°C	-10 to -5°C	-5 to 0°C	-25 to -20°C	-20 to -15°C	-15 to -10°C	-10 to -5°C	-5 to 0°C
New CONUS LWC Data Base										
Maximum LWC observed below 10,000 ft AGL	—	—	.20	.50	.50	—	—	.30	.70	.50
99.9 percentile value of LWC	—	—	.20	.49	.50	—	—	.30	.68	.50
99 - - - -	—	—	.18	.45	.47	—	—	.29	.51	.49
95 - - - -	—	—	.16	.30	.37	—	—	.26	.39	.44
90 - - - -	—	—	.09	.27	.27	—	—	.21	.36	.39
No. of Data Miles represented in given temperature interval:	0	0	60	164	53	0	0	195	190	47
USAF/ETAC Max. LWC for all Altitudes	.20	.25	.30	.30	.35	.30	.35	.40	.40	.45
%ile ranking in new CONUS Data Base	—	—	>Max	(95%)	(95%)	—	—	>Max	95%	95%

Notes: 1. Values in parentheses () for St and As may be slightly underestimated because in the new Data Base the actual cloud type was not always distinguishable from similar types, i.e., Sc and Ac, respectively, which may occasionally contain slightly greater LWCs.
2. Values in brackets [] are uncertain because of an inadequate number of samples in the new Data Base.

	For Cumulus (Cu) Clouds					For Cumulonimbus (Cb) Clouds					For Orographic (Or) Clouds[a]				
Temperature in Cloud at Flight Level:	-25 to -20°C	-20 to -15°C	-15 to -10°C	-10 to -5°C	-5 to 0°C	-25 to -20°C	-20 to -15°C	-15 to -10°C	-10 to -5°C	-5 to 0°C	-25 to -20°C	-20 to -15°C	-15 to -10°C	-10 to -5°C	-5 to 0°C
New CONUS LWC Data Base															
Maximum LWC observed below 10,000 ft AGL	—	.60	1.50	1.70	1.30	—	.60	1.50	1.00	1.20	—	.40	1.40	1.70	1.30
99.9 percentile value of LWC	—	.60	1.49	1.59	1.29	—	.60	1.49	1.00	1.20	—	.40	1.34	1.64	1.30
99 - - - -	—	.59	1.39	1.27	1.23	—	.60	1.45	.96	1.19	—	.40	1.34	1.27	1.28
95 - - - -	—	.57	1.07	1.02	1.00	—	.59	.98	.72	1.16	—	.38	1.22	1.04	1.12
90 - - - -	—	.54	.92	.75	.71	—	.57	.92	.66	1.13	—	.37	1.05	.78	.68
No. of Data Miles represented in given temperature interval:	0	56	483	738	255	0	27	215	222	21	0	26	187	404	84
USAF/ETAC Max. LWC for all Altitudes	3.0	3.0	3.0	3.0	3.0	6.5	6.5	6.5	6.5	6.5	—	—	—	—	—
%ile ranking in new CONUS Data Base	—	>Max	>Max	>Max	>Max	—	>Max	>Max	>Max	>Max	—	—	—	—	—

[a] In the present context, orographic clouds refer to those formed or assisted by uplifting over the windward slopes of mountains. Lee or wave clouds are classified separately as lenticular clouds.

GLOSSARY

The terminology used in this report has the following definitions or meanings.

Icing encounter - a series of icing events consecutively penetrated until an interruption of more than some selected distance, such as 1, 3, or 10 nautical miles is experienced.

Icing event - a portion of a subfreezing cloud over which portion the cloud properties are approximately constant as defined by the "Rules for Defining Uniform Cloud Intervals" in Table 1.

Liquid Water Content (LWC) - the total mass of water contained in all the liquid cloud droplets within a unit volume of cloud. Units of LWC are usually grams of water per cubic meter of air (g/m^3).

Median Volume Diameter (MVD) - the median of the cloud droplet size distribution computed after weighting each droplet by its volume. The MVD divides the LWC of the droplet population in half according to droplet size.

Mixed Phase Cloud - a subfreezing cloud composed of snow and/or ice particles as well as liquid droplets.

Orographic Cloud - a cloud formed or assisted by uplifting over windward slopes of mountains. Lee or wave clouds are classified separately as lenticular clouds.

Subfreezing Cloud - any cloud or portion thereof in which the temperature is below 0°C.

Supercooled Cloud - a subfreezing cloud in which the droplets are still liquid and no significant amount of snow or ice particles are present.

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