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Cloud Climatology For Land Stations Worldwide, 1971–1996

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ABSTRACT

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Surface synoptic weather reports for 26 years were processed to provide a climatology of clouds for each of over 5000 land-based weather stations with long periods of record both day and night. For each station, this digital archive includes: multi-year annual, seasonal and monthly averages for day and night separately; seasonal and monthly averages by year; averages for eight times per day; and analyses of the first harmonic for the annual and diurnal cycles. Averages are given for total cloud cover, clear-sky frequency, and 9 cloud types: 5 in the low level [fog, stratus (St), stratocumulus (Sc), cumulus (Cu), cumulonimbus (Cb)], 3 in the middle level [nimbostratus (Ns), altostratus (As), altocumulus (Ac)], and one in the high level (all cirriform clouds combined). Cloud amounts and frequencies of occurrence are given for all types. In addition, non-overlapped amounts are given for middle and high cloud types, and average base heights are given for low cloud types. Nighttime averages were obtained by using only those reports that met an "illuminance criterion" (i.e., made under adequate moonlight or twilight), thus making possible the determination of diurnal cycles and nighttime trends for cloud types.

1. INTRODUCTION

This report describes an archive of cloud climatological data for 5388 land stations around the globe. The climatology was constructed using surface synoptic weather reports for the 26-year period 1971 through 1996. For each station, this digital archive includes: multi-year annual, seasonal and monthly averages for day and night separately; seasonal and monthly averages by year; averages for eight times per day; and analyses of the first harmonic for the annual and diurnal cycles. Averages are given for total cloud cover, clear-sky frequency, and 9 cloud types [5 in the low level: fog, stratus (St), stratocumulus (Sc), cumulus (Cu), and cumulonimbus (Cb); 3 in the middle level: nimbostratus (Ns), altostratus (As), and altocumulus (Ac); and one in the high level: Ci (all cirriform clouds combined)]. Mean base heights are given for the low cloud types. Cloud amounts and frequencies of occurrence are given for all types. The frequency given is the "actual" frequency of occurrence (not the "frequency of sighting") and amounts given are the "actual" amounts, using the random-overlap assumption where necessary for Ci, Ac and As, and the maximum-overlap assumption where necessary for Ns. In addition, non-overlapped amounts are given for middle and high cloud types. These concepts are discussed in detail by Warren et al. (1986) and by Hahn and Warren (1999).

This archive updates and improves on previous cloud climatologies in this series (NDP-026 and NDP-026A; Hahn et al. 1988, 1994). It uses the illuminance criterion of Hahn et al. (1995) in order to minimize the night-detection bias, making it possible to prepare a climatology of cloud types for both day and night and to meaningfully evaluate diurnal cycles of the cloud types. It covers a greater span of time (26 years) so that interannual variations and trends may be better evaluated. Some cloud types that were grouped together in the earlier climatology are reported separately here: we now distinguish between As and Ac and between Sc, St and fog. Finally, this is a climatology for individual land stations, not grid boxes, so that trends and diurnal cycles can be evaluated without biases that may arise when using data from more than one station within a box.

CAUTION: It is important to note the cautions described in the various sections below so as to avoid erroneous use of the data. For example, not checking the number of observations when required could lead to using unrepresentative values (as has happened in the past in publications by some users of our climatologies), and not checking for the "missing-value code" (a negative number) could lead to erroneous analyses.

Numerous abbreviations will be employed throughout this text. Most will be defined in context or in associated tables. For convenience, **Table 7** defines many of the terms used. **Tables 1–8**, which are required for understanding and use of the data, are grouped in the "TABLES" section, while supplementary tables and figures are put in the APPENDIX.

2. DATA SOURCE AND STATIONS INCLUDED

2.1. Data Source

The data source for this analysis was the "Extended Edited Cloud Reports Archive" (EECRA, Hahn and Warren, 1999), also available from CDIAC as NDP-026C. Land station reports included in the EECRA were originally taken from the "SPOT" archive of the Fleet Numerical Oceanography Center (FNOC) for the years 1971–76 and from an archive of the National Centers for Environmental Prediction (NCEP, formerly NMC) for the years 1977–96. These archives are maintained at the National Center for Atmospheric Research (NCAR) in Boulder, Colorado. Because of changes in procedures at NCEP (Gregg Walters, NCAR, personal communication, 2002), the NCEP data do not contain cloud-type information after March 1997. Thus this climatology terminates with 1996 data. Other problems with these data sets have been discussed by Hahn and Warren (1999).

Several features designed into the EECRA simplified the present cloud analysis. Synoptic weather reports were included in the EECRA only if they contained cloud information and they were put through extensive quality control procedures. These screened reports were then re-written to include additional information that was not directly recorded in, though implicit in, the original report. For example, reports in the EECRA contain both the overlapped and non-overlapped amounts for middle and high clouds. Each report also contains a flag indicating whether the report satisfies the illuminance criterion of Hahn et al. (1995). For the present climatology we used only those reports that satisfied the illuminance criterion ("light obs") and that contained cloud type information (thus the number of reports used for low cloud types is the same as the number used for total cloud).

2.2. Cloud Type Definitions

Table 1 lists the cloud information contained in a synoptic weather report. These quantities, along with the station identification and the time of the report, are the basic data used to create this climatology. Synoptic reports are made every three hours beginning with 00 GMT, though some stations report less frequently. Some stations report only every 6 hours or only during daytime.

Table 2 lists the cloud types analyzed for this climatology and provides their definitions in terms of the synoptic code as defined by the World Meteorological Organization (WMO, 1988) and as modified in the EECRA. Precipitation codes are also given because they are used in our definitions of nimbostratus and cumulonimbus cloud types. The synoptic code is the only system of reporting weather data that is used worldwide, thus providing a degree of uniformity for a global climatology.

As noted above, in contrast to our previous climatology (NDP-026), we now distinguish between St, Sc and Fo in the low level, and between As and Ac in the middle level. In preparation for the present climatology, we tried to distinguish between cirrostratus, cirrocumulus and dense cirrus in the high level but, after mapping the frequencies of occurrence of these individual types, we saw discontinuities at some international boundaries, indicating that reporting procedures were not uniform worldwide. Therefore we group all high clouds together in this dataset.

2.3. Selection of Stations

Hahn and Warren (1999) listed 11,586 stations (by their 5-digit station-identification numbers) for which cloud type information was reported at least once in the EECRA. [Names and further information about each station are given by WMO (1988).] For the present climatology we wanted stations that have sufficiently long periods of record for trend analyses and sufficient numbers of observations (obs) at night for diurnal analyses. **Appendix A1** shows the number of stations that had 20 or more obs for specified numbers of years of January or July. For example, 1680 stations had no years with at least 20 obs in either January or July, of which 961 stations had only one year of any obs (not shown). On the other end of the scale, 2639 stations had 26 years of at least 20 obs in either January or July, of which 2020 stations had at least 20 obs in both months. [The criterion of 20 observations in a month allows a station that routinely reports only once per day to contribute to some analyses but excludes station numbers that appear only spuriously.] Hahn and Warren (1999) also listed 939 stations that did not normally report cloud types; these stations were excluded from this analysis.

For use in this climatology, we initially selected stations if they met three criteria:

1) they normally report cloud types,
2) they had at least 20 obs in at least 15 years (during the 26-yr period) for either January or July, and
3) the number of "night" obs [defined here to be 18 to 06 local time (LT)] was at least about 15% of the total number of obs. (Night obs average about 30% of the total because of screening by the illuminance criterion.)

The number of stations meeting these criteria was 5158 (5838 stations met criteria 1 and 2). However, this group of stations left vast land areas south of 30N underrepresented (in Africa, South America, Australia and Antarctica). We therefore also included 230 stations south of 30N that did not meet criterion 2 or 3. (Many island stations in the Indonesian region were included in the group of added stations.) File 1 of the archive (discussed below) lists the resulting 5388 stations selected and contains a code that distinguishes these two groups. The regional distribution of the land stations used for this climatology is given in **Appendix A2**. The number of these stations that had 20 or more obs per month (shown for July but similar for all months) for each year is plotted in **Appendix A3a**. The number of such stations was rising in the 1970s but has been declining since 1990. The number of observations associated with the 5388 land stations is plotted in **Appendix A3b** for Januarys and Julys. More light obs are available for July because more stations are located in the Northern Hemisphere. The total number of observations used in this climatology is 185 million. Of these, 70% are for "daytime" (defined here as 06 to 18 LT).

It is notable that very few stations in the United States (USA) have 26 years of synoptic cloud reports. With the installation of the Automatic Surface Observing System (ASOS) in the mid 1990s, most USA stations stopped reporting cloud observations in the synoptic code format, despite objections from the climate community (Warren et al., 1991). In addition, many of the synoptic reports still being made are not appearing in the NCEP data set. It is also unfortunate that stations from some major cities in Australia (e.g. Sydney, Melbourne, and Hobart) are not included in this climatology because most of their nighttime reports did not appear in the NCEP data set.

3. DATA SET CONTENTS AND DATA FORMATS

3.1. General

The cloud data provided in this archive are divided into 42 numbered "File Categories" as outlined in **Table 3**. The category divisions are based on the content of the data. The categories are named and given abbreviations intended to be suggestive of the content. Thus Category 1 contains data relating to station identification (STID) and Category 2 contains mean annual cloud amounts (MACA) for 13 cloud types (identified and discussed below). Categories 3–7 give mean seasonal averages for five different cloud parameters (amount, frequency, amount-when-present, non-overlapped amount, and base height), and so on. Categories 2–14 contain the multi-year averages, while Categories 15–42 contain averages for individual years, either seasonally (Categories 15–30) or monthly (Categories 31–42), which can be used for analyses of trends. Numbered categories listed with the same category name, such as Categories 15–18 or Categories 31–42, might logically be listed under a single category number, but the seasonal mean and monthly mean files are so large that these categories are split further by season or month. The organization of the data is described in more detail in the following section.

3.2. Details of Organization

The details of the organization of the archive are displayed in **Table 4**. The data for any particular cloud quantity, such as "multi-year average amount of cumulus cloud for July" (or any other cloud type or parameter or season), are given for all stations, listed consecutively by station ID number, before going on to some other cloud quantity. This grouping is referred to as a "station cloud data group" (SCDG; or "data group" for short). Each file contains a series of one or more SCDGs. A data group consists of 5388 data records (one for each of 5388 stations) and a header record that identifies the group:

```
| Header record identifying data group
|    Data record for first station
|    Data record for second station
|    etc. for 5388 stations
```

The header record specifies the season, cloud type, cloud parameter and data format for the data records in the group. (Formats for the header and data records are discussed in Section 3.3.)

The order in which data groups appear within a multi-group file is:
first season, first type, averages for all stations;
first season, second type, averages for all stations;
etc.
This order is indicated by the order of listing in Table 4.

The order in which the data groups appear for the various cloud types is as shown for Category 2 in Table 4. This same sequence (also given in Table 5) is used for all the files. However, some quantities are not applicable to all types. For example, there is no "amount" for clear-sky frequency, so Cr does not appear in Category 3. Thus for most files only a subset of the 13 types is given; these subsets are listed in a footnote to Table 4.

Each data group is assigned a unique sequence number (the SCDG number) which is indicated in Table 4 and contained in the header record. There are 862 SCDGs in this archive. These sequence numbers are included as a redundant convenience for identifying a desired data group although the group header record contains other information which uniquely defines the group contents. The header record is described in the next section.

Physical files. The size of the entire archive is about 1.6 gigabytes. The File Categories 2–42 each contain a fairly large amount of data (Table 3) so, in practice, they are physically divided into smaller files for ease of handling. The resulting files are given names that indicate their contents. The names contain the File Category number, the category name abbreviation, and several name extensions to indicate the season and/or cloud type(s) whose station cloud data group(s) (SCDGs) is (are) contained in the file. The 862 SCDGs in the 42 File Categories are contained in 433 physical files. A complete *list of the physical file names* is given in **Appendix C**. The means for obtaining the files are available from CDIAC (Section 6). Examples of the contents of the files are given in Table 8; these will be discussed in Section 4.

3.3. Data Formats

The header record is described in **Table 5**. It defines the content of a data group by specifying the parameters: TYPE, PCODE, YEAR, SN and FMT. (Here all data are for land stations, so LO=1 and SIZE=0 in all headers.) Only numerical values are included in the header record so the various cloud types, seasons, etc. are given numerical codes. These codes and their equivalencies are listed as values under the respective parameter name. (Definitions of the cloud types are given in Table 2, and other terms are defined in Table 7.) Each header also has a unique SCDG number which indicates the File Category number and the sequence of the group within the file category. The format number (FMT) given in the header record indicates the format (defined in Table 6) to be used for reading the data records. The header formats (110 and 120) are also listed in Table 6. Format 110 differs from 120 only in that the parameters TYPE, PCODE and SN are not applicable for Category 1 and so a value of "-9" is located in those positions in the header to Category 1.

The data formats used are defined in **Table 6**. The format of a data record depends on the category of data given. Categories 2–9 and 15–30 (formats 121, 122, 126, 127) all have similar content. The station ID number (StaID, which is the first variable in every data record) is followed by three pairs of numbers. Each pair is made up of a number of obs (or the number of seasons for Category 2) and an average (which may be for amount, frequency, or height). The first pair gives daytime values (NobD, AvgDy), the second pair gives nighttime values (NobN, AvgNt), and the third pair gives the total number of obs and the average over both day and night (NobDN, AvgDN). Finally, the ACODE is a coded message providing information regarding NobD and NobN used in obtaining AvgDN (described in Section 3.4 below). Format 122 differs from format 121 only in that the variable formatted is height (in meters, f6.0) rather than amount or frequency (in percent, f6.2). Format 126 is similar to format 121 except that averages are given for each of 26 years for each station. Again, format 127 gives height rather than amount or frequency. Data lines in Categories 10–13 (formats 138, 139) contain only a single data pair (Nobs and Avg for an individual synoptic hour) but 8 such pairs are given consecutively for each station. The synoptic hour is included in these data records. Format 162 is unique in that it contains amount, frequency and amount-when-present in the same data record. It is used for Categories 31–42, the daytime averages for 26 years (monthly). It contains the year (last 2 digits) for each data line and NC, the number of obs used in computing AWP. Formats 140 and 148 (used in Category 14) give the parameters of the first harmonic of either the annual or diurnal cycles. Details for the format contents are given in Section 4 for the particular files.

All data appear as integers (the "I" format) in the data files. To indicate the number of decimal places to which some values are given, the "F" format is shown above the relevant variables in Table 6. For example, the integer "1234" should be read as "12.34" if read under format 121 (F6.2) or as "1234." if read under format 122 (F6.0). If read in this way, amounts and frequencies are given in percent and base heights are given in whole meters. This principle applies to other variables in other formats.

3.4. Averaging Methods.

Except for amounts of middle and high clouds, which will be discussed below, averages for the various cloud variables (amt, fq, awp, nol and hgt) for day, night, and the individual synoptic hours were computed as the simple average of the available obs. The averages were computed even if only one observation was available. The number of obs contributing to each average is included in the data record. If no obs were available for a particular average (Nobs=0), the missing-value code (MCODE; usually –90000, see Table 7) was inserted for that average. One must check for the missing-value code and/or the Nobs when using the data. Note that, because the sky may be overcast with lower clouds, the Nobs for middle clouds (MOBS) and high clouds (HOBS) will generally be less than the Nobs for low (or total) clouds (LOBS ≥ MOBS ≥ HOBS).

To reduce the "partial-undercast bias" (Warren et al. 1986), frequencies for upper-level clouds (As, Ac, Hi) were computed only from reports in which the coverage of a lower cloud layer was less than 7/8. This is simpler than the method used by Warren et al. (1986) to reduce this bias, but we found no significant difference between the two methods.

Amounts of middle and high clouds. Because the synoptic code allows reporting of only two amounts even if clouds are present at all three levels (Table 1), it is possible for the amount of a middle or high cloud to be indeterminate even if the cloud is visible. Therefore we compute an amount-when-present (awp) from the obs for which the amount can be determined ("number of computable obs", NC) and obtain the cloud amount as:

$$\text{amt} = \text{fq} \times \text{awp}. \qquad (1)$$

Again, to reduce the partial-undercast bias, reports in which the coverage of a lower cloud layer was 7/8 were not used in computing awp for upper level clouds, further reducing NC. Thus there may be obs from which to compute fq but no obs from which to compute awp or amt (unless fq=0, in which case amt=0). The Nobs for awp is NC. The Nobs given in the data records for amt is the number of obs used in computing the frequency. To avoid reporting unrepresentative amounts, we imposed a minimum (mina) on NC for reporting amt: mina = min x fq x 0.6, where min has a value that is specified for each File Category (Section 4). If mina was not met, the Mcode was entered for amt. As always, it is necessary to check for the Mcode when using the data.

The non-overlapped amount is the amount actually seen by an observer from below; i.e., the amount not obscured by lower clouds. It is analogous to the quantity reported by most satellite-derived climatologies where the amount reported is the amount not obscured by *higher* clouds. The sum of non-overlapped amounts is equal to the total cloud cover, whereas the sum of the other cloud-type amounts reported in this archive is greater than the total cloud cover because of overlap.

Because one can know that an upper cloud cannot be seen (NOL=0) even if one does not know, because of lower overcast, whether or not it is present, Nobs for NOL is larger than MOBS or HOBS. Indeed, NOL was given in 94% of the EECRs used for this climatology. NOL was not given in EECRs for cases with clouds present in 3 levels because the distribution of the upper amount (N-Nh) between Mid and Hi cannot be computed. However we were able to include this class of reports in the present climatology by apportioning (N-Nh) by reference to the average AWPs of the cloud types when they were computable. We used the following algorithm:

if middle cloud is Ac, then assign NOL(Ac) = 0.7(N-Nh) and NOL(Hi) = 0.3(N-Nh) or
if middle cloud is As or Ns, then assign NOL(As or Ns) = 0.9(N-Nh) and NOL(Hi) = 0.1(N-Nh).

Using this approximation, NOL was computable in 99% of the reports. Only unusual reports, such as those for China in the 1970s (with CL=0 and Nh=/; see below), did not contribute.

The amount of a low cloud can always be determined: it is equal to Nh when it is present, and equal to zero when it is not present (CL=0). Thus it is not necessary to compute awp, as was shown above for middle and high clouds, to obtain low cloud amounts. We do, however, include awp for low clouds in the archive. For a low cloud, the number of computable obs (NC) is equal to the number of times the cloud was present (NTy).

The "daily" (or "diurnal") average (avgDN) was computed by one of three methods depending on the variable averaged. *For frequencies, amounts, and non-overlapped amounts*, avgDN was computed as the average of the Dy and Nt values. This method of forming avgDN weights day and night equally; it is the preferred method, if sufficient obs are available for both day and night, because there are generally fewer usable obs at night due to screening by the illuminance criterion. If NobD or NobN was less than the specified minimum (Section 4), then an average was computed using all available obs, regardless of time of day. A flag, the "averaging code" (Acode), is included in the data record to identify the DN-averaging method employed. Acode values and their meanings are given in Table 7. Note that, since both day and night averages and their Nobs are given, a user is free to obtain a DN average by a method different from the one used here.

For base height, avgDN was always computed as the simple average of all the obs of a low cloud type when it is present, regardless of time of day. The Acode supplied in this case does not represent the averaging method, which never varies, but does indicate the relationship between NobD, NobN and a specified min as defined in Table 7. Nobs for height may be less than the number of occurrences of a type (NTy) because h (Table 1) is sometimes not reported.

AwpDN is computed as: amtDN / fqDN (if fq=0, then awp=Mcode). This preserves the relationship in Eqn. (1) but, in general, awpDN computed in this way does NOT equal (awpD+awpN)/2. For example, if cumulus occurs frequently during daytime but rarely at night, then the awpDN should be weighted toward the daytime awp, as this method ensures. As for base height, the Acode supplied for awpDN indicates not the averaging method, which does not vary, but the relationship between NC(Dy), NC(Nt) and a specified minimum as defined in Table 7.

4. SPECIFIC COMMENTS ON THE DATA FILE CATEGORIES

Refer to Tables 4 and 6 throughout this discussion. The discussion of an individual File Category includes comments on the data content, data format and minima applied. Counts of the number of stations meeting minima for selected cloud variables will be listed. Reference will be made to examples given in **Table 8**.

4.1. File Category 1: Station Identification (STID)

Category 1 (Format 111) provides information about the land stations used. Data records for the 5388 selected stations are listed in ascending order of the 5-digit, WMO station identifiers (StaID) which here range from 01001 to 98851. Latitude and longitude are given in degrees (-90 to 90 N, 0 to 360 E) to 2 decimal places, and elevation is given in meters. The variables ny1, fy1 and ly1 give the number of years of Januarys with at least 20 obs, the first of such years and the last such year (e.g. "96" for 1996), respectively. The variables ny7, fy7 and ly7 give the same information for July. The "station data code" (SDC) indicates whether a station had at least 15 or more years of 20 or more obs in January or July and whether the number of night obs exceeded a certain fraction (about 15%) of the total. The meanings of the five possible values for SDC are given in **Appendix A4**. The table also lists the number of stations that have each value. A station reporting reliably both day and night for many years in all seasons will have SDC=2; there are 5053 such stations.

Two stations with SDC=2 are shown in Example (a) in Table 8. Station 01001, located at 70.93 deg N and 351.33 deg E at an elevation of 9 meters, has 20 or more obs in all 26 years for both January and July, while station 98851 has at least 20 obs/month in 21 of the years from 1971–96. Station 62700, in Africa, had only 3 Januarys and 2 Julys with 20 or more obs (SDC=0); these years were all between 1980 and 1991.

Finally, the variable b5c gives the number of the grid box, on the "5c" grid, that contains the station. We have used this grid in previous climatological data bases (NDP-026, NDP-026A) and in our atlas (Warren et al. 1986) but do not refer to it further here. The variable b5c can be ignored.

4.2. File Category 2: Mean Annual Cloud Amount (MACA)

Category 2 (Format 121) gives the annual average Dy, Nt, and DN amounts for all the cloud types, the clear-sky frequency, the sum of the low-level amounts, and the sum of the middle-level amounts. Annual averages were computed by averaging the seasonal values from Categories 3 (amounts) and 4 (Cr frequency). A seasonal value contributed to the annual average if there were at least 100 obs for the season. NSN is the number of seasons contributing. There were 5383 stations that had 4 seasons contributing to Tc. The Acode assigned here for AvgDN was based on the Acodes of the seasonal averages contributing (Table 7). Acode was assigned as 2 if all seasons contributing to the annual average had Acode=2. If any contributing season had Acode=3, then Acode=3 also for the annual average. Acode=1 does not apply here. Acode=0 if no seasons had 100 obs. Acode=2 was obtained by 5338 stations for Tc and by 5278 stations for Hi amount.

Example (b) in Table 8 shows the annual average total cloud amount for station 21749. These averages were obtained from the seasonal values shown in Examples (c–f). The annual averages were computed from only 3 seasons because DJF, shown in Example (c), contained too few obs. The 3 seasons contributing to AvgDN [75.99 = (74.97 + 77.72 + 75.28) /3] all had Acode=2 so the Acode for the annual average is also 2.

4.3. File Categories 3–5: Mean Seasonal Amount, Frequency, and Amount-when-present (MSCA, MSCF, MSAW)

Categories 3–5 (Format 121) contain the mean-seasonal (multi-year) averages for amt, fq and awp, respectively. Amounts for the low and middle levels (LoL and MiL) are included in Category 3. Category 5 does not include awp for Tc, for which none is computed, or for Fo (sky obscured by fog) which is, by definition, always 100%. Fo is included in both Categories 3 and 4 even though fq_Fo = amt_Fo. These averages were obtained by summing, seasonally, all obs over the span of years for each station; they were not obtained by averaging the season averages of individual years. (Because the source data began with 1971 January, rather than 1970 December, we include data from Decembers 1971–1996 in the DJF averages in order to provide 26 years for each month for that season.) Nobs for awp is NC, the number of occurrences of a cloud type for which an amount was computable. (For low clouds NC=NTy; for upper clouds NC is generally less than NTy.) The Nobs given in a data record for amt is the same as that for fq, though amt may be missing for middle or high clouds (assigned the Mcode) if NC is inadequate (NC < mina as described in Section 3.4). The minimum used in computing avgDN and Acode was 100 for fq and amt, and 50 for awp. In DJF, Acode=2 was obtained by 5352 stations for Tc and by 4877 stations for Hi awp.

Examples (g–i) in Table 8 show amt, fq and awp, respectively, for St for station 15235 in DJF. The nighttime frequency here is quite low (0.93%) so although NobN=1941, there are only 18 occurrences of St from which to compute awp (90.28%). Although the Acode for both fq and amt is 2, and awpDN is computed as amtDN/fqDN (Section 3.4), the Acode assigned to awpDN here is 3, signifying that NC for either Dy or Nt (or both) is less than 50 while NC for DN is ≥50 (221 in this case). In these examples only one of the 4 or 5 SCDGs contained in the file (see Appendix C) is shown. Example (j) lists all 4 SCDGs in the file for middle and high cloud frequency for JJA. Data records are shown for station 30692. Example (k) shows the sum of low cloud amounts for DJF for 3 stations. Station 21749 has few obs in this season as was seen in Example (c). Station 62840 in Africa has only a small amount of low clouds (1.40%) while station 89065 on the Antarctic Peninsula has much more (40.29%). Example (l) shows the use of bogus awp (see Section 5.1 below) for Hi (46%) for station 97760.

4.4. File Category 6: Mean Seasonal Non-overlapped Amount for Upper Clouds (MSUU)

Category 6 (Format 121) contains the mean-seasonal averages of the non-overlapped amount for the four middle and high cloud types. The min used in computing avgDN and Acode for non-overlapped amounts was 100, and the consequent number of stations with Acode=2 is 5352 for Hi in DJF, for example.

Example (m) in Table 8 shows NOL for the four upper types for MAM for two stations. Station 46734 has a small NOL_Hi averaged over day and night (AvgDN=1.67%, Acode=2), while station 89544 has a much larger amount averaged from mostly daytime obs (14.90%, Acode=3).

4.5. File Category 7: Mean Seasonal Low Cloud Base Height (MSLH)

Category 7 (Format 122) contains the base heights for the four low cloud types: St, Sc, Cu, Cb (Hgt for Fo is, by definition, zero). Format 122 differs from Format 121 only in that Avg for Hgt is given to whole meters (F6.0). Nobs for height may be less than NTy since h (Table 1) is not always reported. AvgDN for base height was computed from all available obs, as explained in Section 3.4. Using a min of 50 to determine Acodes, 4463 stations have Acode=2 for Sc in DJF. Fewer stations had Acode=2 for other types which occur less frequently.

Example (n) in Table 8 lists data records for two stations in the SCDGs for low cloud base heights for JJA. The average height of St at station 98851 is 513m as computed from only 52 obs. Cu is far more common in this case with 5331 obs and an average height of 516m. Station 21749, by contrast, has a height of 310m for St from 1189 obs and a height of 798m for Cu from 162 obs.

4.6. File Categories 8 and 9: Mean Monthly Cloud Amount and Frequency (MMCA, MMCF)

Categories 8 and 9 (Format 121) contain the mean-monthly averages for amt and fq. The min used in the computation of AvgDN for these files was 75. The number of stations with Acode=2 for January, for example, is 5283 for Tc, 5082 for fq_Hi and 5059 for amt_Hi. No examples are shown in Table 8 because the principles are the same as for Categories 3 and 4 discussed above. These files were used in computing the annual cycles in Category 14.

4.7. File Categories 10–13: Mean Seasonal Averages by Synoptic Hour (MSAT, MSFT, MSUT, MSHT)

Categories 10–13 (Formats 138 and 139) give cloud variable averages (seasonally) for the eight synoptic hours. Formats 138 and 139 contain fewer variables than Formats 121 and 122 used above but eight data lines (one for each hour) are given for each station. No min was applied for computing these averages (except mina for amt of upper clouds) so the user must check Nobs (and Mcode for amt) to evaluate the representativeness of the average given. These files were used in computing the diurnal cycles in Category 14.

Example (o) in Table 8 lists the data records for two stations for the frequency of clear sky in SON. Station 84782 (Tacna, Peru) has at least 300 obs for all 8 hours while station 72469 (Denver) exceeds 75 obs at only the four 6-hourly times. Cr is reported more frequently at night at Denver but more frequently in the daytime at Tacna. (GMT can be converted to LT by using the station longitude given in Category 1.)

4.8. File Category 14: Annual and Diurnal Cycles (HARM)

Category 14 (Formats 140 and 148) gives the phase (PHASE), amplitude (AMP), and variance accounted for (VAF) of the first harmonic of the annual cycle (DN averages only) and diurnal cycle for cloud amount and frequency. PHASE is the time of maximum of the fitted cosine curve. Formats 140 and 148 differ only in that the label "140" is used to signify that the values of PHASE and NT are representative of months whereas the label "148" is used to signify that PHASE and NT are representative of hours of the day (see Table 7). AVG is the average of the 12 monthly (annual cycle) or 8 (or 4) hourly (diurnal cycle) values; these averages may differ slightly from each other and from the annual averages given in Category 2.

Annual cycles were computed from the monthly (DN) averages in Categories 8–9 and are given for a station only if all 12 months had Acode=2 (min 75 both day and night). Mcode was inserted for the variables if the number of months (NT) was less than 12. In this way, annual cycles were obtained for 5240 stations for Tc, 4913 stations for Fq_Hi and 4829 stations for Amt_Hi.

Example (p) in Table 8 shows the annual harmonic parameters for Tc for 4 stations. Station 89544 did not have 75 obs both day and night in any year so the Mcode was inserted for the variables. The other 3 stations are located in the USA (Tucson, Denver and Seattle, respectively) and have distinctly different climates from each other. Tucson, with the lowest annual cloud amount (38.6%) of the three, shows a small maximum (AMP=1.39% absolute cloud cover) in early December (PHASE=11.86), but VAF is quite small (0.12%). Denver, with an annual cloud amount of 52.6%, shows a larger and more significant cycle (AMP=6.44%) with the maximum in late March (PHASE=3.30) and VAF= 69.6%. Seattle has the greatest cloud cover (69.3%) and the largest variation (AMP=12.35%, VAF= 69.1%) with its maximum in early Feb (PHASE=1.55).

Diurnal cycles were computed from the 3-hourly averages given in Categories 10 and 11. The diurnal parameters for a station are given, in the Category 14 files, if each of the 8 hours had a minimum of 75 obs or if each of the four 6-hourly times (0,6,12,18 GMT) had the minimum 75 obs. A station with 8 hours by this test was then tested for the ratio N6/N3, where N6 is the total number of obs at the 6-hourly times and N3 is the total number of obs at the intermediate 3-hourly times. If this ratio exceeded 4.0 then the diurnal cycle was computed from only the four 6-hourly averages. This was done to reduce a possible bias which may result if reports are made at the intermediate 3-hourly times only in special weather conditions. Diurnal cycles for Tc in DJF, for example, were computed for 4755 stations. Of those, 993 cycles were computed from only 4 hours; of these, 16 had 75 obs for all 8 hours but failed the N6/N3 test.

Example (q) in Table 8 gives the diurnal parameters for Fq_Cr in SON for the two stations listed in Example (o) discussed in Section 4.7. With all 8 hours contributing, station 84782 shows an amplitude of 30.66% (around a mean of 32.4%) with the maximum around 3 PM local time. Only 4 hours contributed to the computations for station 72469 which shows an amplitude of 14.06% around an average of 16.9% with the maximum occurring around 2 AM. Both stations showed a large VAF (77.0 and 73.8, respectively) indicating that the first harmonic represents the diurnal cycle fairly well.

4.9. File Categories 15–30: Seasonal Averages by Year (SMCA, SMCF, SMUU, SMHL)

Categories 15–30 (Formats 126 and 127) provide Dy, Nt and DN averages of the cloud variables for the individual years (1971–96) of each season. The data record for a station contains 26 lines, one for each year, listed in ascending order by year (the year is not included in the data line). The min used in the computation of AvgDN in these files varied with the cloud type because LOBS ≥ MOBS ≥ HOBS, and Nobs becomes limiting as the period of averaging becomes small. A station making one report each night could have a maximum NobN of about 90 for a 3-month season. About 60% of these reports will be excluded by the illuminance criterion and reports are occasionally missing from the source data set due to failures in data transmission or archiving. Considering these factors, we used the mins listed in the following table in computing AvgDN and in setting the Acode for an individual year-season.

min	variable
35	Tc, Cr, low clouds, NOL and Fq_Ns
30	As, Ac and Amt_Ns
25	Hi
20	Hgt (min used for Acode only; Hgt is computed from all available obs)

Using these mins, for DJF for example, the number of stations with Acode=2 in 15 or more years for Tc is 4119 while the number for Amt_Hi is 3536.

Example (r) in Table 8 lists the Cu amounts by year for MAM for station 94248 (Centre Island, northern Australia). This example demonstrates a variety of averaging possibilities. There are 18 years with Acode=2 for AvgDN, such as in 1980 for which AvgDN = 6.44% = (9.76 + 3.12)/2. In 1971 there were 64 obs, all for daytime, so Mcode appears for AvgNt, and AvgDN (7.42) was computed from the daytime obs with Acode=3. In 1976 there were 131 obs but only 22 for nighttime so AvgDN was computed from all the obs with Acode=3. In 1972 there were only 3 obs so Acode=1. There were no obs at all for 1975 so all averages were assigned the Mcode and Acode=0. This example also shows the increase in the number of reports from 1988 to 1989, as is seen for many Australian stations, due to inclusion of intermediate 3-hourly reports beginning at that time. For numerous other stations around the globe, an increase in the number of reports occurs in 1995 due to duplication of 6-hourly reports into succeeding intermediate 3-hourly slots.

These files can be used in analyzing trends in cloud cover. Again, mins were not applied for Dy and Nt averages so NobD and NobN must be consulted to choose representative averages. Middle and high cloud amounts must also be checked for the Mcode. Note that because 1970 December was not available for use in preparing this dataset, "DJF 1971" contains data only for 1971 January and February and thus should not be used in seasonal trend analyses.

4.10. File Categories 31–42: Monthly Daytime Averages by Year (MNYD)

Categories 31–42 (Format 162) give monthly averages for individual years (1971–96) for selected cloud variables. Because more than half of nighttime reports are excluded by the illuminance criterion, nighttime averages for a single month cannot be fully representative of that month. Therefore we give only daytime averages for cloud variables for individual months. It is then convenient to include the three cloud variables (amt, fq, awp) in a single data record (Format 162). The data record for a single year includes Nobs, Amt, Fq, AWP and NC. NC is the number (note exception below) of occurrences of a cloud type for which AWP was computable (and Amt = Fq x AWP). Again, to allow for user flexibility, no min is applied in presenting these averages so the user is responsible for checking Nobs (the maximum possible NobD per month is 124) to determine reliability of Fq, and for checking NC to determine the reliability of AWP and Amt. There are two special situations, involving AWP for middle and high cloud types, for which NC is assigned a code value (<0) instead of the number of computable occurrences. Values of -1 or -2 are used to indicate that one of two types of bogus values for AWP has been used to compute Amt (see Section 5.1 below). NC is not applicable for Tc or Cr and is therefore assigned the value –9 (and AWP=Mcode).

Example (s) in Table 8 shows a few years of data (Ac cloud variables for Januarys) for each of three stations. For station 01035 in 1978 there were 19 obs and Fq_Ac was 15.79% (NTy=3) but AWP was not computable in any report (NC=0) so AWP and Amt contain the Mcode. NC=0 also in 1977 so AWP=Mcode but Amt=0 because Fq=0. The sample listing for the China station 54511 shows NC=-2 for 1978 and 1979 indicating that AWP (29.83) was obtained from 1980–89 data (Section 5.1). For station 97900, a bogus value of AWP (51% for Ac; Section 5.1) was used in all years.

Example (t) shows a partial listing of high cloud data for Decembers for a station in the USA (72290, San Diego). Synoptic weather reports no longer appeared in the source data set after 1995 for this and many other USA stations (Hahn and Warren 1999).

5. IMPORTANT NOTES ON USE OF THIS DATA SET

5.1. Stations with Bogus Amount-When-Present

China. Because of problems in China's reporting procedures in the 1970s [described in detail by Warren et al. (1986) and by Hahn and Warren (1999)], we assigned to AWP, for middle cloud types for the years 1971–79, a value obtained by averaging AWP for 1980–89 (averaged and applied for each of the 12 months separately). This is indicated in Categories 31–42 by the value "-2" assigned to NC (Format 162) for all China stations (StaID begins with "5") for data records for the years 1971–79. Thus any interannual variations of middle cloud amounts obtained in China for these years will be due solely to interannual variations of frequency.

Indonesia and South America. During preliminary analyses, we discovered that there were two equatorial regions in which the ratio NC/NTy for upper cloud types (the number of times the cloud amount was computable, divided by the number of times the cloud was present) was quite small (<0.25 compared to 0.7 globally). Our analysis suggested that the average AWPs obtained from this small sample were unrepresentative. We chose therefore to apply appropriate mean values to AWP for the stations in the affected region. Global, mean annual values for DN averages of AWP were obtained in the preliminary analysis. The values (applied to all seasons and times) used for AWP are 98% for Ns, 80% for As, 51% for Ac, and 46% for Hi.

The stations affected lie in an irregular region between latitudes 10N and 10S and between longitudes 95E and 175E (includes Indonesia and other islands) and in a much smaller region of South America from 0 to 10N and 55 to 60W. StaIDs for the 155 stations affected are listed in **Appendix B**. Ten stations were added to a preliminary list of 145 stations after completion of Categories 2–14.

These "bogus" values of AWP appear in the Dy, Nt and DN avgs in Category 5 for these stations. In Categories 31–42 a "-1" appears in the NC variable. Interannual and diurnal variations of middle or high cloud amounts for these stations will be due solely to variations of frequency.

5.2. Minimum Observations, the Missing-Value Code, and the A-code

We did not impose a minimum number of observations to report averages for the individual synoptic hours, the day average, or the night average. This allows the user to aggregate the data in any manner. However, this also REQUIRES THE USER TO CHECK the sum of Nobs against a user-specified min, and to check an Amt for Mcode before using the data. (The amount of middle or high clouds may be "missing" even when Nobs>0 if AWP is unavailable, as discussed above.) The Acode is a convenient guide for evaluating DN averages if one accepts the mins applied in creating this archive.

6. HOW TO OBTAIN THE DATA

This documentation and the data described herein are available from:

Carbon Dioxide Information Analysis Center
Oak Ridge National Laboratory
Post Office Box 2008
Oak Ridge, TN 37831-6335, U.S.A.
(http://cdiac.ornl.gov/epubs/ndp/ndp026d/ndp026d.html)

The following citation should be used for referencing this archive and/or this documentation report:

Hahn, C.J., and S.G. Warren, 2003: *Cloud Climatology for Land Stations Worldwide, 1971–96*. NDP-026D, Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, Oak Ridge, TN.

(Email to authors: hahn@atmo.arizona.edu; sgw@atmos.washington.edu.)

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TABLE 1. CLOUD INFORMATION CONTAINED IN SYNOPTIC WEATHER REPORTS^

Symbol	Meaning	Codes#
N	total cloud cover	0-8 oktas 9= sky obscured
Nh	lower* cloud amount	0-8 oktas
h	lower* cloud base height	0-9
CL	low cloud type	0-9
CM	middle cloud type	0-9
CH	high cloud type	0-9
ww	present weather	00-99
Ix	present weather indicator	1-6

^ Reports are made 8 times per day: 00, 03, 06, 09, 12, 15, 18, 21 GMT.
# Oktas are eights of sky cover, with "0" meaning completely clear sky and "8" meaning completely overcast sky.
Any category for which information is lacking is coded as "/".
* The "lower" cloud is the middle level if there are no low clouds.

TABLE 2. CLOUD TYPE AND WEATHER TYPE DEFINITIONS USED

Level	Shorthand notation	Meaning	Synoptic codes	Extended codes#
	Tc	total cloud cover	N = 0-9	0-8
	Cr	completely clear sky	N = 0	
	Ppt	precipitation	ww= 50-75,77,79,80-99	
	D	drizzle	50-59	
	R	rain	60-69	
	S	snow	70-75,77,79	
	Ts	thunderstorm or shower	80-99	
Low			CL=	
	Fo	sky obscured by fog	/ with N=9 and ww=10-12,40-49	11
	St	stratus	6,7	
	Sc	stratocumulus	4,5,8	
	Cu	cumulus	1,2	
	Cb	cumulonimbus	3,9, or N=9 with ww=Ts	10
	LoL	Fo + St + Sc + Cu + Cb		
Mid			CM=	
	Ns	nimbostratus	2,7, or N=9 with ww=DRS	12,11,10
			/ with ww=DRS and CL=0,7	10
			/ with ww= RS and CL=4-8	10
	As	altostratus	1; 2 if not DRS	
	Ac	altocumulus	3,4,5,6,8,9; 7 if not DRS	
	MiL	Ns + As + Ac		
High			CH=	
	Ci or Hi	cirriform clouds	1-9	

Used in the source data set, the EECRA (NDP-026C). Extended codes are shown where they differ from synoptic codes. In the extended code the value "-1", rather than "/", is used to signify missing information.

TABLE 3. DATA FILE CATEGORIES FOR LAND STATION CLOUD ARCHIVE, 1971–1996

File Cat.	Category abbrev.	General contents* (for 5388 Stations)	Num of Types	Logical records	Char per data_rec	fmt num	Mega-Bytes
_	RDME	README (brief documentation)		812	80	80	0.07
1	STID	STATION ID, Lat, Lon, Elev & Number of Years Contributing		5,389	48	111	0.26
2	MACA	Mean Annual Cloud AMOUNT	13	70,057	46	121	3.2
3	MSCA	Mean Seasonal Cloud AMOUNT	12	258,672	46	121	11.9
4	MSCF	Mean Seasonal Cloud FREQUENCY	10	215,560	46	121	9.9
5	MSAW	Mean Seasonal AMT-WHEN-PRESENT	8	172,448	46	121	7.9
6	MSUU	Mean Seasonal Mid,Hi Cloud NOL	4	86,224	46	121	4.0
7	MSLH	Mean Seasonal Low Cloud Base HGT	4	86,224	46	122	4.0
8	MMCA	Mean Monthly Cloud AMOUNT	10	646,680	46	121	29.7
9	MMCF	Mean Monthly Cloud FREQUENCY	10	646,680	46	121	29.7
10	MSAT	Mean Seasonal Cloud AMOUNT by synoptic hour	10	215,560	8*20	138	34.5
11	MSFT	Mean Seasonal Cloud FREQUENCY by synoptic hour	10	215,560	8*20	138	34.5
12	MSUT	Mean Seasonal Mid,Hi NOL by synoptic hour	4	86,224	8*20	138	13.8
13	MSHT	Mean Seasonal Low Base HEIGHT by synoptic hour	4	86,224	8*20	139	13.8
14	HARM	Harmonics: DIURNAL, ANNUAL	11	291,006	26	140	7.6
15	SMCA	Seasonal Mean Cloud AMT, DJF	10	53,890	26*46	126	64.4
16	SMCA	Seasonal Mean Cloud AMT, MAM	10	53,890	26*46	126	64.4
17	SMCA	Seasonal Mean Cloud AMT, JJA	10	53,890	26*46	126	64.4
18	SMCA	Seasonal Mean Cloud AMT, SON	10	53,890	26*46	126	64.4
19	SMCF	Seasonal Mean Cloud FQ, DJF	10	53,890	26*46	126	64.4
20	SMCF	Seasonal Mean Cloud FQ, MAM	10	53,890	26*46	126	64.4
21	SMCF	Seasonal Mean Cloud FQ, JJA	10	53,890	26*46	126	64.4
22	SMCF	Seasonal Mean Cloud FQ, SON	10	53,890	26*46	126	64.4
23	SMUU	Seasonal Mean Mid,Hi NOL, DJF	4	21,556	26*46	126	25.8
24	SMUU	Seasonal Mean Mid,Hi NOL, MAM	4	21,556	26*46	126	25.8
25	SMUU	Seasonal Mean Mid,Hi NOL, JJA	4	21,556	26*46	126	25.8
26	SMUU	Seasonal Mean Mid,Hi NOL, SON	4	21,556	26*46	126	25.8
27	SMHL	Seasonal Mean Base HEIGHT, DJF	4	21,556	26*46	127	25.8
28	SMHL	Seasonal Mean Base HEIGHT, MAM	4	21,556	26*46	127	25.8
29	SMHL	Seasonal Mean Base HEIGHT, JJA	4	21,556	26*46	127	25.8
30	SMHL	Seasonal Mean Base HEIGHT, SON	4	21,556	26*46	127	25.8
31	MNYD	Monthly Day AMT, FQ, AWP JAN	11	59,279	26*34	162	52.4
|		|					
42	MNYD	Monthly Day AMT, FQ, AWP DEC	11	59,279	26*34	162	52.4
1-14	(long term averages)			3,082,508			205
15-30	(individual year-season avgs)			603,568			722
31-42	(individual year-month avgs)			711,348			629
1-42				3,397,424			1,555

* The specific cloud types given within each category are listed in footnote to Table 4. Data formats are given in Table 6. Abbreviations used are defined in Table 7.

TABLE 4. DATA ORGANIZATION FOR LAND STATION CLOUD ARCHIVE, 1971–1996

File Cat.*	Num of SCDGs	SCDG numbers#	Contents**	(File Category name abbreviation)	Data Format
STATION ID				(STID)	
1	1	01001	LAND_STATION_ID, Lat,Lon, Elev, Yrs of data		111
MEAN-ANNUAL AVERAGES				(MACA)	
2	13	02001-13	Mean-Annual CLOUD AMOUNT & CLEAR-SKY FQ		121
			ANN:		
		1	Tc		
			5388 Stations		
		2	Cr		
			5388 Stations		
		3	Fo "		
		4	St "		
		5	Sc "		
		6	Cu "		
		7	Cb "		
		8	Ns "		
		9	As "		
		10	Ac "		
		11	Hi "		
		12	MiL "		
		13	LoL "		
MEAN-SEASONAL AVERAGES					
3	48	03001-48	Mean-Seasonal Cloud AMOUNT	(MSCA)	121
		1-12	DJF: 12 TYPES, 5388 Stations		
		13-24	MAM: 12 TYPES, 5388 Stations		
		25-36	JJA: 12 TYPES, 5388 Stations		
		37-48	SON: 12 TYPES, 5388 Stations		
4	40	04001-40	Mean-Seasonal Cloud FREQUENCY	(MSCF)	121
		1-10	DJF: 10 TYPES, 5388 Stations		
		11-20	MAM: 10 TYPES, 5388 Stations		
		21-30	JJA: 10 TYPES, 5388 Stations		
		31-40	SON: 10 TYPES, 5388 Stations		
5	32	05001-32	Mean-Seasonal AMOUNT-WHEN-PRESENT	(MSAW)	121
		1-8	DJF: 8 TYPES, 5388 Stations		
		9-16	MAM: 8 TYPES, 5388 Stations		
		17-24	JJA: 8 TYPES, 5388 Stations		
		25-32	SON: 8 TYPES, 5388 Stations		
6	16	06001-16	Mean-Seasonal NON-OVERLAPPED AMT Upper 4 SEASONS, 4 TYPES, 5388 Stations	(MSUU)	121
7	16	07001-16	Mean-Seasonal BASE HEIGHTs Low Clouds 4 SEASONS, 4 TYPES, 5388 Stations	(MSLH)	122
MEAN-MONTHLY AVERAGES					
8	120	08001-120	Mean-Monthly Cloud AMOUNT 12 MONTHS (Jan-Dec), 10 TYPES, 5388 Stations	(MMCA)	121
9	120	09001-120	Mean-Monthly Cloud FREQUENCY 12 MONTHS, 10 TYPES, 5388 Stations	(MMCF)	121
MEAN-SEASONAL by SYNOPTIC HOUR					
10	40	10001-40	Mean-Seasonal Cloud AMOUNT by Hour 4 SEASONS, 10 TYPES, 5388 Stations, 8 Hrs	(MSAT)	138
11	40	11001-40	Mean-Seasonal Cloud FREQUENCY by Hour 4 SEASONS, 10 TYPES, 5388 Stations, 8 Hrs	(MSFT)	138
12	16	12001-16	Mean-Seasonal NOL Upper Clouds by Hour 4 SEASONS, 4 TYPES, 5388 Stations, 8 Hrs	(MSUT)	138
13	16	13001-16	Mean-Seasonal BASE HGT Low by Hour 4 SEASONS, 4 TYPES, 5388 Stations, 8 Hrs	(MSHT)	139

TABLE 4 cont. DATA ORGANIZATION FOR LAND STATION CLOUD ARCHIVE, 1971–1996

File Cat.*	Num of SCDGs	SCDG numbers#	Contents** (File Category name abbreviation)	Data Format
HARMONIC ANALYSES			(HARM)	
14	100	14001-100	Annual and Diurnal Cycles, First Harmonic	
		1-10	ANNUAL CYCLE AMOUNT (DN) 10 TYPES, 5388 Stations	140
		11-20	ANNUAL CYCLE FREQUENCY (DN) 10 TYPES, 5388 Stations	140
		21-60	DIURNAL CYCLE AMOUNT 4 SEASONS, 10 TYPES, 5388 Stations	148
		61-100	DIURNAL CYCLE FREQUENCY 4 SEASONS, 10 TYPES, 5388 Stations	148
SEASONAL-MEAN AVERAGES				
			each SEASON: 10 TYPES, 5388 Stations, 26 Yrs (SMCA)	
15	10	15001-10	Seasonal-Mean CLOUD AMOUNT, DJF	126
16	10	16001-10	Seasonal-Mean CLOUD AMOUNT, MAM	126
17	10	17001-10	Seasonal-Mean CLOUD AMOUNT, JJA	126
18	10	18001-10	Seasonal-Mean CLOUD AMOUNT, SON	126
			each SEASON: 10 TYPES, 5388 Stations, 26 Yrs (SMCF)	
19	10	19001-10	Seasonal-Mean CLOUD FREQUENCY, DJF	126
20	10	20001-10	Seasonal-Mean CLOUD FREQUENCY, MAM	126
21	10	21001-10	Seasonal-Mean CLOUD FREQUENCY, JJA	126
22	10	22001-10	Seasonal-Mean CLOUD FREQUENCY, SON	126
			each SEASON: 4 TYPES, 5388 Stations, 26 Yrs (SMUU)	
23	4	23001-4	Seasonal-Mean NOL Upper Clouds, DJF	126
24	4	24001-4	Seasonal-Mean NOL Upper Clouds, MAM	126
25	4	25001-4	Seasonal-Mean NOL Upper Clouds, JJA	126
26	4	26001-4	Seasonal-Mean NOL Upper Clouds, SON	126
			each SEASON: 4 TYPES, 5388 Stations, 26 Yrs (SMHL)	
27	4	27001-4	Seasonal-Mean BASE HGT Low Clouds, DJF	127
28	4	28001-4	Seasonal-Mean BASE HGT Low Clouds, MAM	127
29	4	29001-4	Seasonal-Mean BASE HGT Low Clouds, JJA	127
30	4	30001-4	Seasonal-Mean BASE HGT Low Clouds, SON	127
MONTHLY-MEAN AVERAGES, DAY			(MNYD)	
			each MONTH: 11 TYPES, 5388 Stations, 26 Yrs	
31	11	31001-11	Monthly-Mean Daytime Cloud AMT,FQ,AWP, JAN	162
32	11	42001-11	Monthly-Mean Daytime CLOUD AMT,FQ,AWP, FEB	162
33	11	42001-11	Monthly-Mean Daytime CLOUD AMT,FQ,AWP, MAR	162
34	11	42001-11	Monthly-Mean Daytime CLOUD AMT,FQ,AWP, APR	162
35	11	42001-11	Monthly-Mean Daytime CLOUD AMT,FQ,AWP, MAY	162
36	11	42001-11	Monthly-Mean Daytime CLOUD AMT,FQ,AWP, JUN	162
37	11	42001-11	Monthly-Mean Daytime CLOUD AMT,FQ,AWP, JUL	162
38	11	42001-11	Monthly-Mean Daytime CLOUD AMT,FQ,AWP, AUG	162
39	11	42001-11	Monthly-Mean Daytime CLOUD AMT,FQ,AWP, SEP	162
40	11	42001-11	Monthly-Mean Daytime CLOUD AMT,FQ,AWP, OCT	162
41	11	42001-11	Monthly-Mean Daytime CLOUD AMT,FQ,AWP, NOV	162
42	11	42001-11	Monthly-Mean Daytime CLOUD AMT,FQ,AWP, DEC	162

* Abbreviations and non-standard terms are defined in Table 7.

Data group (SCDG) numbers encoded in header format 120 are:
(file_category_number x 1000) + (sequence-number within file category).
Order of data groups in a multi-group file is: hold
LEFT (upper) group qualifier constant and increment RIGHT (lower) qualifier.

** Not all types are given in every file. The rule applied is:

```
 "13 types" means  Tc, Cr, Fo, St, Sc, Cu, Cb, Ns, As, Ac, Hi, MiL, LoL.
 "12 types" means  Tc,     Fo, St, Sc, Cu, Cb, Ns, As, Ac, Hi, MiL, LoL.
 "11 types" means  Tc, Cr, Fo, St, Sc, Cu, Cb, Ns, As, Ac, Hi.
 "10 types" means  Tc,     Fo, St, Sc, Cu, Cb, Ns, As, Ac, Hi (for Amt).
        or means       Cr, Fo, St, Sc, Cu, Cb, Ns, As, Ac, Hi (for Fq).
 " 8 types" means              St, Sc, Cu, Cb, Ns, As, Ac, Hi (for Awp).
 " 4 types" means                              Ns, As, Ac, Hi (for NOL),
         or means              St, Sc, Cu, Cb                 (for Hgt).
```

TABLE 5. HEADER RECORD FORMAT (Format 120) AND CODES* USED FOR LAND STATION CLOUD CLIMATOLOGY ARCHIVE#

Format	I5	I5	I3	I2	I3	I2	I5	I3	I4
Parameter	SCDG	NSTA	SIZE	LO	TYPE	PCODE	YEAR	SN	FMT
Values	10001 | 42011	5388 (820) (1820)	0 (5) (10)	1=Land (2=Ocean) (3=Global)	1=Tc 2=Cr (3=Ppt) 11=Fo 12=St 13=Sc 14=Cu 15=Cb 21=Ns 22=As 23=Ac 30=Hi 20=MiL 10=LoL	0=AFW 1=AMT 2=FQ 3=AWP 4=NOL 5=HGT	(1951) | 1971 | 1996 (5296) 7196	0=ANN 1=Jan | 12=Dec 41=DJF 42=MAM 43=JJA 44=SON	111 121 122 126 127 138 139 140 148 162

* Terms are defined in text or in Tables 2 & 7.
# Values in parentheses are not used in this Land Station Archive but are included to show generalized header record to be used also in land and ocean gridded climatologies.

TABLE 6. DATA FORMATS* FOR READING LAND STATION CLOUD CLIMATOLOGY

Format number	Variables & Format	(Num of characters in record)	Files# in which used
80	Text: 812A80	(80)	F0
110	I5 I5 I3 I2 I3 I2 I5 I3 I4 SCDG NSTA SIZE LO -9 -9 YR -9 FMT	(32)	F1,Header
111	I5 F6.2 F6.2 I5 I3 I3 I3 I3 I3 I3 I3 I5 StaID LAT LON ELEV ny1 fy1 ly1 ny7 fy7 ly7 SDC b5c	(48)	F1,Data
120	I5 I5 I3 I2 I3 I2 I5 I3 I4 SCDG NSTA SIZE LO TYPE PCODE YR SN FMT	(32)	Headers
121	I5 I7 F6.2 I7 F6.2 I7 F6.2 I2 StaID NobD AvgDy NobN AvgNt NobDN AvgDN Acode StaID NSNd AvgDy NSNn AvgNt NSNdn AvgDN Acode	(46)	Data: F3-6,8-9 F2
122	I5 I7 F6.0 I7 F6.0 I7 F6.0 I2 StaID NobD AvgDy NobN AvgNt NobDN AvgDN Acode	(46)	F7
126	26(I5 I7 F6.2 I7 F6.2 I7 F6.2 I2) StaID NobD AvgDy NobN AvgNt NobDN AvgDN Acode	(26x 46)	F15-26
127	26(I5 I7 F6.0 I7 F6.0 I7 F6.0 I2)		F27-30
138	8(I5 I3 I6 F6.2) StaID HR Nobs Avg	(8x 20)	F10-12
139	8(I5 I3 I6 F6.0)		F13
140	I5 F5.2 F5.2 F4.1 I3 F4.1 StaID PHASE AMP VAF NT AVG	(26)	F14
148	" " " " " "		
162	26(I5 I3 I4 F6.2 F6.2 F6.2 I4) StaID YR Nobs Amt Fq AWP NC	(26x 34)	F31-42

* Abbreviations are defined in text or in Table 7. The value "-9" in Format 110 means that the variable (used in Format 120) is not applicable.
# File categories (F1-F42) are listed in Tables 3 & 4 and discussed in Section 4.

TABLE 7. GLOSSARY OF TERMS AND ABBREVIATIONS USED

Term	Meaning and description
Acode	"Average code" for avgDN; indicates relations between NobD, NobN and min: Acode / Nobs / AvgDN 0 / 0 / missing value entered 1 / NobD+NobN < min / avg all obs [except awp=amt/fq] 2 / NobD≥min and NobN≥min / (avgDy+avgNt)/2 [except awp=amt/fq and avg all obs for Hgt] 3 / NobD+NobN≥min / avg all obs [except awp=amt/fq]
AFW	Amount, Frequency, Amount-When-Present.
AMP	Absolute amplitude of harmonic (not normalized).
Amt	Amount of cloud cover (actual).
ANN	Annual.
Avg	Average (of Amt, Fq, AWP, NOL or Hgt).
AvgDy, AvgNt	Average of daytime or nighttime obs.
AvgDN	Average over day and night ("daily" or "diurnal" average).
AWP	Amount-When-Present.
B5c	One of 1820 grid boxes distributed over the globe such that the dimensions (lat x lon) of the boxes are 5x5 deg between 50N and 50S, 5x10 deg for lats 50-70, 5x20 deg for lats 70-80, 5x40 deg for lats 80-85, and 5x360 deg for lats 85-90. The boxes are numbered east-to-west (beginning at the Greenwich Meridian) and north-to-south.
Cat.	Category.
D, Dy	Abbreviation or suffix meaning "daytime".
day	Refers to either the full 24-hour day or to "daytime" (q.v.), depending on context.
daytime	Local time 06-18. Abbreviations used are Dy and D.
DJF	December, January, February.
EECRA	Extended Edited Cloud Report Archive (Hahn & Warren, 1999).
EECR	A report in the EECRA.
ELEV	Station elevation in meters.
FMT	Data format number (see Table 6).
Fq	Frequency of occurrence (actual).
GMT	Greenwich Mean Time.
Hgt	Low cloud base height (given in meters).
HR	Hour. (00, 03, 06, 09, 12, 15, 18, 21 GMT)
HOBS	Number of obs with cloud information for the high level.
JJA	June, July, August.
Lat	Latitude (-90 to 90 degrees North).
Lon	Longitude (0 to 360 degrees East).
light obs	Obs that satisfy the illuminance criterion of Hahn et al.(1995).
LOBS	Number of obs with cloud information for low level.
LoL	Sum of all clouds in the low level.
Low	Low level cloud types (Fo, St, Sc, Cu, Cb).
LT	Local time; determined from Lon in File Cat. 1.

cont.

TABLE 7 *cont.* GLOSSARY OF TERMS AND ABBREVIATIONS USED

Term	Meaning and description
MAM	March, April, May.
Mcode	Missing-value code (q.v.).
mean seasonal	Average over several years for a season.
Mid	Middle level cloud types (Ns, As, Ac).
MiL	Sum of all clouds in the middle level (if none missing).
min	Minimum number of obs used for averaging or reporting.
mina	= minimum NC required for computing amts for Hi or Mid clouds. = min * Fq * 0.6.
missing-value code	The integer -90000 (-900 for hgt and harmonic parameters); put in data record where no legitimate value is computed.
mns	Months. (Jan,Feb,Mar,Apr,May,Jun,Jul,Aug,Sep,Oct,Nov,Dec)
MOBS	Number of obs with cloud information for middle level.
N	1) Number (of obs, etc.); used with other abbreviations. 2) Used as suffix for "night" (as in "NobN"). 3) Symbol for total cloud cover in Synoptic Code.)
NC	Number of obs with cloud type present and amount computable.
night(time)	Local time 18-06. Abbreviations used are Nt and N.
Nobs	Number of observations; generic for LOBS,MOBS,HOBS, NTy, NC.
NOL	Non-overlapped amount; the amount of a middle or high cloud visible from below.
NSN	Number of seasons contributing to the annual average.
NSTA	Number of land stations for which data are given (5388).
Nt	Abbreviation or suffix for "nighttime" (distinct from NT).
NT	Number of HRs used (4 or 8) for diurnal harmonic analysis or number of months used (12) for annual harmonic analysis.
NTy	Number of times a cloud type was reported present.
Num	Number.
obs	Cloud reports or observations.
PC	Pcode (q.v.).
Pcode	Parameter code: 0=AFW, 1=Amt, 2=Fq, 3=AWP, 4=NOL, 5=Hgt.
PHASE	Phase of first harmonic (time of maximum). Diurnal: 0-24 hours mean solar time of station longitude; when indeterminate (AMP=0), value was set to "-899". Annual: month (0.5 to 12.4 [1.0 = middle of January, etc.]; 0 if AMP=0).
SCDG	Station Cloud Data Group number. Aid in identifying data.
SDC	Station data code. See text for File Cat. 1 (Section 4.1) and Appendix A4.
seasonal mean	Average for an individual year for a particular season.
SN	Season or month indicator in header record or file names.
SON	September, October, November.
StaID	Station identification number (5 digits) assigned by WMO.
upper cloud	Clouds in middle or high levels.
VAF	Percent variance accounted for by the first harmonic.
WMO	World Meteorological Organization.
YEAR, YR	Year(s) that apply to data group. Coded as 19yr or as yfyl for multi-year averages where yf=yr of the first year and yl=yr of the last year of the period analyzed. (For example, "7196" means 1971 through 1996.)

TABLE 8. EXAMPLES OF CONTENTS OF DATA FILES

```
Example             Header* and sample Data^ Records                   Comments
   File_name        *SCDG NSta sz lo Ty PC YR SN FMT
_________________   _________________________________________________  _________

a) 01_STID           1001 5388  0 1 -9-9 7196 -9 111
                    01001  7093 35133    9 26 71 96 26 71 96  2   46   first
                    62700  1670  3343  360  3 80 82  2 81 91  0  629   Africa
                    98851   612 12518   15 21 71 96 21 71 96  2  792   last

b) 02_MACA.tc        2001 5388  0 1  1 1 7196 00 121
                    21749      3  7472      3  7727      3  7599 2     ann

c) 03_MSCA.41.tc     3001 5388  0 1  1 1 7196 41 121
                    21749     18  6667      2  4375     20  6437 1     djf

d) 03_MSCA.42.tc     3013 5388  0 1  1 1 7196 42 121
                    21749    475  7326    497  7669    972  7497 2     mam

e) 03_MSCA.43.tc     3025 5388  0 1  1 1 7196 43 121
                    21749   2446  7693   2525  7852   4971  7772 2     jja

f) 03_MSCA.44.tc     3037 5388  0 1  1 1 7196 44 121
                    21749   2357  7396    911  7661   3268  7528 2     son

g) 03_MSCA.41.low    3003 5388  0 1 12 1 7196 41 121
                    15235   6676   257   1941    84   8617   170 2     amt_St

h) 04_MSCF.41.low    4003 5388  0 1 12 2 7196 41 121
                    15235   6676   304   1941    93   8617   198 2     fq_St

i) 05_MSAW.41.low    5001 5388  0 1 12 3 7196 41 121
                    15235    203  8454     18  9028    221  8588 3     awp_St

j) 04_MSCF.43.mh     4027 5388  0 1 21 2 7196 43 121                   fq_Ns
                    30692   8428   247   4832   321  13260   284 2
                     4028 5388  0 1 22 2 7196 43 121                   fq_As
                    30692   6787   417   3948   436  10735   426 2
                     4029 5388  0 1 23 2 7196 43 121                   fq_Ac
                    30692   6787  2929   3948  3873  10735  3401 2
                     4030 5388  0 1 30 2 7196 43 121                   fq_Hi
                    30692   5903  6353   3351  6121   9254  6237 2

k) 03_MSCA.41.lol    3012 5388  0 1 10 1 7196 41 121                   sum_low
                    21749     18  2777      2     0     20  2499 1
                    62840   1545   176    168   104   1713   140 2
                    89065    644  4274    585  3784   1229  4029 2

l) 05_MSAW.41.mh     5008 5388  0 1 30 3 7196 41 121
                    97760    976  4600     83  4600   1059  4600 3     bogus_awp
                    97900   1132  4122    311  3969   1443  4052 2     *App.B

m) 06_MSUU.42        6005 5388  0 1 21 4 7196 42 121                   nol_Ns
                    46734   7852    24   2706    22  10558    23 2
                    89544    367   722      3  2917    370   740 3
                     6006 5388  0 1 22 4 7196 42 121                   nol_As
                    46734   7852   107   2706   104  10558   105 2
                    89544    367  1454      3  2917    370  1466 3
                     6007 5388  0 1 23 4 7196 42 121                   nol_Ac
                    46734   7852   647   2706   590  10558   619 2
                    89544    367  1206      3     0    370  1196 3
                     6008 5388  0 1 30 4 7196 42 121                   nol_Hi
                    46734   7845   212   2702   121  10547   167 2
                    89544    366  1492      3  1250    369  1490 3

n) 07_MSLH.43        7009 5388  0 1 12 5 7196 43 122                   hgt_St
                    21749    583   299    606   321   1189   310 2
                    98851     35   533     17   472     52   513 3
                     7010 5388  0 1 13 5 7196 43 122                   hgt_Sc
                    21749    795   501    656   510   1451   505 2
                    98851    137   652     54   583    191   632 2
                     7011 5388  0 1 14 5 7196 43 122                   hgt_Cu
                    21749    127   750     35   976    162   798 3
                    98851   3811   523   1520   500   5331   516 2
                     7012 5388  0 1 15 5 7196 43 122                   hgt_Cb
                    21749    112   410     97   466    209   436 2
                    98851   1259   534    265   475   1524   524 2
-----------------------------------------------------------------------------
```

cont.

Table 8 *cont*. Examples of Contents of Data Files

```
Example             Header* and sample Data^ Records                       Comments
   File_name        *SCDG NSta sz lo Ty PC YR SN FMT

o) 11_MSFT.44.cr    11031 5388  0 1  2 2 7196 44 138
                    72469  0  2097   544                                     4 hrs
                    72469  3     7     0
                    72469  6   643  2784
                    72469  9    15  1333
                    72469 12   815  2589
                    72469 15    35  1429
                    72469 18  2050   854
                    72469 21    25   800
                    84782  0   498  3233                                     8 hrs
                    84782  3   497  1529
                    84782  6   528  1402
                    84782  9   364   934
                    84782 12  2018   971
                    84782 15  1799  4380
                    84782 18  2040  7059
                    84782 21  1706  6419

p) 14_HARM.aa.tc    14001 5388  0 1  1 1 7196  0 140                       annual cycle
                    72274 1186  139  12 12 386                               Tucson
                    72469  330  644 696 12 526                               Denver
                    72793  155 1235 691 12 693                               Seattle
                    89544 -900 -900-900  0-900                               Mcode

q) 14_HARM.df.44.cr 14091 5388  0 1  2 2 7196 44 148                       diurnal cycle
                    72469  212 1406 738  4 169                               4 hrs
                    84782 1462 3066 770  8 324                               8 hrs

r) 16_SMCA.42.cu    16005 5388  0 1 14 1 7196 42 126
                    94248     64   742      0-90000     64   742 3           1971
                    94248      2     0      1     0      3     0 1
                    94248      0-90000      0-90000      0-90000 0
                    94248      0-90000      0-90000      0-90000 0
                    94248      0-90000      0-90000      0-90000 0           1975
                    94248    109  1330     22   511    131  1193 3
                    94248    145  1241     29   690    174  1149 3
                    94248    163  1097     42    30    205   563 2
                    94248    160  1305     47   346    207   825 2
                    94248    169   976     52   312    221   644 2           1980
                    94248    159  1164     45   278    204   721 2
                    94248    161   683     36   312    197   498 2
                    94248    158   578     52    96    210   337 2
                    94248    151   745     41   183    192   464 2
                    94248    137   940     30     0    167   771 3           1985
                    94248    170   618     35    36    205   327 2
                    94248    169   703     45   139    214   421 2
                    94248    150   767     43   291    193   529 2
                    94248    350  1450    133   893    483  1171 2
                    94248    286  1010    107   432    393   721 2           1990
                    94248    357   886    140   286    497   586 2
                    94248    351  1068    139   279    490   674 2
                    94248    359   912    141   204    500   558 2
                    94248    359   609    131   153    490   381 2
                    94248    338   758    138   344    476   551 2           1995
                    94248    361   436    181   221    542   329 2

s) 31_MNYD.01.ac    31010 5388  0 1 23 0 7196  1 162
                          |
                    01035 77   2     0     0-90000   0                       fq=0
                    01035 78  19-90000  1579-90000   0                       NTy=3,NC=0
                    01035 79  29   453  1034  4375   2
                          |
                    54511 78 121   592  1983  2983  -2                       China_70s
                    54511 79 116   334  1121  2983  -2
                    54511 80 118   487  1780  2738  21                       China_80s
                    54511 81 117   687  2393  2870  27
                          |
                    97900 79 103  2377  4660  5100  -1                       bogus_awp
                    97900 80 104  3237  6346  5100  -1

t) 42_MNYD.12.hi    42011 5388  0 1 30 0 7196 12 162
                    72290 71  49  2022  4490  4504  18
                          |
                    72290 92  52  1949  5385  3620  22
                    72290 93  57  2611  6140  4252  33
                    72290 94  49  1738  3878  4482  17
                    72290 95  96  2231  4583  4867  43
                    72290 96   0-90000-90000-90000   0                       USA_1996
```

^ Only 1 to 3 station data records are shown in any sample data group.

APPENDIX A. NUMBERS OF STATIONS AND OBSERVATIONS USED

Appendix A1. Number of Stations from EECRA with 20 or More Reports Containing Cloud Type Data for Specified Number of Years for January or July 1971–1996

Num Yrs:	0	1-2	3-5	6-10	11-15	16-20	21-25	26	Total
Num Sta:	1680	1220	930	1235	849	1127	1906	2639	11,586

Appendix A2. REGIONAL DISTRIBUTION OF CONTRIBUTING STATIONS

Station ID Number Range*	Region	Number of Stations
0nnnn and 1nnnn	Europe#	1190
2nnnn and 3nnnn	Soviet Union (former)	1558
4nnnn	Asia##	507
5nnnn	China	586
6nnnn	Africa	452
7nnnn	North & Central America	498
80000 to 88962	South America	268
88963 to 89999	Antarctica	29
94100 to 94999	Australia	74
91000 to 98999**	SW Pacific Islands	226
01001 to 98851	TOTAL	5388

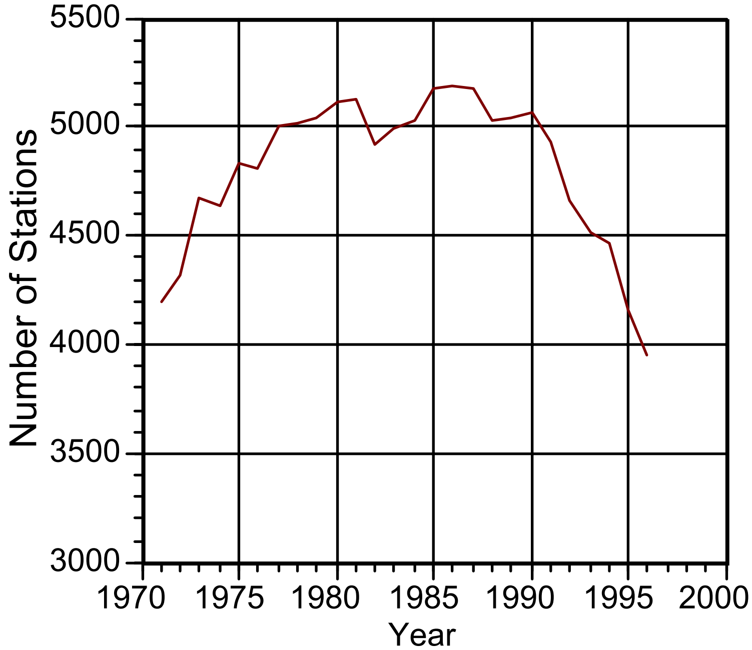
* Synoptic weather stations are assigned (by WMO) 5-digit identification numbers ranging from 01001 to 98999. Each country is assigned a specific range of numbers.

\# Excluding former Soviet Union.

\## Excluding former Soviet Union and China.

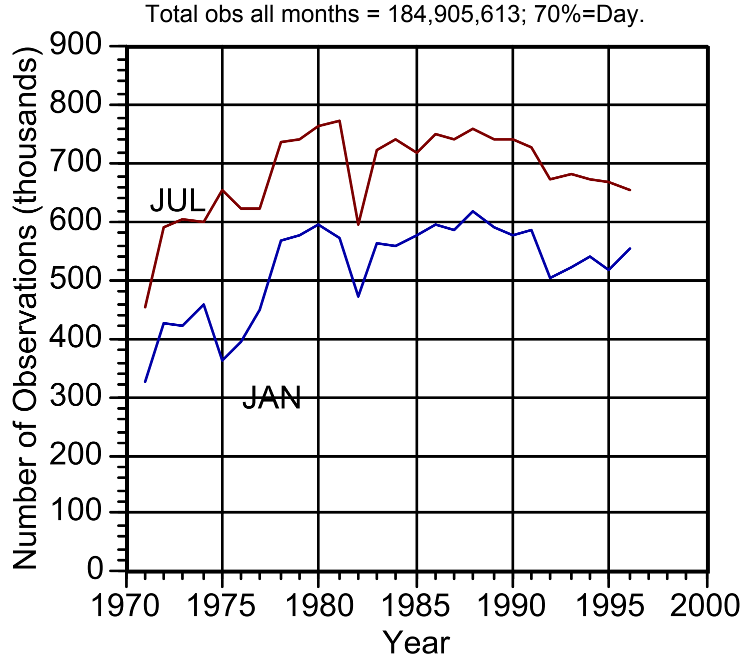
** Excluding Australia.

Appendix A3a. Number of Stations with
20 or More Observations per Month for Julys



Appendix A3b. Number of Observations per Month
Obtained from 5388 Stations for Januarys and for Julys

Total obs all months = 184,905,613; 70%=Day.



Appendix A4. NUMBER OF STATIONS WITH SPECIFIED STATION DATA CODE (SDC)

SDC*	-2	-1	0	1	2
Numumber of Stations**	102	14	114	105	5053

```
* SDC meaning:
   2  both   Jan and Jul have "Y" and R < 6,
   1  either Jan or  Jul has  "Y" and R < 6,
   0 neither Jan nor Jul has  "Y", R unspecified,
  -1  either Jan or  Jul has  "Y" and R > 6,
  -2  both   Jan and Jul have "Y" and R > 6,
  where "Y" means: at least 15 yrs with at least 20 obs,
  and  R  means: NobDy/NobNt.
** All stations with SDC < 1 are located south of 30 deg N.
```

APPENDIX B

155 STATIONS# FOR WHICH BOGUS^ AMOUNT-WHEN-PRESENT WAS USED FOR MIDDLE AND HIGH CLOUDS

48077	48096	48108	48110	48112	48300	48303	48325	48327	48328
48330	48331	48351	48352	48353	48354	48356	48357	48375	48376
48377	48378	48379	48381	48383	48400	48403	48405	48407	48425
48426	48430	48431	48432	48450	48455	48456	48459	48460	48462
48475	48477	48480	48500	48501	48517	48532	48550	48551	48552
48564	48565	48567	48568	48569	48580	48583	48601	48615	48620
48647	48657	48665	48698	48917	59995	81200	81202	81225	81250
81251	81253	91203	91212	91217	91317	91324	91334	91348	91353
91356	91366	91367	91371	91376	91408	91413	91425	91434	94044
94085	96001	96009	96011	96015	96035	96073	96075	96091	96109
96145	96147	96163	96171	96179	96221	96237	96249	96253	96295*
96413	96421	96441	96449	96471	96491	96581	96633	96685	96743*
96747*	96797*	96805*	96839	96925	96933	97008	97016	97048	97072
97086	97096	97146	97180	97230	97260	97300	97340	97388*	97390*
97395*	97406	97430	97502	97530	97560	97630	97690	97698	97724
97748	97760	97900*	97980*	98618					

The stations affected lie in an irregular region between latitudes 10N and 10S and between longitudes 95E and 175E (includes Indonesia and other islands) and in a much smaller region of South America from 0 to 10N and 55 to 60W.

^ The values used for AWP are 98% for Ns, 80% for As, 51% for Ac, and 46% for Hi.

* Added to a preliminary list of 145 stations after completion of Files 2-14.

APPENDIX C. LAND-STATION CLOUD ARCHIVE FILE NAMES, NDP-026D

862 SCDGs in 433 files in 42 File Categories

SCDGs	bytes	File_Name
	48164	README
01001	264045	01_STID
02001	253269	02_MACA.tc
02002	253269	02_MACA.cr
02003-07	1266345	02_MACA.low
02008-11	1013076	02_MACA.mh
02012	253269	02_MACA.mil
02013	253269	02_MACA.lol
03001	253269	03_MSCA.41.tc
03002-06	1266345	03_MSCA.41.low
03007-10	1013076	03_MSCA.41.mh
03011	253269	03_MSCA.41.mil
03012	253269	03_MSCA.41.lol
03013	253269	03_MSCA.42.tc
03014-18	1266345	03_MSCA.42.low
03019-22	1013076	03_MSCA.42.mh
03023	253269	03_MSCA.42.mil
03024	253269	03_MSCA.42.lol
03025	253269	03_MSCA.43.tc
03026-30	1266345	03_MSCA.43.low
03031-34	1013076	03_MSCA.43.mh
03035	253269	03_MSCA.43.mil
03035	253269	03_MSCA.43.lol
03037	253269	03_MSCA.44.tc
03038-42	1266345	03_MSCA.44.low
03043-46	1013076	03_MSCA.44.mh
03047	253269	03_MSCA.44.mil
03048	253269	03_MSCA.44.lol
04001	253269	04_MSCF.41.cr
04002-06	1266345	04_MSCF.41.low
04007-10	1013076	04_MSCF.41.mh
04011	253269	04_MSCF.42.cr
04012-16	1266345	04_MSCF.42.low
04017-20	1013076	04_MSCF.42.mh
04021	253269	04_MSCF.43.cr
04022-26	1266345	04_MSCF.43.low
04027-30	1013076	04_MSCF.43.mh
04031	253269	04_MSCF.44.cr
04032-36	1266345	04_MSCF.44.low
04037-40	1013076	04_MSCF.44.mh
05001-04	1013076	05_MSAW.41.low
05005-08	1013076	05_MSAW.41.mh
05009-12	1013076	05_MSAW.42.low
05013-16	1013076	05_MSAW.42.mh
05017-20	1013076	05_MSAW.43.low
05021-24	1013076	05_MSAW.43.mh
05025-28	1013076	05_MSAW.44.low
05029-32	1013076	05_MSAW.44.mh
06001-04	1013076	06_MSUU.41
06005-08	1013076	06_MSUU.42
06009-12	1013076	06_MSUU.43
06013-16	1013076	06_MSUU.44
07001-04	1013076	07_MSLH.41
07005-08	1013076	07_MSLH.42
07009-12	1013076	07_MSLH.43
07013-16	1013076	07_MSLH.44
08001	253269	08_MMCA.01.tc
08002-06	1266345	08_MMCA.01.low
08007-10	1013076	08_MMCA.01.mh
08011	253269	08_MMCA.02.tc
08012-16	1266345	08_MMCA.02.low
08017-20	1013076	08_MMCA.02.mh
08021	253269	08_MMCA.03.tc
08022-26	1266345	08_MMCA.03.low
08027-30	1013076	08_MMCA.03.mh
08031	253269	08_MMCA.04.tc
08032-36	1266345	08_MMCA.04.low
08037-40	1013076	08_MMCA.04.mh
08041	253269	08_MMCA.05.tc
08042-46	1266345	08_MMCA.05.low
08047-50	1013076	08_MMCA.05.mh
08051	253269	08_MMCA.06.tc
08052-56	1266345	08_MMCA.06.low
08057-60	1013076	08_MMCA.06.mh
08061	253269	08_MMCA.07.tc
08062-66	1266345	08_MMCA.07.low
08067-70	1013076	08_MMCA.07.mh
08071	253269	08_MMCA.08.tc
08072-76	1266345	08_MMCA.08.low
08077-80	1013076	08_MMCA.08.mh
08081	253269	08_MMCA.09.tc
08082-86	1266345	08_MMCA.09.low
08087-90	1013076	08_MMCA.09.mh
08091	253269	08_MMCA.10.tc
08092-96	1266345	08_MMCA.10.low
08097-100	1013076	08_MMCA.10.mh
08101	253269	08_MMCA.11.tc
08102-106	1266345	08_MMCA.11.low
08107-110	1013076	08_MMCA.11.mh
08111	253269	08_MMCA.12.tc
08112-116	1266345	08_MMCA.12.low
08117-120	1013076	08_MMCA.12.mh
09001	253269	09_MMCF.01.cr
09002-06	1266345	09_MMCF.01.low
09007-10	1013076	09_MMCF.01.mh
09011	253269	09_MMCF.02.cr
09012-16	1266345	09_MMCF.02.low
09017-20	1013076	09_MMCF.02.mh
09021	253269	09_MMCF.03.cr
09022-26	1266345	09_MMCF.03.low
09027-30	1013076	09_MMCF.03.mh
09031	253269	09_MMCF.04.cr
09032-36	1266345	09_MMCF.04.low
09037-40	1013076	09_MMCF.04.mh
09041	253269	09_MMCF.05.cr
09042-46	1266345	09_MMCF.05.low
09047-50	1013076	09_MMCF.05.mh
09051	253269	09_MMCF.06.cr
09052-56	1266345	09_MMCF.06.low
09057-60	1013076	09_MMCF.06.mh
09061	253269	09_MMCF.07.cr
09062-66	1266345	09_MMCF.07.low
09067-70	1013076	09_MMCF.07.mh
09071	253269	09_MMCF.08.cr
09072-76	1266345	09_MMCF.08.low
09077-80	1013076	09_MMCF.08.mh
09081	253269	09_MMCF.09.cr
09082-86	1266345	09_MMCF.09.low
09087-90	1013076	09_MMCF.09.mh
09091	253269	09_MMCF.10.cr
09092-96	1266345	09_MMCF.10.low
09097-100	1013076	09_MMCF.10.mh
09101	253269	09_MMCF.11.cr
09102-106	1266345	09_MMCF.11.low
09107-110	1013076	09_MMCF.11.mh
09111	253269	09_MMCF.12.cr
09112-116	1266345	09_MMCF.12.low
09117-120	1013076	09_MMCF.12.mh
10001	905217	10_MSAT.41.tc
10002-06	4526085	10_MSAT.41.low
10007-10	3620868	10_MSAT.41.mh
10011	905217	10_MSAT.42.tc
10012-16	4526085	10_MSAT.42.low
10017-20	3620868	10_MSAT.42.mh
10021	905217	10_MSAT.43.tc
10022-26	4526085	10_MSAT.43.low
10027-30	3620868	10_MSAT.43.mh
10031	905217	10_MSAT.44.tc
10032-36	4526085	10_MSAT.44.low
10037-40	3620868	10_MSAT.44.mh
11001	905217	11_MSFT.41.cr
11002-06	4526085	11_MSFT.41.low
11007-10	3620868	11_MSFT.41.mh
11011	905217	11_MSFT.42.cr
11012-16	4526085	11_MSFT.42.low
11017-20	3620868	11_MSFT.42.mh
11021	905217	11_MSFT.43.cr
11022-26	4526085	11_MSFT.43.low
11027-30	3620868	11_MSFT.43.mh
11031	905217	11_MSFT.44.cr
11032-36	4526085	11_MSFT.44.low
11037-40	3620868	11_MSFT.44.mh
12001-04	3620868	12_MSUT.41
12005-08	3620868	12_MSUT.42
12009-12	3620868	12_MSUT.43
12013-16	3620868	12_MSUT.44
13001-04	3620868	13_MSHT.41
13005-08	3620868	13_MSHT.42
13009-12	3620868	13_MSHT.43

13013-16	3620868	13_MSHT.44
14001	145509	14_HARM.aa.tc
14002-06	727545	14_HARM.aa.low
14007-10	582036	14_HARM.aa.mh
14011	145509	14_HARM.af.cr
14012-16	727545	14_HARM.af.low
14017-20	582036	14_HARM.af.mh
14021	145509	14_HARM.da.41.tc
14022-26	727545	14_HARM.da.41.low
14027-30	582036	14_HARM.da.41.mh
14031	145509	14_HARM.da.42.tc
14032-36	727545	14_HARM.da.42.low
14037-40	582036	14_HARM.da.42.mh
14041	145509	14_HARM.da.43.tc
14042-46	727545	14_HARM.da.43.low
14047-50	582036	14_HARM.da.43.mh
14051	145509	14_HARM.da.44.tc
14052-56	727545	14_HARM.da.44.low
14057-60	582036	14_HARM.da.44.mh
14061	145509	14_HARM.df.41.cr
14062-66	727545	14_HARM.df.41.low
14067-70	582036	14_HARM.df.41.mh
14071	145509	14_HARM.df.42.cr
14072-76	727545	14_HARM.df.42.low
14077-80	582036	14_HARM.df.42.mh
14081	145509	14_HARM.df.43.cr
14082-86	727545	14_HARM.df.43.low
14087-90	582036	14_HARM.df.43.mh
14091	145509	14_HARM.df.44.cr
14092-96	727545	14_HARM.df.44.low
14097-100	582036	14_HARM.df.44.mh
15001	6584169	15_SMCA.41.tc
15002	6584169	15_SMCA.41.fo
15003	6584169	15_SMCA.41.st
15004	6584169	15_SMCA.41.sc
15005	6584169	15_SMCA.41.cu
15006	6584169	15_SMCA.41.cb
15007	6584169	15_SMCA.41.ns
15008	6584169	15_SMCA.41.as
15009	6584169	15_SMCA.41.ac
15010	6584169	15_SMCA.41.hi
16001	6584169	16_SMCA.42.tc
16002	6584169	16_SMCA.42.fo
16003	6584169	16_SMCA.42.st
16004	6584169	16_SMCA.42.sc
16005	6584169	16_SMCA.42.cu
16006	6584169	16_SMCA.42.cb
16007	6584169	16_SMCA.42.ns
16008	6584169	16_SMCA.42.as
16009	6584169	16_SMCA.42.ac
16010	6584169	16_SMCA.42.hi
17001	6584169	17_SMCA.43.tc
17002	6584169	17_SMCA.43.fo
17003	6584169	17_SMCA.43.st
17004	6584169	17_SMCA.43.sc
17005	6584169	17_SMCA.43.cu
17006	6584169	17_SMCA.43.cb
17007	6584169	17_SMCA.43.ns
17008	6584169	17_SMCA.43.as
17009	6584169	17_SMCA.43.ac
17010	6584169	17_SMCA.43.hi
18001	6584169	18_SMCA.44.tc
18002	6584169	18_SMCA.44.fo
18003	6584169	18_SMCA.44.st
18004	6584169	18_SMCA.44.sc
18005	6584169	18_SMCA.44.cu
18006	6584169	18_SMCA.44.cb
18007	6584169	18_SMCA.44.ns
18008	6584169	18_SMCA.44.as
18009	6584169	18_SMCA.44.ac
18010	6584169	18_SMCA.44.hi
19001	6584169	19_SMCF.41.cr
19002	6584169	19_SMCF.41.fo
19003	6584169	19_SMCF.41.st
19004	6584169	19_SMCF.41.sc
19005	6584169	19_SMCF.41.cu
19006	6584169	19_SMCF.41.cb
19007	6584169	19_SMCF.41.ns
19008	6584169	19_SMCF.41.as
19009	6584169	19_SMCF.41.ac
19010	6584169	19_SMCF.41.hi
20001	6584169	20_SMCF.42.cr
20002	6584169	20_SMCF.42.fo
20003	6584169	20_SMCF.42.st
20004	6584169	20_SMCF.42.sc
20005	6584169	20_SMCF.42.cu
20006	6584169	20_SMCF.42.cb
20007	6584169	20_SMCF.42.ns
20008	6584169	20_SMCF.42.as
20009	6584169	20_SMCF.42.ac
20010	6584169	20_SMCF.42.hi
21001	6584169	21_SMCF.43.cr
21002	6584169	21_SMCF.43.fo
21003	6584169	21_SMCF.43.st
21004	6584169	21_SMCF.43.sc
21005	6584169	21_SMCF.43.cu
21006	6584169	21_SMCF.43.cb
21007	6584169	21_SMCF.43.ns
21008	6584169	21_SMCF.43.as
21009	6584169	21_SMCF.43.ac
21010	6584169	21_SMCF.43.hi
22001	6584169	22_SMCF.44.cr
22002	6584169	22_SMCF.44.fo
22003	6584169	22_SMCF.44.st
22004	6584169	22_SMCF.44.sc
22005	6584169	22_SMCF.44.cu
22006	6584169	22_SMCF.44.cb
22007	6584169	22_SMCF.44.ns
22008	6584169	22_SMCF.44.as
22009	6584169	22_SMCF.44.ac
22010	6584169	22_SMCF.44.hi
23001	6584169	23_SMUU.41.ns
23002	6584169	23_SMUU.41.as
23003	6584169	23_SMUU.41.ac
23004	6584169	23_SMUU.41.hi
24001	6584169	24_SMUU.42.ns
24002	6584169	24_SMUU.42.as
24003	6584169	24_SMUU.42.ac
24004	6584169	24_SMUU.42.hi
25001	6584169	25_SMUU.43.ns
25002	6584169	25_SMUU.43.as
25003	6584169	25_SMUU.43.ac
25004	6584169	25_SMUU.43.hi
26001	6584169	26_SMUU.44.ns
26002	6584169	26_SMUU.44.as
26003	6584169	26_SMUU.44.ac
26004	6584169	26_SMUU.44.hi
27001	6584169	27_SMHL.41.st
27002	6584169	27_SMHL.41.sc
27003	6584169	27_SMHL.41.cu
27004	6584169	27_SMHL.41.cb
28001	6584169	28_SMHL.42.st
28002	6584169	28_SMHL.42.sc
28003	6584169	28_SMHL.42.cu
28004	6584169	28_SMHL.42.cb
29001	6584169	29_SMHL.43.st
29002	6584169	29_SMHL.43.sc
29003	6584169	29_SMHL.43.cu
29004	6584169	29_SMHL.43.cb
30001	6584169	30_SMHL.44.st
30002	6584169	30_SMHL.44.sc
30003	6584169	30_SMHL.44.cu
30004	6584169	30_SMHL.44.cb
31001	4903113	31_MNYD.01.tc
31002	4903113	31_MNYD.01.cr
31003	4903113	31_MNYD.01.fo
31004	4903113	31_MNYD.01.st
31005	4903113	31_MNYD.01.sc
31006	4903113	31_MNYD.01.cu
31007	4903113	31_MNYD.01.cb
31008	4903113	31_MNYD.01.ns
31009	4903113	31_MNYD.01.as
31010	4903113	31_MNYD.01.ac
31011	4903113	31_MNYD.01.hi
32001	4903113	32_MNYD.02.tc
32002	4903113	32_MNYD.02.cr
32003	4903113	32_MNYD.02.fo
32004	4903113	32_MNYD.02.st
32005	4903113	32_MNYD.02.sc
32006	4903113	32_MNYD.02.cu
32007	4903113	32_MNYD.02.cb
32008	4903113	32_MNYD.02.ns

SCDG	bytes	File_Name
32009	4903113	32_MNYD.02.as
32010	4903113	32_MNYD.02.ac
32011	4903113	32_MNYD.02.hi
33001	4903113	33_MNYD.03.tc
33002	4903113	33_MNYD.03.cr
33003	4903113	33_MNYD.03.fo
33004	4903113	33_MNYD.03.st
33005	4903113	33_MNYD.03.sc
33006	4903113	33_MNYD.03.cu
33007	4903113	33_MNYD.03.cb
33008	4903113	33_MNYD.03.ns
33009	4903113	33_MNYD.03.as
33010	4903113	33_MNYD.03.ac
33011	4903113	33_MNYD.03.hi
34001	4903113	34_MNYD.04.tc
34002	4903113	34_MNYD.04.cr
34003	4903113	34_MNYD.04.fo
34004	4903113	34_MNYD.04.st
34005	4903113	34_MNYD.04.sc
34006	4903113	34_MNYD.04.cu
34007	4903113	34_MNYD.04.cb
34008	4903113	34_MNYD.04.ns
34009	4903113	34_MNYD.04.as
34010	4903113	34_MNYD.04.ac
34011	4903113	34_MNYD.04.hi
35001	4903113	35_MNYD.05.tc
35002	4903113	35_MNYD.05.cr
35003	4903113	35_MNYD.05.fo
35004	4903113	35_MNYD.05.st
35005	4903113	35_MNYD.05.sc
35006	4903113	35_MNYD.05.cu
35007	4903113	35_MNYD.05.cb
35008	4903113	35_MNYD.05.ns
35009	4903113	35_MNYD.05.as
35010	4903113	35_MNYD.05.ac
35011	4903113	35_MNYD.05.hi
36001	4903113	36_MNYD.06.tc
36002	4903113	36_MNYD.06.cr
36003	4903113	36_MNYD.06.fo
36004	4903113	36_MNYD.06.st
36005	4903113	36_MNYD.06.sc
36006	4903113	36_MNYD.06.cu
36007	4903113	36_MNYD.06.cb
36008	4903113	36_MNYD.06.ns
36009	4903113	36_MNYD.06.as
36010	4903113	36_MNYD.06.ac
36011	4903113	36_MNYD.06.hi
37001	4903113	37_MNYD.07.tc
37002	4903113	37_MNYD.07.cr
37003	4903113	37_MNYD.07.fo
37004	4903113	37_MNYD.07.st
37005	4903113	37_MNYD.07.sc
37006	4903113	37_MNYD.07.cu
37007	4903113	37_MNYD.07.cb
37008	4903113	37_MNYD.07.ns
37009	4903113	37_MNYD.07.as
37010	4903113	37_MNYD.07.ac
37011	4903113	37_MNYD.07.hi
38001	4903113	38_MNYD.08.tc
38002	4903113	38_MNYD.08.cr
38003	4903113	38_MNYD.08.fo
38004	4903113	38_MNYD.08.st
38005	4903113	38_MNYD.08.sc
38006	4903113	38_MNYD.08.cu
38007	4903113	38_MNYD.08.cb
38008	4903113	38_MNYD.08.ns
38009	4903113	38_MNYD.08.as
38010	4903113	38_MNYD.08.ac
38011	4903113	38_MNYD.08.hi
39001	4903113	39_MNYD.09.tc
39002	4903113	39_MNYD.09.cr
39003	4903113	39_MNYD.09.fo
39004	4903113	39_MNYD.09.st
39005	4903113	39_MNYD.09.sc
39006	4903113	39_MNYD.09.cu
39007	4903113	39_MNYD.09.cb
39008	4903113	39_MNYD.09.ns
39009	4903113	39_MNYD.09.as
39010	4903113	39_MNYD.09.ac
39011	4903113	39_MNYD.09.hi
40001	4903113	40_MNYD.10.tc
40002	4903113	40_MNYD.10.cr
40003	4903113	40_MNYD.10.fo
40004	4903113	40_MNYD.10.st
40005	4903113	40_MNYD.10.sc
40006	4903113	40_MNYD.10.cu
40007	4903113	40_MNYD.10.cb
40008	4903113	40_MNYD.10.ns
40009	4903113	40_MNYD.10.as
40010	4903113	40_MNYD.10.ac
40011	4903113	40_MNYD.10.hi
41001	4903113	41_MNYD.11.tc
41002	4903113	41_MNYD.11.cr
41003	4903113	41_MNYD.11.fo
41004	4903113	41_MNYD.11.st
41005	4903113	41_MNYD.11.sc
41006	4903113	41_MNYD.11.cu
41007	4903113	41_MNYD.11.cb
41008	4903113	41_MNYD.11.ns
41009	4903113	41_MNYD.11.as
41010	4903113	41_MNYD.11.ac
41011	4903113	41_MNYD.11.hi
42001	4903113	42_MNYD.12.tc
42002	4903113	42_MNYD.12.cr
42003	4903113	42_MNYD.12.fo
42004	4903113	42_MNYD.12.st
42005	4903113	42_MNYD.12.sc
42006	4903113	42_MNYD.12.cu
42007	4903113	42_MNYD.12.cb
42008	4903113	42_MNYD.12.ns
42009	4903113	42_MNYD.12.as
42010	4903113	42_MNYD.12.ac
42011	4903113	42_MNYD.12.hi

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