ADDENDUM

USER'S GUIDE FOR THE AERMOD METEOROLOGICAL PREPROCESSOR (AERMET)

(EPA-454/B-03-002, November 2004)

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air Quality Planning and Standards
Air Quality Assessment Division
Research Triangle Park, North Carolina 27711

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PREFACE

This document provides updated user instructions for the AERMOD meteorological preprocessor program, AERMET, including modifications introduced with version 06341 and later. This addendum supplements and updates the information contained in the current AERMET User's Guide (EPA, 2004).

ACKNOWLEDGEMENTS

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1.0 INTRODUCTION

This document provides user instructions for revisions to the AERMOD meteorological preprocessor program, AERMET. The discussion provided here supplements and updates the information contained in the current AERMET User's Guide (EPA, 2004), and it is assumed that the reader is already familiar with the contents of that document. Note that portions of the current AERMET User's Guide are no longer valid or applicable. This Addendum includes a complete updated reference of AERMET keywords and parameters in Appendix A.

1.1 OVERVIEW OF AERMET REVISIONS

Two sets of AERMET revisions are included in this Addendum:

1. The first set of revisions, introduced with version 06341 of AERMET, includes modifications to address several problems associated with extraction and processing of National Weather Service (NWS), Federal Aviation Administration (FAA), or other airport data in the Integrated Surface Hourly Data (a.k.a., ISHD, ISH, ISD, TD-3505) format; inclusion of an optional station elevation parameter on the LOCATION keyword for the UPPERAIR, SURFACE, ONSITE, and METPREP pathways; and modifications to use a single executable file, AERMET.EXE, to perform all three stages of processing, replacing the STAGE1N2.EXE and STAGE3.EXE files (additional information is provided in Model Change Bulletin (MCB) #1 provided on the SCRAM AERMET webpage); and
2. The second set of revisions, introduced with version 11059 of AERMET, includes:
    a. further enhancements to the use of user-specified station elevations for surface stations to substitute for missing station pressure;
    b. enhancements to increase the maximum record length for the runstream input file from 80 to 132 characters, increase the maximum field length for filenames from 48 to 96, and allow use of double quotes (") as field delimiters for filenames to support filenames with embedded spaces;
    c. enhancements to the selection of upper air sounding to support applications of AERMOD beyond the U.S., and including an option to select the most appropriate sounding based on local sunrise;
    d. enhancement to allow the use of hourly averaged winds derived from 1-minute ASOS wind data (TD-6405);

e. adjustment of ASOS-based wind speeds (including winds derived from 1-minute ASOS data) to account for reported ASOS wind speeds being truncated (rather than rounded) to whole knots;

f. enhancements to the error handling and reporting related to processing ONSITE data, including an option to use 'FREE' format to read the data and the option to specify missing data codes and upper/lower bounds for ONSITE data as REAL variables;

g. an option/requirement to specify a secondary set of surface characteristics for use when NWS winds are substituted for missing on-site winds: and

h. enhancements to utilize on-site precipitation and relative humidity data, if available.

Additional information on changes introduced with version 11059 is provided in MCB #2 available on the SCRAM AERMET webpage.

AERMET is designed to be run as a three-stage process (see Figure 1-1 of the AERMET User's Guide) and to operate on three basic types of data – NWS, FAA or other hourly surface observations, NWS twice-daily upper air soundings, and data collected from an on-site measurement program such as from an instrumented tower. The first stage of AERMET processing extracts (retrieves) data from the raw data files and assesses data quality. The second stage combines (merges) the available UPPERAIR, SURFACE, and ONSITE data for 24-hour periods and writes these data to an intermediate file. The third and final stage reads the merged data file, develops the necessary boundary layer parameters for dispersion calculations by AERMOD, and outputs AERMOD-ready meteorological data files.

Note that many references are made in the AERMET User's Guide and Addendum to 'NWS' surface data, which should be interpreted generically as any source of hourly surface weather observations, typically but not exclusively from airports. Also, AERMET defines the ONSITE pathway for inputting hourly surface observations taken from an on-site, or site-specific meteorological tower. The *Guideline on Air Quality Models* (Appendix W to 40 CFR Part 51) was modified in April 2003 to use the term 'site-specific' in place of 'on-site,' recognizing that collection of surface meteorological data on the property of a facility does not guarantee that such data are representative for purposes of dispersion modeling, while data collected 'off-site'

are not automatically precluded from being considered representative. As a result, the terms 'on-site' and 'site-specific' are used interchangeably in the AERMET User's Guide and Addendum.

The AERMET program was revised, beginning with version 06341, to use a single executable file, AERMET.EXE, to perform all three stages of processing, replacing the STAGE1N2.EXE and STAGE3.EXE executable files used in earlier versions of AERMET. The AERMET program is designed to read a hardcoded input filename of 'AERMET.INP' for all three stages, and the program is run by entering 'AERMET' at a 'DOS' command prompt, or by double-clicking the AERMET.EXE file from a folder view. Note that the change to a single AERMET executable only affects the number of executables; AERMET, as currently configured, can still only perform one stage of processing at a time.

The AERMET.INP file is a text file containing the instructions for processing (a.k.a., the command input file); this file must be located in the same directory as the AERMET executable. Note that all AERMET output filenames are user-specified. As currently configured, AERMET can only handle one processing stage at a time. Therefore, in a typical application the command line would be entered three times, once for stage 1 processing (extraction and quality assurance (QA)), a second time for stage 2 processing (merge), and a third time for stage 3 processing (met preparation). Since stage 1 processing is designed to support QA of raw input data, stage 1 may involve some iteration if data problems are encountered. Prior to running AERMET one should review the instructions in the command input file and, as necessary, replace them with instructions appropriate to the particular application and stage of processing. A batch file to facilitate the procedure of running AERMET for the three processing stages follows:

```
@         ECHO OFF

rem            RUNAERMET   filename

rem       This is a DOS utility program for use in running the meteorological
rem       preprocessor, AERMET.  The program is run from the DOS prompt using
rem       the following syntax:

rem       where:   RUNAERMET is entered 'as is' and
rem                    filename is the name of the input file

        :START
             IF '%1' == ''  GOTO END
             IF EXIST %1  GOTO COPY
             ECHO Error locating input file
             GOTO STOP

           :COPY
                COPY %1  AERMET.INP
                ECHO Proceed with processing
                PAUSE
                AERMET
                GOTO STOP
          :END

ECHO ..
ECHO ..
ECHO      AERMET is run from the DOS prompt using the following syntax
ECHO ..
ECHO           RUNAERMET   filename
ECHO ..
ECHO      where:   RUNAERMET is entered 'as is'
ECHO                    filename is the name of the input file
ECHO ..
ECHO ..
                PAUSE

          :STOP
```

The revisions to AERMET introduced with version 06341 to address several problems associated with extraction and processing of National Weather Service airport data in the Integrated Surface Hourly Data (a.k.a., ISHD, ISH, ISD, TD-3505) format included:

- corrections to the procedure for selecting which record to process for hours with multiple records;
- corrections to code for processing of sky cover fields;
- addition of code for identifying "variable" winds, introduced on July 1, 1996, with adoption of the METAR reporting standard, with valid wind speed but missing wind direction (formerly flagged as calms);
- code for initializing the "additional" character variable to avoid data fields from previous hours being used; and
- code for handling mixed-format ISHD data files with full and condensed archival formats (note that ‘condensed’ format refers to ISHD data without the location and

elevation fields on each record, which is not the same as the 'abbreviated' format for ISHD data, which is not supported by AERMET).

Some of the QA defaults presented in the current AERMET User's Guide (EPA, 2004) have been revised to maintain consistency with the current AERMET code, including upper and lower bounds and missing indicators. These revisions are reflected in modified tables from the AERMET User's Guide provided below in Appendix B.

Additional details regarding these and other revisions to the AERMET code are presented in the AERMET MCB#1 and MCB#2, and through comments embedded in the Fortran source code. Given the scope of code changes associated with the update dated 11059 (MCB#2), an annotated list of changes in the source code has not been developed.

2.0 USER INSTRUCTIONS

This section documents revisions to the user instructions associated with modifications to the AERMET program, including changes introduced with version 06341 and later.

2.1 STATION ELEVATIONS

Beginning with version 06341, AERMET allowed the option to specify station elevation above mean sea-level (MSL) as the last field on the LOCATION keyword in the UPPERAIR, SURFACE, and ONSITE pathways in the Stage 1 control file, and the METPREP pathway in the Stage 3 control file. However, this optional station elevation was only used under version 06341 when processing ISHD data on the SURFACE pathway and all other occurrences of user-specified station elevations were ignored. Beginning with version 11059, AERMET was revised to make full use of user-specified station elevations for the SURFACE and ONSITE pathways to estimate station pressure if station pressure is missing, but to no longer allow station elevation on the UPPERAIR pathway. The LOCATION keyword has also been removed from the METPREP pathway beginning with version 11059. AERMET will issue a warning message if the elevation field is included on the UPPERAIR LOCATION keyword, but the user-specified elevation will be ignored and processing will continue. AERMET will also issue a warning message and ignore all inputs on the LOCATION keyword if specified on the METPREP pathway.

The handling of station elevation within AERMET, beginning with version 11059, is summarized below:

1. A non-fatal warning message will occur if the station elevation is encountered on the LOCATION keyword on the UPPERAIR (Stage 1) pathway, or if the LOCATION keyword is included on the METPREP (Stage 3) pathway, but the inputs will be ignored and processing will continue.
2. The station elevation is allowed as an optional argument on the LOCATION keyword for the SURFACE and ONSITE pathways in Stage 1.

3. If the station elevation is included in the raw SURFACE input file to Stage 1 (ISHD or SAMSON formats), then the elevation from the data file is used; otherwise the user-specified station elevation is used, if available.
4. If the station elevation is not specified on the SURFACE pathway and is not in the raw surface data input file for Stage 1, then 0 meters (sea-level) is used for the SURFACE station elevation.
5. If the station elevation is not specified on the ONSITE pathway in Stage 1, then 0 meters (sea-level) is used for the ONSITE station elevation.

Station elevation is used within Stage 3 of AERMET processing in the substitution for missing station pressure. While station elevation is currently an optional parameter on the LOCATION keyword under the SURFACE and ONSITE pathways, users are encouraged to include station elevation since it may improve the representativeness of the station pressure used by AERMET if station pressure is missing. The following hierarchy is used for determining station pressure, depending on the availability of ONSITE and/or SURFACE station pressure, sea-level pressure and station elevation, depending on the source of ambient temperature data:

1. If ONSITE temperature data is used, then:
    a. Use ONSITE station pressure, if available;
    b. Adjust ONSITE sea-level pressure to ONSITE station elevation, if provided on the LOCATION keyword in the ONSITE pathway;
    c. Adjust NWS/FAA station pressure to ONSITE station elevation, if station elevation is available for both the SURFACE and ONSITE data;
    d. Adjust NWS/FAA sea-level pressure to ONSITE station elevation, if ONSITE station elevation is provided;
    e. Use NWS/FAA station pressure, if available, without adjustment;
    f. Adjust NWS/FAA sea-level pressure to SURFACE station elevation, if available;
    g. Estimate station pressure based on standard atmosphere using ONSITE station elevation, if available;
    h. Estimate station pressure based on standard atmosphere using SURFACE station elevation, if available;
    i. Assign ONSITE sea-level pressure to station pressure if no ONSITE station elevation is available;

j. Assign SURFACE sea-level pressure to station pressure if no SURFACE station elevation is available; or

k. Assign standard sea-level pressure of 1013.25 mb to station pressure.

2. If SURFACE temperature data is used, then:

a. Use SURFACE station pressure, if available;

b. Adjust SURFACE sea-level pressure to SURFACE station elevation, if provided on the LOCATION keyword in the SURFACE pathway or in the SURFACE data file;

c. Adjust ONSITE station pressure to SURFACE station elevation, if station elevation is available for both the SURFACE and ONSITE data;

d. Adjust ONSITE sea-level pressure to SURFACE station elevation, if SURFACE station elevation is provided;

e. Use ONSITE station pressure, if available, without adjustment;

f. Adjust ONSITE sea-level pressure to ONSITE station elevation, if available;

g. Estimate station pressure based on standard atmosphere using SURFACE station elevation, if available;

h. Estimate station pressure based on standard atmosphere using ONSITE station elevation, if available;

i. Assign SURFACE sea-level pressure to station pressure if no SURFACE station elevation is available;

j. Assign ONSITE sea-level pressure to station pressure if no ONSITE station elevation is available; or

k. Assign standard sea-level pressure of 1013.25 mb to station pressure.

2.2 UPPER AIR SOUNDING SELECTION

The AERMET meteorological preprocessor was originally developed to work with NWS upper air sounding data available in the United States and North America. Since that time, AERMET has been increasingly applied in areas outside North America. If observed ONSITE mixing heights are not available, AERMET requires a morning sounding to compute the hourly convective mixing heights for AERMOD. The preferred sounding time is prior to sunrise, before the convective mixed layer begins to develop. In North America, this generally means the 1200 GMT sounding (also referred to as the 12Z sounding). In other parts of the world this means the

0000 GMT (or 00Z) sounding. Originally, AERMET was designed to automatically select the 12Z sounding, consistent with the primary focus of the AERMOD model development to support modeling applications within the U.S. Since the reported upper air observation time is known to vary slightly, AERMET also defined a default "sounding window" of ±1 hour, i.e., AERMET accepted the 11Z, 12z, or 13Z sounding. Beginning with version 11059, AERMET has been enhanced to select an upper air sounding that is more appropriate for the location where AERMET is being applied.

The world is divided into 24 time zones, but most zones do not follow a straight north-south line of longitude (see Figure 2-1). As a result, the time zone adjustment parameter on the LOCATION keyword is not a reliable indicator for selecting the appropriate sounding time. Beginning with version 11059, the default approach in AERMET has been enhanced to search for an appropriate sounding for all locations based on the longitude entered on the LOCATION keyword under the UPPERAIR pathway for Stage 1 processing, and computes a 'pseudo' time zone based on this longitude. The longitude is divided by 15 with the result rounded to the nearest integer. For example, 156.76° West yields a time zone of -10 (in keeping with the standard convention that west longitudes are negative). It is worth noting that in Alaska, the time zone is -9 for the entire state but the state actually spans pseudo-zones -9, -10, and -11 based on longitude. This is not an uncommon occurrence.

Table 2-1 shows which default sounding AERMET will use based on the longitude-dependent 'pseudo' time zone (note that time zones -12 and +12 refer to the same zone). The values shown in the table are also shown across the top of Figure 2-1. A sounding time of -12 indicates the use of the 1200 GMT (12Z) sounding from the previous day and is primarily used in the Far East, southeast Asia, Australia, and New Zealand.

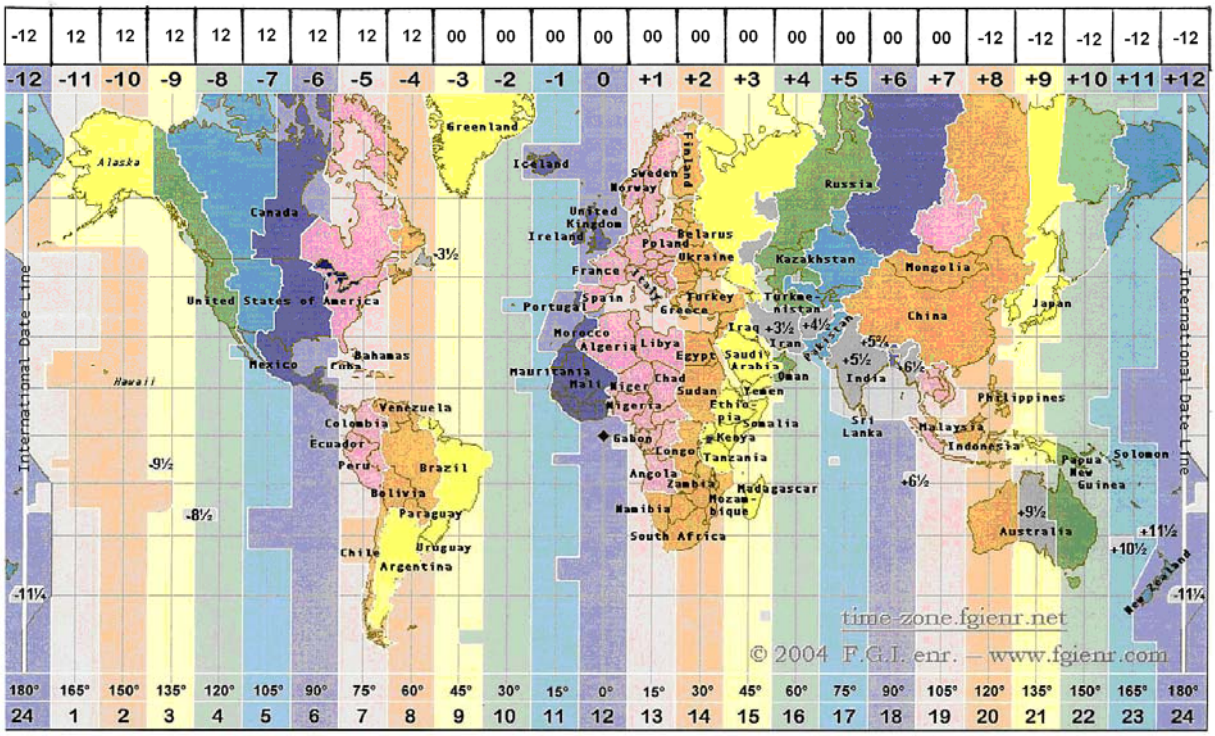

Figure 2-1. Time Zone Boundaries (with preferred sounding time across top)

Table 2-1. Sounding Selection by Time Zone

Time Zone	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0
Sounding	-12	12	12	12	12	12	12	12	12	00	00	00	00
Time Zone	1	2	3	4	5	6	7	8	9	10	11	12	--
Sounding	00	00	00	00	00	00	00	-12	-12	-12	-12	-12	--

2.2.1 Adjusting the Default Sounding Window

By default, AERMET uses a 1-hour window before and after the preferred sounding time as the search window to locate a sounding to use. Beginning with version 11059, the user can expand (or contract) this window by using the optional UAWINDOW keyword under the METPREP pathway in Stage 3. The syntax of the UAWINDOW keyword is as follows:

Syntax:	UAWINDOW w*indow_begin window_end*
Type:	Optional, Non-repeatable

where w*indow_begin* represents the beginning of the sounding window and w*indow_end* represents the end of the sounding window, entered as the number of hours relative to the preferred sounding time (whether it be 12Z or 00Z). A negative number indicates the number of hours before the reference sounding, and a positive number indicates the number of hours after the sounding. The default sounding window would be input as: UAWINDOW -1 +1 (note that the plus sign in not required). The sounding window does not have to be symmetric about the sounding time. For example if the user wants to search more hours before the sounding time and fewer after, the following could be used: UAWINDOW -5 +2. To force AERMET to accept only soundings corresponding to the reference sounding time, the use would input: UAWINDOW 0 0. If multiple soundings are available within the upper air sounding window, AERMET will select the sounding closest in time to the reference sounding, with a preference for soundings prior to and including the reference sounding time. For example, if UAWINDOW -5 +2 is specified, and soundings are available for 9Z, 12Z, and 15Z, AERMET would select the 12Z sounding. However, if soundings were available for 9Z and 13Z, AERMET would select the 9Z sounding.

2.2.2 Option to Select Sounding Based on Sunrise

By default, AERMET uses the 12Z/00Z sounding criterion described above to locate a sounding for its computations. Beginning with version 11059, AERMET has been enhanced to include an optional method to search for the morning sounding based on the local time of sunrise at the UPPERAIR station location. Rather than looking for a 00Z or 12Z sounding, AERMET searches for the sounding nearest to sunrise. By default, AERMET attempts to find a sounding within 6 hours before sunrise, and if that search fails, it searches up to 2 hours after sunrise (equivalent to UAWINDOW -6 +2). As with the sounding window for the default selection in Section 2.2.1, priority is given to soundings prior to and including sunrise, such that a sounding that is 4 hours before sunrise is preferred, and selected, over a sounding that is 1 hour after

sunrise.

To invoke this search, a new option for the METHOD keyword under the METPREP pathway in Stage 3 has been defined: UASELECT. The syntax of the new UASELECT option is as follows:

Syntax:	METHOD UASELECT SUNRIS(E)
Type:	Optional, Non-repeatable

The 'E' on 'SUNRISE' is optional and can be omitted. As with the 12Z/00Z sounding search, the user can expand or contract the search window for the SUNRIS option (-6 to +2 hours by default) using the UAWINDOW keyword. The syntax for the UAWINDOW keyword is the same in both cases:

Syntax:	UAWINDOW w*indow_begin window_end*
Type:	Optional, Non-repeatable

where w*indow_begin* represents the beginning of the sounding window and w*indow_end* represents the end of the sounding window, entered as the number of hours relative to sunrise to conduct the search. For purposes of applying the sounding window, sunrise is defined as the beginning of the hour during which the sun rises. For example, if sunrise is calculated to occur at 06:45 local time, AERMET will define sunrise as 0600 and preference will be given to a sounding at 0600 vs. a sounding at 0700.

2.3 PROCESSING OF ASOS DATA

Beginning with version 11059, several modifications have been made to AERMET related to the processing of surface observations from Automated Surface Observing Systems (ASOS) used to collect weather measurements at airports located with the U. S. The U.S. National Weather Service (NWS) and Federal Aviation Administration (FAA) began an effort in 1992 to replace the traditional observer-based system for collecting and reporting weather data

with an automated system. As of 2010, there were over 900 ASOS stations located at airports across the U.S. The transition from the observer-based system to an automated system has presented both challenges and opportunities in relation of the use of such data to support dispersion modeling applications (EPA, 1997). This section describes several modifications to AERMET to address some of these challenges, as well as to take advantage of the opportunities, and the most significant changes are related to processing of ASOS wind data.

2.3.1 Use of 1-minute ASOS Wind Data

In addition to the standard archives of surface observations based on ASOS, the National Climatic Data Center (NCDC) began routinely archiving 1-minute ASOS wind data (TD-6405), beginning with data for January 2000 for first-order NWS ASOS stations, and beginning with data for March 2005 for all other ASOS stations. The 1-minute ASOS wind data files include the 2-minute average wind speed and direction reported every minute, i.e., the files consist of 60 overlapping 2-minute averages for an hour. By contrast, the standard archives of surface observations based on ASOS include a single 2-minute average wind speed, usually reported within 10 minutes before the hour. The values included in the 1-minute ASOS wind data files are reported to the nearest degree for wind direction and whole knots for wind speed. More importantly, whereas the standard ASOS archives report any wind speed below 3 knots as 0 knots to represent a calm, consistent with the METAR standard adopted in July 1996, the 1-minute ASOS wind data files include values for 1 knot and 2 knots.

The use of hourly-averaged wind speed and direction provides a more appropriate input for the AERMOD dispersion model than a single 2-minute average. Utilizing wind data for the full hour will typically result in a more complete data set since many hours classified as calm or variable (with a non-missing wind speed up to 6 knots, but missing wind direction) based on a single 2-minute average will be filled in with hourly averages derived from the 1-min ASOS wind data. Furthermore, the use of hourly averaged wind direction, derived from 2-minute averages reported to the nearest degree, eliminates the need to randomize wind directions as done for the standard observations which are reported to the nearest 10 degrees.

Beginning with version 11059, AERMET has been updated to accept hourly averages of wind speed and wind direction derived from 1-minute ASOS wind observations available from NCDC at ftp://ftp.ncdc.noaa.gov/pub/data/asos-onemin/. The hourly-averaged wind speed and wind direction files input to AERMET should be generated using EPA's 1-minute ASOS wind data processor, AERMINUTE (EPA, 2010). Hourly-averaged wind speed and direction data derived from 1-minute ASOS wind data files using AERMINUTE will be referenced below as "1-minute ASOS wind data."

The 1-minute ASOS wind data are read by AERMET during the Stage 2 merge processing. AERMET is instructed to include these data in the merged output by adding the ASOS1MIN keyword followed by the filename of the 1-minute ASOS wind data file on the SURFACE pathway in the Stage 2 control file using the following format:

```
ASOS1MIN    file_name
```

When provided, 1-minute ASOS wind data can be used to substitute for missing ONSITE wind data or replace wind data from standard NWS or FAA SURFACE data formats when ONSITE data are not included. To substitute for missing on-site winds or replace standard SURFACE winds, the secondary keyword REFLEVEL must be specified with the SUBNWS parameter as a METHOD on the METPREP pathway in the Stage 3 control file.

When SUBNWS is specified, AERMET uses the following hierarchy, based on data availability for each hour, to select the wind data used to calculate boundary layer scaling parameters, and ultimately written to the surface file (SFC) generated during Stage 3 processing:

1. ONSITE winds,
2. 1-min ASOS winds; then
3. standard SURFACE winds.

Neither NWS nor 1-min ASOS wind data will be used to substitute for missing onsite wind data if the 'REFLEVEL SUBNWS' option under the METHOD keyword is omitted from the Stage 3 control file.

Wind speeds from 1-minute ASOS wind data files are extracted and merged during Stage 2 processing. AERMET checks the observation date for consistency with the ASOS commission date, and if the 1-minute ASOS wind date precede the commission date the reference wind speed and direction are set to missing and an error message is generated (see Section 2.3.3 for more details).

2.3.2 Adjustment to Truncated ASOS Wind Speeds

Beginning with version 11059, AERMET has been modified to add ½ knot (0.26 m/s) to all ASOS-based wind speeds in order to compensate for the bias introduced due to the wind speeds being truncated, rather than rounded, to whole knots (NOAA, 2008). There are two sources of ASOS wind data that can be input to AERMET: 1) NWS data in one of the standard NWS surface data formats; and 2) hourly-averaged wind speed and direction derived from 1-minute ASOS wind data files generated with AERMINUTE (EPA, 2010).

The ½ knot ASOS wind speed adjustment is applied, by default, during Stage 3 processing to wind speeds substituted from 1-minute ASOS wind data as well as those substituted from standard NWS/FAA surface data determined to be ASOS winds based on the ASOS commission date. The user can override the default truncation adjustment by adding the ASOS_ADJ method and NO_ADJ keyword to the Stage 3 METPREP pathway using the following format:

```
METHOD   ASOS_ADJ   NO_ADJ
```

In order to document the source of the wind data in the Stage 3 SFC file output by AERMET, and identify whether the wind speed was adjusted, a two-part code is appended to the end of each record. The first part of the code indicates whether the wind speed was or was not adjusted with either "ADJ" or "NAD," respectively. The source of the wind data for each record is encoded as either "OS", "SFC", or "A1" to indicate the use of ONSITE, SURFACE, or 1-minute ASOS winds, respectively. The two parts of the code are separated by a hyphen, and if no wind data are available for a particular hour, the second part of the code is blank.

2.3.3 Identifying ASOS Observations

In order to implement the ASOS wind speed adjustment described in Section 2.3.2, AERMET must determine whether surface wind observations are ASOS or not. Wind data in the standard NWS surface formats read by AERMET are identified as ASOS based on the published commission date of the ASOS equipment for the Weather-Bureau-Army-Navy (WBAN) number reported in either the header of the NWS surface file or the first observation, or the 3- or 4-character station call letters included in the observations, depending on the format input to AERMET. A table of commission dates was added to AERMET to support the determination of whether an observation was measured by ASOS instrumentation. As each observation is extracted from the NWS surface file during Stage 1 processing, the observation date and time are temporarily converted to LST and the 1-24 hour convention, then the converted date is compared to the ASOS commission date. Those records for which the observation date falls on or after the ASOS commission date are identified as ASOS by appending an "A" to the extracted record in the Stage 1 surface extraction and surface QA files. If a commission date is not found or the observation occurred before the commission date, the record is tagged with an "N" to indicate it is not an ASOS observation. For those formats that report hours using the 00-23 hour convention, the 00 hour becomes hour 24 on the previous day. Thus, data reported for hour 00 on the ASOS commission date, after the date and time is converted, will not be recognized as an ASOS hour.

For those NWS surface formats that include a data field to indicate that measurements were made with ASOS instrumentation (HUSWO, TD-3280, and in some cases ISHD), a validation is performed on each record to check the consistency between the ASOS flag in the raw data file with the ASOS flag set by AERMET based on the commission date. If the ASOS flag in the raw data file indicates an ASOS observation, the record in the extracted file will be appended with an "A" to indicate an ASOS observation, but a warning will be included in the Stage 1 message file if the station is not found on the ASOS commission list, or if the station is found but the data period precedes the commission date contained within AERMET.

To address cases where an ASOS station is not included in the ASOS commission list in AERMET but the station is known to be an ASOS site, AERMET includes an optional parameter on the DATA keyword under the SURFACE pathway allowing the user to specify that the data are ASOS. Note that this optional 'ASOS' parameter is only allowed for surface data in the ISHD format, and should only be used if the station is known to be ASOS, but is not included in the ASOS commission list within AERMET (see Table A-6 for a description of the DATA keyword format).

The ASOS commission date and the count of extracted ASOS records are reported in the Stage 1 message file. Similarly, the surface records are marked with either an "A" or an "N", as appropriate, in the Stage 2 merge file to facilitate the ASOS wind speed truncation adjustment applied in Stage 3. Since 1-minute ASOS wind data are presumed to be ASOS by definition, the ASOS flag is not included on the 1-minute ASOS wind data in the merge file.

<u>NOTE:</u> Beginning with version 11059, Stage 2 processing requires the presence of the ASOS flag appended to each surface record in the Stage 1 surface extraction and QA files. Similarly, Stage 3 processing requires the presence of the ASOS flag appended to applicable records in the Stage 2 merge file. If the ASOS flag is omitted from either of these files, a fatal error is issued and processing is aborted. Therefore, version 11059 of

AERMET, or later, will not process surface extraction or merge files generated with an earlier version of AERMET.

2.3.4 Validation of NWS Surface Format by Active Date Range

Validations were incorporated in AERMET, beginning with version 11059, to check for consistency between the date of the observation in the NWS surface file and the range of dates for which the NWS format is considered to be active and valid. A file that contains data outside the format's valid date range is assumed to have been reformatted from some other data format and its use in AERMET may result in inconsistencies with data processed for the same station and dates input in their native format. Use of reformatted data files in AERMET is discouraged, and AERMET results based on processing reformatted data should be used with caution.

The date consistency check is performed for each hour of data extracted from the NWS surface file, until an observation is found that is outside the valid date range. Once an observation is encountered that is outside the valid date range, a variable is set to indicate the data was likely reformatted, and a warning is issued in the Stage 1 message file when the data extraction is complete. Table 1 lists the active dates for each of the NWS surface formats read by AERMET as currently implemented in AERMET. Note that ISHD and TD-3280 are currently active formats and the validation is not performed against either of those formats.

Table 2-2. Format Active Dates

NWS Surface Format	Start Date	End Date
CD-144	---	12/31/1995
HUSWO	1/1/1990	12/31/1995
ISHD	---	---
SAMSON	1/1/1961	12/31/1990
SCRAM	1/1/1984	12/31/1992
TD-3280	---	---

2.3.5 Validation of WBAN Between Stage 1 Control File and NWS Surface Data File

Another validation was incorporated into AERMET, beginning with version 11059, to ensure consistency in the WBAN number specified by the user on the LOCATION card in the Stage 1 SURFACE pathway and the NWS surface data file. The WBAN number from the control file is compared to the WBAN number stored on the header record of the NWS surface file (SAMSON) or the WBAN number recorded for the first observation for those formats without a header record that repeat the WBAN number on each observation record (CD-144, HUSWO, SCRAM, and TD-3280). When the WBAN number from the control file is found to be different from that recorded in the NWS surface file, a fatal error is issued and processing is aborted. This validation is performed for all NWS surface formats read by AERMET with the exception of the ISHD format since ISHD includes many stations located within the U.S. and internationally for which a WBAN number has not be assigned.

For those formats in which the WBAN number is repeated on each observation record, an additional validation is performed to check for internal consistency across all observation records in the surface file. If a mismatch is encountered, a fatal error is issued and processing is aborted. Note: This check for internal consistency is performed for the ISHD format as well as the other applicable formats; however, since the WBAN number is not consistently included in ISHD files a fatal error will only be issued and processing aborted if a mismatch occurs between two non-missing (i.e., not '99999') WBAN numbers. For the ISHD format, the validation is applied to the 5-digit ID stored in positions 11-15 on each record. The first non-missing (not '99999') WBAN number encountered is stored and used to compare against each subsequent record.

2.3.6 ASOS Cloud Cover from SCRAM and SAMSON Set to Missing

Due to the difficulties that arise when attempting to reformat cloud cover information collected with ASOS instrumentation to the SAMSON and SCRAM formats, there are concerns over the validity of the representation of ASOS clouds in these older pre-ASOS formats. For this

reason, AERMET was modified (beginning with version 11059) to set opaque and total cloud cover to missing for observations extracted from SAMSON and SCRAM formats for which the observation date falls on or after the ASOS commission date. For each hour this condition is encountered, opaque and total cloud cover are set to missing and warning (up to 24) or informational messages are issued in the Stage 1 message file. Note that this also applies to SCRAM-formatted data available on the EPA SCRAM website for a few stations that were commissioned as ASOS during the last four months of 1992, the last year of data archived in the SCRAM format.

2.4 DEFINING THE ONSITE FILE STRUCTURE – READ AND FORMAT

One of the more difficult challenges for many users attempting to run the AERMET meteorological processor is to specify the inputs necessary to read and process site-specific, or ONSITE, meteorological data. Since the AERMOD dispersion model was designed to utilize a wide range of site-specific meteorological variables, including wind, temperature and turbulence data from a multi-level tower and/or SODAR, it is not practical to specify a standard format for site-specific data being input to AERMET. Also, since AERMET was written using the Fortran programming language, part of the challenge may be for users to understand some of the basic rules and concepts for reading data based on the Fortran language. This section describes the process for defining ONSITE meteorological inputs for AERMET, including enhancements introduced with version 11059 of AERMET that may simplify this process, and also provide better error handling and reporting if problems are encountered.

The key to reading site-specific meteorological data correctly in AERMET is to define what data variables are present and specify the format for reading the data. This task is accomplished with two related keywords on the ONSITE pathway: 1) the READ keyword, which defines the list and order of variables present on a data record; and 2) the FORMAT keyword, which defines the format of the data on each record. As noted above, these two statements together operate much like reading or writing data in a Fortran program. The syntax and type of these two keywords are as follows:

Syntax:	READ *record_index osname*1 *osname*2 ... *osname*n
Type:	Mandatory (Stage 1 ONSITE pathway), Repeatable, Reprocessed

Syntax:	FORMAT *record_index Fortran_format*
Type:	Mandatory (Stage 1 ONSITE pathway), Repeatable, Reprocessed

Each READ keyword is paired with a corresponding FORMAT keyword through the *record_index* field. This index refers to one "record" of data for an observation period, although the READ can span multiple records within the data file. The indices are numbered sequentially beginning with 1. There can be up to 50 variables on any one data record and up to 50 "records" (or READs) per observation period. There is no fixed limit on the record length for each physical record within the data file; however some of the error handling and reporting performed by AERMET for ONSITE data is limited to the first 500 characters of a given data record.

The *osname*1, *osname*2, … *osname*n fields on the READ keyword are the variable names for the variables included in the ONSITE data file for a particular data record, in the order in which they are to be read. The variable names available for ONSITE data are described in Table B-3a for "scalar" (single-level) variables and Table B-3b for "vector" (multi-level) variables. The *Fortran_format* field on the FORMAT keyword is normally the Fortran format statement that will be used to read the data from the corresponding READ keyword. However, beginning

with version 11059, user's can specify 'FREE' (without quotes and not case-sensitive) for the *Fortran_format* to indicate that the variables for a particular data record should be read as free-formatted data, in accordance with Fortran language standards. Free-formatted, also called list-directed data, are read as a list of values which are separated by at least one blank space or by a comma. The user has the option to specify FREE format for some data records, while specifying the Fortran FORMAT explicitly for other data records. The FREE format option may simplify the process of specifying the READ and FORMAT inputs for some users, but still requires an understanding of some basic rules to ensure that the data are input properly to AERMET.

The structure and format of the site-specific data is reasonably flexible, but subject to the following restrictions:

(1) The data for one observation period can be spread across several records (up to 50), but the records for one data period must be contiguous;

(2) The same variables must appear for all observation periods, even if the values for those variables are missing for certain hours;

(3) The ONSITE data file must be an ASCII text file and it must be in a form that can be read using Fortran FORMAT statements or as FREE format;

(4) The date and time information for each observation must be on the first record of the period; these may occur in any order within the first record, and are read as INTEGER format (Fortran 'I' format or FREE format);

(5) The (non-date) data variables on the READ keywords must be a subset of those listed in Appendix B, Tables B-3a and B-3b, and are read as REAL format (Fortran 'F' or 'E' format or as FREE format);

(6) Using an 'F' or 'E' (REAL) Fortran format specifier to read a date/time variable will cause an AERMET runtime error; and using an 'I' (INTEGER) format specifier to read a data variable will also cause an AERMET runtime error.

When specifying the multi-level variables, such as wind or temperature observations from an instrumented tower, the variable name is composed of a two-character prefix that identifies the atmospheric quantity and a two-character (numeric) suffix that identifies the level.

For example, height, temperature and wind speed from the first level would appear as HT01, TT01 and WS01 on the READ keyword, as HT02, TT02 and WS02 for the second level, and so on. The same variables do not have to appear for each level of data. For example, winds may appear at three levels but temperature only at two levels. However, multi-level data **must** be entered in ascending height order. More details regarding options and requirements for specifying measurement heights for ONSITE data processed through AERMET are provided in Section 2.5.

Unless FREE format is specified for a particular READ, the *Fortran_format* on the corresponding FORMAT keyword is a character string that AERMET uses directly within the program to read the data. Hence, the string must comply with all the rules of Fortran for creating a format statement. The format must begin with an open parenthesis and end with a closing parenthesis. Any book on the Fortran programming language can provide guidance on constructing a format statement, but here are some important points to remember:

- The Fortran I format specifier for integer constants consists of 'I' followed by the width of the data field, such that a format of 'I4' will read a 4-character data string as an integer number;
- A read error will be generated if a non-numeric character (other than a leading '+' or '-'), including a decimal ('.'), occurs within the date field being read with an I format;
- The Fortran F format specifier for real constants consists of 'F' followed by the width of the field and number of places after the decimal point (F*w*.*d*), such that a format of 'F5.2' will read a 5-character data string, including the decimal, as a real number, with 2 places after the decimal point;
- Data being read as real constants using the 'F' format specifier are not required to include decimal places within the data string; however, users must be aware of the rules for assigning values using the F edit descriptor in such cases:
  - If the data string includes a decimal place, then the value assigned to the REAL variable will reflect the number of decimal places specified; e.g., reading the string '10.23' as F5.2, F5.1, or F5.0 will all assign the value 10.23 to the variable.
  - However, if the data string does not include a decimal point the number of decimal places assigned will be based on the F format specifier, such that reading the string '*b*1023' (where '*b*' represents a blank) as F5.2, F5.1, or F5.0 will assign the values 10.23, 102.3, and 1023. to the variable, respectively.

- Data being read as REAL constants using the 'FREE' format option will reflect the values as specified in the data file, such that a string of '10.23' will be assigned a value of 10.23, whereas a string of '1023' will be assigned a value of 1023;
- Reading date variables as INTEGER constants using the 'FREE' format option will not result in a read error if a decimal ('.') occurs within the data field being read, but any data after the decimal point will be ignored, such that a data field of '4.8' will be read as an INTEGER value of 4. However, any other non-numeric character in the data field (other than a leading '+' or '-') will result in a Fortran read error.

The fourth bullet above related to the number of decimal places reflected in the data highlights one of the more significant problems that could arise with reading ONSITE data in AERMET, since the value assigned to the variable may not be the value intended by the user. This situation may arise if the ONSITE data file has been generated by exporting data from a spreadsheet program. In such cases the data values for a particular parameter may have a varying number of decimal places, including values with no decimal places for some records, since the spreadsheet program may output a fixed number of significant digits. While this issue could occur with any ONSITE data variables, it may be more likely for parameters that vary over a large range, such as solar radiation data. Given the potential problems that could arise if the data values being read by AERMET may not match the values intended, users are strongly encouraged to review the QAOUT file for the ONSITE data to ensure that the data have been read properly by AERMET. The QA audit statistics on values exceeding the upper and lower bounds for a given parameter may also highlight potential problems with the data. For cases when the "raw" ONSITE data include a variable number of decimal places, using the 'FREE' format option or using 'F*w*.0' as the Fortran format specifier may avoid the issue described above.

Beginning with version 11059, AERMET performs additional checks related to the processing of ONSITE data which may help the user to identify and avoid potential problems. One such check compares the number of decimals included in the data string for ONSITE data with the number of REAL variables being read. Warning messages are generated if the number of decimals found is less than the number of REAL variables, and if the number of decimals changes from one data record to another. Another issue that may arise with processing ONSITE

data is that the missing data code used within the data file does not match the default missing code used by AERMET (shown in Table B-3). AERMET will process the "missing" value as valid data in such cases, which may produce errors or anomalous results. The user can specify missing indicators that differ from the default using the RANGE keyword on the ONSITE pathway, and the QA audit statistics on values exceeding the upper and lower bounds may also highlight if such a problem exists. In addition, AERMET will issue warning messages, which are included in the REPORT files, for cases when the upper and lower bounds are exceeded by an amount larger than one half the range defined by UPPER-LOWER, which may flag this issue in some cases.

Not all of the variables present in the site-specific data file need to be read. Any superfluous data can easily be skipped over using the X, T and / edit descriptors in the Fortran FORMAT specifier. However, the 'FREE' format option does not allow for skipping values within the data record and assigns values to the variables based on the order of variables within the data file. Also, users should note that:

☞ **the same format used to read the original site-specific data file is also used to write the QA output (QAOUT) file.**

If some variables or entire lines of data are skipped, then the QA output file will contain corresponding blank fields and/or blank lines.

Once the variables and formats have been defined, the user does not need to specify them for any subsequent AERMET runs (e.g., for Stage 3 processing) as long as the information remains in the header records of the QAOUT file generated in Stage 1 and the MERGE file generated in Stage 2. AERMET reprocesses these records as needed whenever the data are used in subsequent processing stages, saving the user the time required to setup that portion of a runstream file and avoiding introducing errors on these two keywords.

2.5 SPECIFYING ONSITE MEASUREMENT HEIGHTS

AERMET provides two options for specifying the measurement heights for the multi-level profile data input through the ONSITE pathway. One option is to explicitly specify the measurement heights within the input data file, using the 'HTnn' variable on the READ keyword, where 'HT' refers to the height variable and 'nn' refers to the level at which the observation was taken, beginning with '01' for the first (lowest) level, '02 for the next lowest level, up to the highest level (see Table B-3). With this option the 'HTnn' variables would need to be included for each observation period within the data file. While AERMET allows the measurement heights to vary from one observation to the next with the 'HTnn' option (which is normally not the case), the number of levels must be the same for each data period, and the heights must be defined in increasing order from lowest height (HT01) to the highest height. Under this option, if measurement heights are found to decrease with height or be duplicated, all multi-level data for that observation period will be set as missing.

The OSHEIHGTS keyword on the ONSITE pathway provides an alternative approach for specifying measurement heights for multi-level profile data. The syntax and type for the OSHEIGHTS keyword are as follows:

Syntax:	OSHEIGHTS *height1 height2 ... heightn*
Type:	Optional if height information is provided in the data; otherwise mandatory (Stage 1), Repeatable, Reprocessed

The *height1*, *height2*, … *heightn* variables are the measurement heights in meters, ordered from lowest to highest. If the OSHEIGHTS keyword is specified and the 'HTnn' variables are also defined on the READ keywords, AERMET will use the heights based on the OSHEIGHTS keyword to override the height variables that may be present in the data file. For example, if the heights in the data file are 10.0, 50.0 and 100.0 meters, but the user knows that the heights are really 9.0, 50.0 and 100.0 meters, rather than modify the data file, the OSHEIGHTS keyword can be used to rectify the problem.

2.6 SECONDARY SITE SURFACE CHARACTERISTICS

AERMET has been revised, beginning with version 11059, to require two sets of surface characteristics (primary and secondary) in the METPREP pathway of the Stage 3 control file when the SUBNWS option is specified and both ONSITE and SURFACE data are provided (including 1-minute ASOS wind data). If either ONSITE data or SURFACE data are omitted, only a single (primary) set of surface characteristics is required. In addition, AERMET includes optional keywords, AERSURF and AERSURF2 under the METPREP pathway, which can be used to specify separate external files which contain the necessary AERMET keyword inputs to specify surface characteristics for the primary and secondary site, respectively. These keywords facilitate the use of surface characteristics based on the AERSURFACE tool (EPA, 2008), without the requiring the user to copy-and-paste the results into the AERMET input file. The syntax of the new AERSURF and AERSURF2 keywords is as follows:

Syntax:	AERSURF *primary_surfchar_filename* AERSURF2 *secondary_surfchar_filename*
Type:	Optional, Non-repeatable

where *primary_surfchar_filename* and *secondary_surfchar_filename* refer to the names of the files containing the surface characteristics for the primary and secondary sites, respectively.

The primary set of surface characteristics, which include the temporal frequency (monthly, seasonal, or annual), number of sectors, and the values for albedo, Bowen ratio, and effective roughness length, should be specified in the Stage 3 control file in the same manner as in previous versions of AERMET using the existing keywords FREQ_SECT, SECTOR, and SITE_CHAR, respectively. To include a secondary set of surface characteristics in the Stage 3 control file, the user specifies the temporal frequency, number of sectors, and the site characteristics (albedo, Bowen ratio, and effective surface roughness length) in a similar manner to the primary set using the new keywords FREQ_SECT2, SECTOR2, and SITE_CHAR2.

These should be added to the METPREP pathway immediately after the primary set of characteristics which are defined with the original set of keywords (FREQ_SECT, SECTOR, and SITE_CHAR). The following shows the format for adding a secondary set of surface characteristics to the METPREP pathway:

```
** Primary Surface Characteristics
   FREQ_SECT    frequency   number_of_sectors
   SECTOR       sector_index   beginning_direction   ending_direction
   SITE_CHAR    frequency_index   sector_index   albedo Bowen roughness

** Secondary Surface Characteristics
   FREQ_SECT2   frequency   number_of_sectors
   SECTOR2      sector_index   beginning_direction   ending_direction
   SITE_CHAR2   frequency_index   sector_index   albedo Bowen roughness
```

Note that surface characteristics included in an AERSURF file are interpreted by AERMET to be for the primary surface observation site, and setup errors will occur if keywords for the secondary surface characteristics site (FREQ_SECT2, SECTOR2, or SITE_CHAR2) are encountered. On the other hand, data included in the AERSURF2 file are interpreted by AERMET to be for the secondary site, and will be processed as if the FREQ_SECT2, SECTOR2, and SITE_CHAR2 keywords were used, even if the primary site keywords are specified. This allows for the use of an AERSURFACE output file for the AERSURF2 keyword without requiring the user to edit the AERSURFACE file to modify the keywords.

The primary set of characteristics will be applied for those hours in which the onsite data are used when onsite data are provided. Likewise, the primary characteristics will be applied to the NWS surface data if onsite data are omitted from the application and only one set of surface characteristics is required. If both onsite data and NWS surface data (including 1-minute ASOS) are provided, along with the SUBNWS option to allow substitution of NWS surface data for missing ONSITE wind and temperature data, the primary surface characteristics will be applied to the onsite data for those hours in which onsite wind data are used, and the effective surface roughness from the secondary set will be applied for those hours in which wind data from the

NWS surface file or 1-minute ASOS wind data file are substituted for missing or calm onsite data. **Note: The albedo and Bowen ratio from the primary set of surface characteristics are always applied regardless of whether ONSITE or SURFACE data are used for a given hour. The albedo and Bowen ratio from the secondary set are not used at this time, but values must be included to maintain consistency in the formats for reading the data.**

2.7 REVISED SURFACE FILE FORMAT TO SUPPORT AERMOD DEPOSITION ALGORITHMS

Beginning with version 06341, the AERMET program includes additional meteorological parameters in the surface file that are needed to support application of the deposition algorithms in AERMOD. The additional variables include the precipitation code, precipitation rate, relative humidity, surface pressure, and cloud cover. These additional variables are automatically included after the standard variables for each hour, and do not require any additional user input. The precipitation data needed for wet deposition calculations in AERMOD can be obtained from ONSITE data, or from SURFACE data in the SAMSON, HUSWO or ISHD (TD-3505) formats currently supported by AERMET (EPA, 2004). A description of the revised surface file format is provided below:

The AERMET Surface File

Header record:

READ( ) *latitude, longitude, UA identifier, SF identifier, OS identifier, Version date*

FORMAT (2(2X,A8), 8X,' UA_ID: ',A8, ' SF_ID: ',A8, ' OS_ID: ',A8, T85, 'VERSION:', A6)

where *latitude* = latitude specified in Stage 1 for primary surface station
longitude = longitude specified in Stage 1 for primary surface station
UA identifier = station identifier for upper air data; usually the WBAN number used to extract the data from an archive data set
SF identifier = station identifier for hourly

surface observations; usually the WBAN number used in extracting the data

OS identifier = site-specific identifier

Version date = AERMET version date; this date also appears in the banner on each page of the summary reports

Note that the ' ??_ID: ' fields in the FORMAT statement above include two spaces before the 2-character pathway ID and one space after the colon.

Data records:

READ( ) *year, month, day, j_day, hour, H, u_* , w_* , VPTG, Zic, Zim, L, z_o , B_o , r, W_s , W_d , z_{ref} , temp, z_{temp}, ipcode, pamt, rh, pres, ccvr, WSADJ*

FORMAT (3(I2,1X), I3,1X, I2,1X, F6.1,1X, 3(F6.3,1X), 2(F5.0,1X), F8.1,1X, F7.4,1X, 2(F6.2,1X), F7.2,1X, F5.0, 3(1X,F6.1), 1X,I5, 1X,F6.2, 2(1X, F6.0), 1X, I5, 1X, A7)

where *j_day* = Julian day

H = sensible heat flux (W/m^2)

u_* = surface friction velocity (m/s)

w_* = convective velocity scale (m/s)

VPTG = vertical potential temperature gradient above *Zic* (K/m)

Zic = height of convectively-generated boundary layer (m)

Zim = height of mechanically-generated boundary layer (m)

L = Monin-Obukhov length (m)

z_0 = surface roughness length (m)

B_0 = Bowen ratio

r = Albedo

W_s = reference wind speed (m/s)

W_d = reference wind direction (degrees)

z_{ref} = reference height for wind (m)

temp = reference temperature (K)

z_{temp} = reference height for temperature (m)

ipcode = precipitation type code (0=none, 11=liquid, 22=frozen, 99=missing)

pamt = precipitation amount (mm/hr)

rh = relative humidity (percent)

pres = station pressure (mb)

ccvr	=	cloud cover (tenths)
WSADJ	=	wind speed adjustment and data source flag

3.0 REFERENCES

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APPENDIX A. FUNCTIONAL KEYWORD/PARAMETER REFERENCE

This appendix provides a functional reference for the keywords and parameters used by the input runstream files for AERMET. The keywords are organized by functional pathway and within each pathway the order of the keywords is alphabetical, excluding the keyword that identifies the start of a pathway. The pathways used by AERMET are as follows, including the applicable AERMET processing stages and the in the order in which they appear in the tables that follow:

JOB - for specifying overall **JOB** control options (all stages);
UPPERAIR - for processing NWS **UPPER AIR** data (Stages 1 and 2);
SURFACE - for processing NWS hourly **SURFACE** data (Stages 1 and 2);
ONSITE - for processing **ONSITE** meteorological data (Stages 1 and 2);
MERGE - to **MERGE** the three data types into one file, including 1-minute ASOS wind data, if available (Stage 2);
METPREP - for **MET**eorological data **PREP**aration for use in a dispersion Model (Stage 3).

Two types of tables are provided for each pathway. The first table lists all of the keywords for that pathway, identifies each keyword as to its type (either mandatory or optional, either repeatable or non-repeatable, and if it is reprocessed), and provides a brief description of the function of the keyword. The second type of table, which may take up more than one page, describes each parameter in detail.

The following conventions are used in these tables. The parameter names are intended to be descriptive of the input variable being represented. Square brackets around a parameter indicate that the parameter is optional for that keyword. The default that is used when an optional parameter is left blank is explained in the discussion for that parameter.

Beginning with version 11059, the maximum record length for the AERMET runstream input file has been increased from 80 to 132 characters. Another important enhancement introduced with version 11059 of AERMET, which applies across all pathways, is that the maximum field length for filenames has been increased from 48 to 96 and the use

of double quotes (“) as field delimiters for filenames is allowed to support filenames with embedded spaces

TABLE A-1

DESCRIPTION OF JOB PATHWAY KEYWORDS

Keyword	Type	Description
JOB	Optional, Non-repeatable	Start of JOB pathway. This statement is optional if the statements associated with this block appear first in the input control file.
CHK_SYNTAX	Optional, Non-repeatable	Flag indicating that only the syntax of the input statements should be checked for errors, i.e., no data are processed.
MESSAGES	Mandatory, Non-repeatable	Identifies the warning/error messages file.
REPORT	Optional, Non-repeatable	Identifies the general report file.

TABLE A-2

DESCRIPTION OF KEYWORD PARAMETERS FOR THE JOB PATHWAY

Keyword	Parameters	
CHK_SYNTAX	<none>	
MESSAGES	message_filename	
where:	message_filename	The name of the file where all source-code-generated messages are written
REPORT	summary_filename	
where:	summary_filename	The name of the file where AERMET writes a summary of all preprocessor activity for the current run

TABLE A-3

DESCRIPTION OF UPPERAIR KEYWORDS

Keyword	Type	Description
UPPERAIR	Mandatory, Non-repeatable	Start of UPPERAIR pathway.
AUDIT	Optional, Repeatable	Identify variables to be audited. These are in addition to any automatically audited variables.
DATA	Mandatory, Non-repeatable, Reprocessed	File name of raw upper air data.
EXTRACT	Mandatory, Non-repeatable	File name of extracted upper air data.
LOCATION	Mandatory, Non-repeatable, Reprocessed	Site ID and location information. Required only for extraction processing.
MODIFY	Optional, Non-repeatable, Reprocessed	Flag indicating corrections should be made to the sounding data when extracted. See §5 for a discussion of these corrections
NO_MISSING	Optional, Repeatable	Identifies those variables to QA and summarize the messages only; detailed message identifying the violation and date is suppressed
QAOUT	Mandatory, Non-repeatable	File name of upper air data for quality assessed output/ merge input
RANGE	Optional, Repeatable, Reprocessed	Set new upper and lower bounds and missing values for QA of the variable listed.
XDATES	Mandatory, Non-repeatable	Inclusive dates identifying the period of time to extract from the archive data file.

TABLE A-4

DESCRIPTION OF KEYWORD PARAMETERS FOR THE UPPERAIR PATHWAY

Keyword	**Parameter(s)**	
AUDIT	uaname1 ... uanameN	
where:	uaname1 ... uanameN	Name(s) of variables that are to be tracked and reported during quality assessment (as defined in Table B-1 of Appendix B).
DATA	archive_filename file_format	
where:	archive_filename	The name of the file containing the archive of upper air data
	file_format	Archive file format; valid parameters are: **6201FB** (TD-6201 fixed-length blocks) or **6201VB** (TD-6201 variable-length blocks) or **FSL** for data retrieved from National Climatic Data Center (NCDC) web site. Also available on the 'Radiosonde Data of North America' CD-ROM. **NOTE:** The blocking factor and data type (ASCII or EBCDIC) parameters are no longer supported by AERMET, beginning with version 11059. The default values for these parameters are 1 for blocking factor and ASCII for data type. AERMET will issue a warning message if these parameters are included in on the DATA keyword.
EXTRACT	extracted_data_filename	
where:	extracted_data_ filename	Name of the output file for data extracted from an archive data file and the name of the input file for upper air data QA

TABLE A-4, continued

DESCRIPTION OF KEYWORD PARAMETERS FOR THE UPPERAIR PATHWAY

Keyword	**Parameter(s)**	
LOCATION	site_id lat(long) long(lat) [tadjust]	
where:	site_id	Site identifier for which data are to be processed.
	lat(long)	Station latitude (or longitude) in decimal degrees with the suffix N for sites north of the equator, S for sites south of the equator (or W for sites west of Greenwich, E for sites east of Greenwich).
	long(lat)	Station longitude (or latitude) in decimal degrees with the suffix W for sites west of Greenwich, E for sites east of Greenwich (or N for sites north of the equator, S for sites south of the equator).
	[tadjust]	An integer used to convert the time reported in the database to local Standard time. For standard upper-air data reported in Greenwich Mean Time (GMT), the value is the same as the time zone for the station (e.g., a value of 5 for the Eastern time zone). NOTE: Beginning with version 11059, the optional station elevation parameter is no longer supported on the UPPERAIR pathway.
MODIFY	<none>	
NO_MISSING	uaname1 . . . uanameN	
where:	uaname1 . . . . . uanameN	Suppresses missing data messages for the upper air variables specified, as defined in Appendix B; the number of times the variable is missing is not tallied
QAOUT	qa_output_filename	
where:	qa_output_ filename	Name of the output file from the QA/input to merge data

TABLE A-4, continued

DESCRIPTION OF KEYWORD PARAMETERS FOR THE UPPERAIR PATHWAY

Keyword	**Parameter(s)**	
RANGE	uaname lower_bound <[=] upper_bound missing_indicator	
where:	uaname	Variable name, as defined in Table B-1
	lower_bound	Minimum value of the valid range of values for uaname
	<[=]	Exclude (<) or include (<=) the lower and upper bounds (the endpoints) in the QA
	upper_bound	Maximum value of the valid range of values for uaname
	missing_indicator	Value to indicate the value is missing
XDATES	YB/MB/DB [TO] YE/ME/DE	
	YB/MB/DB	Beginning year, month and day to extract; the slash (/) between each part of the date field is required; there can be no blanks in this parameter
	[TO]	Optional; used to make this record more readable
	YE/ME/DE	Ending year, month and day to extract; the slash (/) between each part of the date field is required; there can be no blanks in this parameter

TABLE A-5

DESCRIPTION OF SURFACE PATHWAY KEYWORDS

Keyword	Type	Description
SURFACE	Mandatory, Non-repeatable	Start of SURFACE pathway.
ASOS1MIN	Optional, Non-repeatable	File name for 1-minute ASOS wind data to be merged in Stage 2
AUDIT	Optional, Repeatable	Identify variables to be audited. These are in addition to any automatically audited variable.
DATA	Mandatory, Non-repeatable, Reprocessed	Input file name of raw surface data.
EXTRACT	Mandatory, Non-repeatable	File name of extracted surface data.
LOCATION	Mandatory, Non-repeatable, Reprocessed	Site ID and location information.
NO_MISSING	Optional, Repeatable	Identifies those variables to QA and summarize the messages only; detailed message identifying the violation and date is suppressed.
QAOUT	Mandatory, Non-repeatable	File name for hourly surface data for quality assessed output/merge input.
RANGE	Optional, Repeatable, Reprocessed	Set new upper and lower bounds and missing values for QA of the variable listed.
XDATES	Mandatory, Non-repeatable	Inclusive dates identifying the period of time to extract from the archive data file.

TABLE A-6

DESCRIPTION OF KEYWORD PARAMETERS FOR THE SURFACE PATHWAY

Keyword	**Parameter(s)**	
ASOS1MIN	asos1min_filename	
where:	asos1min_filename	Filename for hourly-averaged wind speed and direction derived from 1-minute ASOS wind data (TD-6405), to be merged in Stage 2
AUDIT	sfname1 ... sfnameN	
where:	sfname1 ... ... sfnameN	Name(s) of variables that are to be tracked and reported during quality assessment (as defined in Table B-2 of Appendix B).
DATA	archive_filename file_format [ASOS]	
where:	archive_filename	The name of the file containing the archive of hourly surface observations
	file_format	Archive file format; valid parameters are: **CD144** or **SCRAM** or **SAMSON** (data retrieved from SAMSON CD-ROM) or **3280VB** and **3280FB** or **HUSWO** (data retrieved from HUSWO CD-ROM; assumes metric units) or **ISHD** (data in the full archival TD-3505 format)
	[ASOS]	Optional parameter to indicate that ISHD data are from an Automated Surface Observing System (ASOS) site. This parameter is only allowed with the ISHD file format, and instructs AERMET to apply the wind speed truncation adjustment to all hours (see Section 2.3.2). Beginning with version 11059, AERMET includes a table of ASOS commission dates, which is used to identify whether surface data input to AERMET are from an ASOS site. ***The optional 'ASOS' parameter for ISHD data should only be used if the data are known to be from an ASOS site which is not included in the ASOS station list within AERMET.*** **NOTE:** The blocking factor and data type (ASCII or EBCDIC) parameters are no longer supported by AERMET, beginning with version 11059. The default values for these parameters are 1 for blocking factor and ASCII for data type. AERMET will issue a warning message if these parameters are included on the DATA keyword.

TABLE A-6, continued

DESCRIPTION OF KEYWORD PARAMETERS FOR THE SURFACE PATHWAY

Keyword	**Parameter(s)**	
EXTRACT	extracted_data_filename	
where:	extracted_data_ filename	Name of the output file for data extracted from an archive data file
LOCATION	site_id lat(long) long(lat) [tadjust] [elevation]	
where:	site_id	Site identifier for which data are to be processed.
	lat(long)	Station latitude (or longitude) in decimal degrees with the suffix N for sites north of the equator, S for sites south of the equator (or W for sites west of Greenwich, E for sites east of Greenwich).
	long(lat)	Station longitude (or latitude) in decimal degrees with the suffix W for sites west of Greenwich, E for sites east of Greenwich (or N for sites north of the equator, S for sites south of the equator).
	[tadjust]	An integer used to convert the time reported in the database to local Standard time. For most surface databases, the value is 0. For TD-3505 (ISHD) data, which is reported in GMT, the value is the same as the time zone for the station (e.g., a value of 5 for the Eastern time zone).
	[elevation]	Station elevation (m above sea-level); default of 0m if omitted.
NO_MISSING	sfname1 . . . sfnameN	
where:	sfname1 . . . . . sfnameN	Suppresses missing data messages for the surface variables specified, as defined in Appendix B; the number of times the variable is missing is not tallied
QAOUT	qa_output_filename	
where:	qa_output_filename	Name of the output file from the QA/input to merge data
RANGE	sfname lower_bound <[=] upper_bound missing_indicator	
where:	sfname	Variable name, as defined in Table B-2
	lower_bound	Minimum value of the valid range of values for sfname
	<[=]	Exclude (<) or include (<=) the lower and upper bounds in the QA
	upper_bound	Maximum value of the valid range of values for sfname
	missing_indicator	Value to use to indicate the observed variable is missing

TABLE A-6, continued

DESCRIPTION OF KEYWORD PARAMETERS FOR THE SURFACE PATHWAY

Keyword	**Parameter(s)**	
XDATES	YB/MB/DB [TO] YE/ME/DE	
where:	YB/MB/DB	Beginning year, month and day to extract; the slash (/) between each part of the date field is required; there can be no blanks in this parameter
	[TO]	Optional; used to make this record more readable
	YE/ME/DE	Ending year, month and day to extract; the slash (/) between each part of the date field is required; there can be no blanks in this parameter

TABLE A-7

DESCRIPTION OF ONSITE PATHWAY KEYWORDS

Keyword	Type	Description
ONSITE	Mandatory, Non-repeatable	Start of ONSITE pathway.
AUDIT	Optional, Repeatable	Identify variables to be audited. These variables are in addition to any automatically audited variables.
DATA	Mandatory, Non-repeatable, Reprocessed	Input file name of site-specific data.
DELTA_TEMP	Optional, Repeatable, Reprocessed	Define heights (meters) for temperature differences.
FORMAT	Mandatory, Repeatable, Reprocessed	FORTRAN format for reading one site-specific data record.
LOCATION	Mandatory, Non-repeatable, Reprocessed	Site ID and location information.
NO_MISSING	Optional, Repeatable	Identifies those variables to QA and summarize the messages only; detailed message identifying the violation and date is suppressed.
OBS/HOUR	Optional*, Non-repeatable	Number of observations each hour. *Mandatory only if the observations are more frequent than once per hour.
OSHEIGHTS	Optional*, Repeatable, Reprocessed	Define heights of the site-specific measurements. *Mandatory if the heights are not defined in the data file.

Table A-7, continued

DESCRIPTION OF ONSITE PATHWAY KEYWORDS

Keyword	Type	Description
QAOUT	Mandatory, Non-repeatable	File name of site-specific data for quality assessment output/merge input
RANGE	Optional, Repeatable, Reprocessed	Set new upper and lower bounds and missing values for QA of the variable listed.
READ	Mandatory, Repeatable, Reprocessed	Defines the name and order of variables as they appear in the site-specific DATA file.
THRESHOLD	Mandatory, Non-repeatable, Reprocessed	Sets the minimum wind speed (meters/second) below which the wind is treated as calm.
XDATES	Optional, Non-repeatable	Inclusive dates for data processing.

TABLE A-8

DESCRIPTION OF KEYWORD PARAMETERS FOR THE ONSITE PATHWAY

Keyword	**Parameter(s)**	
AUDIT	osname1 . . . osnameN	
where:	osname1 . . . . . osnameN	Name(s) of variables, as defined in Table B-3 of Appendix B, that are to be tracked during the quality assessment
DATA	Filename	
where:	Filename	The name of the file containing the ONSITE data
DELTA_TEMP	index lower_height upper_height	
where:	index	Index for the i^{th} temperature difference measurement
	lower_height	Lower measurement height for the i^{th} temperature difference
	upper_height	Upper measurement height for the i^{th} temperature difference
FORMAT	record_index Fortran_format	
where:	record_index	Specifies the record # in the ONSITE data to which the Fortran format refers; linked to record_index on corresponding READ keyword
	Fortran_format	The Fortran format used to read the ONSITE data record: May be defined using a Fortran format specifier or as free-formatted (also called list-directed) data using the optional 'FREE' parameter (without quotes and not case-sensitive). The Fortran format specifier must include open and close parentheses and must fit within the record length of the runstream image (up to 132 characters including keyword and record index), and may include embedded spaces. Note that date variables are read as INTEGER format (Fortran 'I' format) and all other data variables are read as REAL format (Fortran 'F' or 'E' format). Using an 'F' or 'E' format specifier to read date variables or 'I' format specifier to read other data variables will cause an AERMET runtime error. See Section 2.4 for a more detailed discussion of the READ and FORMAT keywords.

TABLE A-8, continued

DESCRIPTION OF KEYWORD PARAMETERS FOR THE ONSITE PATHWAY

Keyword	**Parameter(s)**	
LOCATION	site_id lat(long) long(lat) [tadjust] [elevation]	
where:	site_id	Site identifier for which data are to be processed.
	lat(long)	Station latitude (or longitude) in decimal degrees with the suffix N for sites north of the equator, S for sites south of the equator (or W for sites west of Greenwich, E for sites east of Greenwich).
	long(lat)	Station longitude (or latitude) in decimal degrees with the suffix W for sites west of Greenwich, E for sites east of Greenwich (or N for sites north of the equator, S for sites south of the equator).
	[tadjust]	An integer used to convert the time reported in the database to local Standard time. For most onsite databases, the value is 0.
	[elevation]	Station elevation (m above sea-level); default of 0m if omitted.
NO_MISSING	osname1 . . . osnameN	
where:	osname1 . . . osnameN	Suppresses missing data messages for the ONSITE variables specified, as defined in Appendix B; the number of time the variable is missing is not tallied
OBS/HOUR	n_obs	
where:	n_obs	Number of time periods per hour the ONSITE data are reported; for example if the data are recorded every 15 minutes, then n_obs = 4. Maximum value is 12, corresponding with 5-minute averages. If OBS/HOUR is not specified, AERMET will assume 1 observation per hour.
OSHEIGHTS	height1 ... heightN	
where:	height1 . . . heightN	Heights of the ONSITE data measurements; can be used to specify heights if they are not included in the data file. Must be in ascending order from lowest to highest height. If the OSHEIGHTS keyword is specified and heights are also defined in the data file, the OSHEIGHTS input will be used and values in the data file (HT01, HT02, etc.) will be ignored. See Section 2.5 for a more detailed discussion about specifying measurement heights.

TABLE A-8, continued

DESCRIPTION OF KEYWORD PARAMETERS FOR THE ONSITE PATHWAY

Keyword	**Parameter(s)**	
QAOUT	qa_output_filename	
where:	qa_output_ filename	File name of the quality assessment output/merge input.
RANGE	osname lower_bound <[=] upper_bound missing_indicator	
where:	osname	Variable name, as defined in Table B-3.
	lower_bound	Minimum value of the valid range of values for osname.
	<[=]	Determines whether to include (<=) or exclude (<) the lower and upper bounds in the range of acceptable values Exclude (<) or include (<=) the lower and upper bounds (the endpoints) in the QA.
	upper_bound	Maximum value of the valid range of values for osname.
	missing_indicator	Value to use to indicate the value is missing.
		NOTE: Beginning with version 11059, AERMET allows the use of REAL values for lower_bound, upper_bound, and missing_indicator.
READ	record_index osname1 . . . osnameN	
where:	record_index	Links the list of variables named on this keyword statement to a Fortran format defined on a FORMAT keyword statement. While the corresponding Fortran format specifier must fit within a single record in the runstream input file (up to 132 characters total per record), multiple READ keywords can be used to list variables for a single read by repeating the same record_index.
	osname1 ... osnameN	Specifies the list and order of variables in the ONSITE data file that are to be read. See Appendix B for ONSITE variable names.
		See Section 2.4 for a more detailed discussion of the READ and FORMAT keywords.

TABLE A-8, continued

DESCRIPTION OF KEYWORD PARAMETERS FOR THE ONSITE PATHWAY

Keyword	**Parameter(s)**	
THRESHOLD	threshold_wind_speed	
where:	threshold_ wind_speed	Minimum valid wind speed for the ONSITE measurements; cannot exceed 1.0 ms^{-1}
XDATES	YB/MB/DB [TO] YE/ME/DE	
where:	YB/MB/DB	Beginning year, month and day to QA; the slash (/) between each part of the date field is required; there can be no blanks in this parameter.
	[TO]	Optional; used to make this record more readable.
	YE/ME/DE	Ending year, month and day to QA; the slash (/) between each part of the date field is required; there can be no blanks in this parameter.

TABLE A-9

DESCRIPTION OF MERGE PATHWAY KEYWORDS

Keyword	Type	Description and Usage
MERGE	Mandatory, Non-repeatable	Start of MERGE pathway.
OUTPUT	Mandatory, Non-repeatable	File identifier for merged data.
XDATES	Optional, Non-repeatable	Inclusive dates for data processing. If omitted, the earliest date found in the data is used as the beginning date and the ending date is 367 days later. However, AERMET can MERGE multi-year data files if the XDATES keyword is specified.

TABLE A-10

DESCRIPTION OF KEYWORD PARAMETERS FOR THE MERGE PATHWAY

Keyword	Parameter(s)	
OUTPUT	merged_data_filename	
where:	merged_data_filename	Name of the output file from STAGE 2.
XDATES	YB/MB/DB [TO] YE/ME/DE	
where:	YB/MB/DB	Beginning year, month and day to merge; the slash (/) between each part of the date field is required; there can be no blanks in this parameter.
	[TO]	Optional; used to make this record more readable.
	YE/ME/DE	Ending year, month and day to merge; the slash (/) between each part of the date field is required; there can be no blanks in this parameter.

TABLE A-11

DESCRIPTION OF METPREP PATHWAY KEYWORDS

Keyword	Type	Description and Usage
METPREP	Mandatory, Non-repeatable	Start of METPREP pathway.
AERSURF	Optional, Non-repeatable	Specify file name for ***primary*** surface characteristics, such as output file from AERSURFACE; contains FREQ_SECT, SECTOR, and SITE_CHAR keyword inputs.
AERSURF2	Optional, Non-repeatable	Specify file name for ***secondary*** surface characteristics, such as output file from AERSURFACE; inputs in the AERSURF2 file are interpreted as secondary site characteristics, and may contain FREQ_SECT2, SECTOR2, and SITE_CHAR2 keyword inputs, or FREQ_SECT, SECTOR, and SITE_CHAR keywords. This allows users to include data from an AERSURFACE output file as secondary site characteristics without having to edit the file to change the keywords.
DATA	Mandatory, Repeatable	Input filename of merged data.
FREQ_SECT	Mandatory, Repeatable, Reprocessed	Number of surface characteristics by wind direction sector and time period for the ***primary*** location. Must precede SECTOR and SITE_CHAR statements, and also must precede secondary site keywords, if provided.
FREQ_SECT2	Optional*, Repeatable, Reprocessed	Number of surface characteristics by wind direction sector and time period for the ***secondary*** location. Must precede SECTOR2 and SITE_CHAR2 statements.
LOCATION	OBSOLETE	The LOCATION keyword under the METPREP pathway in Stage 3 is no longer used by AERMET. Sunrise for CBL height calculations is now based on the primary surface station location in Stage 1; either the ONSITE pathway, if available, or the SURFACE pathway. A warning message will be generated if the LOCATION keyword is included under the METPREP pathway, and the inputs will be ignored.
METHOD	Process dependent*, Repeatable	Specify processing methodology used for a particular variable. * - whether or not this keyword is mandatory depends on the processing to be performed and the data in the merged data base
MODEL	Optional, Non-repeatable	Name of model for which data are processed. Default: AERMOD
NWS_HGT	Optional*, Non-repeatable	NWS instrument height, in meters, for the specified variable. * - Mandatory if METHOD REFLEVEL SUBNWS is specified

TABLE A-11, continued

DESCRIPTION OF METPREP PATHWAY KEYWORDS

Keyword	Type	Description and Usage
OUTPUT	Mandatory, Non-repeatable	File name for surface output data file.
PROFILE	Mandatory, Non-repeatable	File name for the output profile data file..
SECTOR	Mandatory, Repeatable, Reprocessed	Defines a wind direction sector in degrees for the ***primary*** location. See also FREQ_SECT and SITE_CHAR.
SECTOR2	Optional*, Repeatable, Reprocessed	Defines a wind direction sector in degrees for the ***secondary*** location. See also FREQ_SECT2 and SITE_CHAR2.
SITE_CHAR	Mandatory, Repeatable, Reprocessed	Define the direction-dependent surface characteristics of albedo, Bowen ratio, and surface roughness length (meters) for the ***primary*** location. See also FREQ_SECT and SECTOR.
SITE_CHAR2	Optional*, Repeatable, Reprocessed	Define the direction-dependent surface characteristics of albedo, Bowen ratio, and surface roughness length (meters) for the ***secondary*** location. See also FREQ_SECT2 and SECTOR2.
UAWINDOW	Optional, Non-repeatable	Specifies the time window to use for selecting upper air sounding.
XDATES	Optional, Non-repeatable	Inclusive dates for data processing.

* Surface characteristics for the ***secondary*** site are required for applications with ONSITE data and the REFLEVEL SUBNWS option under the METHOD keyword to substitute for missing ONSITE wind data.

TABLE A-12

DESCRIPTION OF KEYWORD PARAMETERS FOR THE METPREP PATHWAY

Keyword	**Parameter(s)**	
AERSURF	primary_surfchar_filenam	*(for primary surface data location)*
AERSURF2	secondary_surfchar_filenam	*(for optional secondary surface data location)*
where:	primary_surfchar_filenam	The name of the file containing the surface characteristic inputs for the ***primary*** surface data location (FREQ_SECT, SECTOR, and SITE_CHAR keywords)
	secondary_surfchar_filenam	The name of the file containing the surface characteristic inputs for the ***secondary*** surface data location (FREQ_SECT2, SECTOR2, and SITE_CHAR2 keywords)
DATA	merged_data_filename	
where:	merged_data_filename	The name of the file containing the merged NWS and, if any, site-specific data
FREQ_SECT	frequency number_of_sectors	*(for primary surface data location)*
FREQ_SECT2	frequency number_of_sectors	*(for optional secondary surface data location)*
where:	frequency	Specifies how often the surface characteristics change; valid parameters are: **MONTHLY** - every calendar month **SEASONAL** - where the seasons are defined as: Spring = March, April, May Summer = June, July, August Autumn = September, October, November Winter = December, January, February **ANNUAL** - constant for the entire year
	number_of_sectors	Specifies the number of wind direction sectors by which the surface characteristics vary
LOCATION	**LOCATION keyword under the METPREP pathway is obsolete – inputs are ignored!**	

TABLE A-12, continued

DESCRIPTION OF KEYWORD PARAMETERS FOR THE METPREP PATHWAY

Keyword	**Parameter(s)**	
METHOD	atmos_variable option	
where:	atmos_variable	Identifies the variable that will be processed: **UASELECT** – selecting upper air sounding. **WIND_DIR** – processing of NWS wind directions. **REFLEVEL** – substitution of NWS data **STABLEBL** – specify option for SBL processing **ASOS_ADJ** – adjustment of ASOS wind speeds for truncation
	option	Processing options: For **UASELECT**, valid parameters are: **SUNRIS(E)** – select upper air sounding based on local sunrise For **WIND_DIR**, valid parameters are: **NORAND** – leaves NWS wind directions to the nearest 10º (default) or **RANDOM** – randomize NWS wind directions. For **REFLEVEL**, valid parameters are: **SUBNWS** – allows substitution of NWS data for missing onsite wind and/or temperature data (other parameters are automatically substituted); NOTE: this option **must** be used if no onsite data are provided. For **STABLEBL**, valid parameters are: **BULKRN** – Bulk Richardson Number - This option requires onsite measurements of temperature difference. For **ASOS_ADJ**, valid parameters are: **NO_ADJ** – do not adjust ASOS wind speeds for truncation.
MODEL	model_name	
where:	model_name	Name of the dispersion model which uses the output files generated by AERMET. Allowable names are: **AERMOD**

TABLE A-12, continued

DESCRIPTION OF KEYWORD PARAMETERS FOR THE METPREP PATHWAY

Keyword	**Parameter(s)**	
NWS_HGT	variable_name instrument_height	
where:	variable_name	Weather variable that requires an instrument height to be defined; valid names are: WIND (to specify anemometer height)
	instrument_height	Height of the instrument above ground, in meters.
OUTPUT	parameter_filename	
where:	parameter_ filename	Name of the output file from STAGE 3, with one record per hour
PROFILE	profile_filename	
where:	profile_name	Name of the output file containing multi-level onsite data, or single level wind and temperature data from NWS site
SECTOR	sector_index beginning_direction ending_direction	*(for primary data location)*
SECTOR2	sector_index beginning_direction ending_direction	(*for optional secondary data location)*
where:	sector_index	Index that links a specific set of site characteristics to a specific wind sector.
	beginning_ direction	Specifies the beginning wind direction of the sector, and is considered a part of this sector.
	ending_direction	Specifies the ending wind direction of the sector, and is NOT considered a part of the sector NOTE: the end of one sector must be the same as the beginning of the next sector.

TABLE A-12, continued

DESCRIPTION OF KEYWORD PARAMETERS FOR THE METPREP PATHWAY

Keyword	**Parameter(s)**	
SITE_CHAR	frequency_index sector_index albedo Bowen roughness *(for primary data location)*	
SITE_CHAR2	frequency_index sector_index albedo Bowen roughness *(for secondary data location)*	
where:	frequency_index	Index of the time period for which the surface characteristics apply; for **ANNUAL** on FREQ_SECT keyword, valid values: 1 (for the entire year) for **MONTHLY** on FREQ_SECT keyword, valid values: 1 ... 12 (corresponding to each month of the year) for **SEASONAL** on FREQ_SECT keyword, valid values: 1 = Winter = December, January, February 2 = Spring = March, April, May 3 = Summer = June, July, August 4 = Autumn = September, October, November
	sector_index	Sector corresponding to direction from which the wind is blowing.
	albedo	Albedo for the frequency index and sector index specified.
	Bowen	Bowen ratio for the frequency index and sector index specified.
	roughness	Surface roughness for the frequency index and sector index specified.
UAWINDOW	window_begin window_end	
where:	window_begin	Beginning of the sounding window, entered as the number of hours relative to the preferred sounding time (12Z, 00Z or -12Z for the default selection; or local sunrise for the UASELECT SUNRIS option)
	window_end	Ending of the sounding window entered as the number of hours relative to the preferred sounding time NOTE: A negative number indicates the number of hours before the reference sounding (or sunrise), and a positive number indicates the number of hours after the sounding (or sunrise)
XDATES	YB/MB/DB [TO] YE/ME/DE	
where:	YB/MB/DB	Beginning year, month and day to process; a slash (/) between each part of the date field is required; with no blanks
	[TO]	Optional; used to make this record more readable
	YE/ME/DE	Ending year, month and day to process; a slash (/) between each part of the date field is required; with no blanks

APPENDIX B. VARIABLE NAMES AND DEFAULT QA VALUES

This appendix lists the variable names for each type of data and provides a short description of and the units for each variable, and gives the default bounds and missing value codes. This information is presented in the tables (Tables B-1, B-2, B-3a, and B-3b) that follow, with each table divided into the following fields:

Variable Name

This is the four-character name that can be used on RANGE, AUDIT, and READ statements. An asterisk (*) indicates that the variable is automatically included in the QA for the path and need not be specified on an AUDIT record in the control file.

Description and Units

A brief description of each variable and the units follow the name. For UPPERAIR and SURFACE, real variables are stored as integers, in which case the units include a multiplier, such as *10 or *100, in order to maintain additional significant digits. For example, if the units are °C*10, then 1.5 °C is stored and referenced as 15.

Type of Check

The type of check determines whether to include (<=) or exclude (<) the lower and upper bounds in the range of acceptable values, and can be changed on a RANGE statement for specific variables.

Missing Value Code

The missing value code is the value that AERMET interprets to mean that a value is not present. It is also the value written/stored by AERMET when the variable is not present or cannot be calculated.

Bounds

The last two fields are the lower and upper bounds that determine the interval of acceptable values. The value of the variable is accepted if it lies within this interval, where the endpoints are either included or excluded according to the Type of Check. Note that the multiplier, if present, must also be applied to these values.

TABLE B-1

VARIABLE AND QA DEFAULTS FOR THE UPPERAIR VARIABLES

Variable Name	Description	Units	Type*	Missing Indicator	Lower Bound	Upper Bound
UAPR	Atmospheric pressure	millibars*10	<	99999	5000	10999
UAHT	Height above ground	meters	<=	99999	0	5000
UATT	Dry bulb temperature	ºC*10	<	9990	350	+350
UATD	Dew point temperature	ºC*10	<	9990	350	+350
UAWD	Wind direction	degrees from north	<=	999	0	360
UAWS	Wind speed	meters/second *10	<	9990	0	500
UASS	Wind speed shear	(m/s)/(100 meters)	<=	9999	0	5
UADS	Wind direction shear	degrees/(100 meters)	<=	9999	0	90
UALR	Temperature lapse rate	ºC/(100 meters)	<=	9999	2	5
UADD	Dew point deviation	ºC/(100 meters)	<=	9999	0	2

* Type determines whether to include (<=) or exclude (<) the lower and upper bounds in the range of acceptable values, and can be changed on a RANGE statement.

TABLE B-2

VARIABLE AND QA DEFAULTS FOR THE SURFACE VARIABLES

Variable Name	Description	Units	Type	Missing Indicator	Lower Bound	Upper Bound
PRCP	Precipitation amount	millimeters*100	<=	-9	0	25400
SLVP[†]	Sea level pressure	millibars*10	<	99999	9000	10999
PRES	Station pressure	millibars*10	<	99999	9000	10999
CLHT	Ceiling height	kilometers*10	<=	999	0	300
TSKC	Total//opaque sky cover	tenths//tenths	<=	9999	0	1010
ALC1[a]	Sky cond//height, level 1	code//hundredths ft	<=	09999	0	07300
ALC2[a]	Sky cond//height, level 2	code//hundredths ft	<=	09999	0	07300
ALC3[a]	Sky cond//height, level 3	code//hundredths ft	<=	09999	0	07300
ALC4[b]	Sky cond//height, level 4	code//hundredths ft	<=	09999	0	07850
ALC5[b]	Sky cond//height, level 5	code//hundredths ft	<=	09999	0	07850
ALC6[b]	Sky cond//height, level 6	code//hundredths ft	<=	09999	0	07850
PWVC	Present weather (vicinity)		<=	9999	0	9800
PWTH	Precipitation type		<=	9999	0	9800
ASKY[c]	ASOS Sky condition	tenths	<=	99	0	10
ACHT[d]	ASOS Ceiling	kilometers*10	<=	999	0	888
HZVS	Horizontal visibility	kilometers*10	<=	99999	0	1640
TMPD[*]	Dry bulb temperature	ºC*10	<	999	-300	360
TMPW	Wet bulb temperature	ºC*10	<	999	-650	350
DPTP	Dew-point temperature	ºC*10	<	999	-650	350
RHUM	Relative humidity	whole percent	<=	999	0	100
WDIR[*]	Wind direction	tens of degrees	<=	999	0	36
WSPD[*]	Wind speed	meters/second*10	<=	999	0	500

[*] Automatically included in audit report.

[†] A value < 800 in CD144 files is converted to SLVP/10.0 + 1000.0

// The two variables have been combined to form one variable; the missing value flags, as well as the upper and lower bounds have also been concatenated.

[a] ASOS sky condition (code table) and height (hundredths of feet) for levels 1-3

[b] ASOS sky condition (code table) and height (hundredths of feet) for levels 4-6 (for augmented sites)

[c] ASOS sky condition (tenths), derived from layer data.

[d] ASOS ceiling (kilometers *10), derived from layer data.

TABLE B-3a

VARIABLE AND QA DEFAULTS FOR THE ONSITE (SITE-SPECIFIC)
SINGLE-VALUE AND DATE/TIME VARIABLES

Variable Name	Description	Units	Type*	Missing Indicator	Lower Bound	Upper Bound
HFLX	Surface heat flux	watts/square meter	<	-999	-100	800
USTR	Surface friction velocity	meters/second	<	-9	0	2
MHGT	Mixing height	meters	<	9999	0	4000
ZOHT	Surface roughness length	meters	<	999	0	2
SAMT	Snow amount	centimeters	<=	999	0	250
PAMT	Precipitation amount	centimeters	<=	999	0	25
INSO	Insolation	watts/square meter	<=	9999	0	1250
NRAD	Net radiation	watts/square meter	<	999	-100	800
DT01	Temperature diff.(U - L)[1]	°C	<	9	-2	5
DT02	Temperature diff.(U - L)[1]	°C	<	9	-2	5
DT03	Temperature diff.(U - L)[1]	°C	<	9	-2	5
US01	User's scalar #1	user's units	<	999	0	100
US02	User's scalar #2	user's units	<	999	0	100
US03	User's scalar #3	user's units	<	999	0	100
PRCP	Precipitation	millimeters*100	<=	-9	0	25400
SLVP	Sea level pressure	millibars*10	<	99999	9000	10999
PRES	Station pressure	millibars*10	<	99999	9000	10999
CLHT	Ceiling height	kilometers*10	<=	999	0	300
TSKC	Sky cover (total or opaque)	tenths	<=	99	0	10
OSDY	Day		<=	-9	1	31
OSMO	Month		<=	-9	1	12
OSYR	Year		<=	-9	0	99
OSHR	Hour		<=	-9	0	24
OSMN	Minutes		<=	-9	0	60

[1](U - L) indicates (upper level) - (lower level).

* Type determines whether to include (<=) or exclude (<) the lower and upper bounds in the range of acceptable values, and can be changed on a RANGE statement.

Note: Shaded parameters are not currently used in AERMET.

TABLE B-3b

VARIABLE AND QA DEFAULTS FOR THE ONSITE (SITE-SPECIFIC) MULTI-LEVEL VARIABLES

Variable Name	Description	Units	Type	Missing Indicator	Lower Bound	Upper Bound
HTnn	Height	meters	<	9999	0	4000
SAnn	Std. dev. horizontal wind	degrees	<	99	0	35
SEnn	Std. dev. vertical wind	degrees	<	99	0	25
SVnn	Std. dev. v-comp. of wind	meters/second	<	99	0	3
SWnn	Std. dev. w-comp. of wind	meters/second	<	99	0	3
SUnn	Std. dev. u-comp. of wind	meters/second	<	99	0	3
TTnn*	Temperature	°C	<	99	-30	40
WDnn*	Wind direction	degrees from north	<=	999	0	360
WSnn*	Wind speed	meters/second	<=	99	0	50
VVnn	Vertical wind component	meters/second	<	999	0	5
DPnn	Dew-point temperature	°C	<	99	-65	35
RHnn	Relative humidity	whole percent	<=	999	0	100
V1nn	User's vector #1	user's units	<	999	0	100
V2nn	User's vector #2	user's units	<	999	0	100
V3nn	User's vector #3	user's units	<	999	0	100

'nn' in variables HT to V3 refers to the level at which the observation was taken; e.g., TT01 is the temperature at the first level and WS02 is wind speed at the second level.

*Automatically included in audit report.

Note: Shaded parameters are not currently used in AERMET.

APPENDIX C. DATA FILE FORMATS

This appendix describes the format of the data files created by AERMET. This includes the EXTRACT and QA files of NWS upper air and surface data, the merged file, and the OUTPUT and PROFILE files that will be input to AERMOD. It does not describe the QA file for site-specific data since this file is written with the same user-specified format used to read the original site-specific file.

The format of the files is given in terms of the FORTRAN READ statements that must be used to input the data for each observation. Variable names shown in capital letters correspond to those given in Appendix B. Variable names shown in lower case italics are "local" variables that do not correspond to any in Appendix B.

C.1 UPPER AIR SOUNDINGS

Each upper air sounding in both the EXTRACT and QA files is composed of two parts: (1) an identifying header record consisting of the year, month, day, hour, and the number of sounding levels; and (2) a sounding record composed of pressure, height above ground level, temperature, dew-point temperature, wind speed, and wind direction, which is repeated for each level.

Upper air header record:

READ( )	*year, month, day, hour, # levels*
FORMAT	(1X, 4I2, I5)

where *hour* is expressed in local standard time (LST) and *# levels* is the number of levels in this sounding. If no soundings were extracted or there are no levels to the data, then *# levels* is zero.

Upper air sounding level data (if *# levels* > 0), repeated # *levels* times.

READ( ) UAPR, UAHT, UATT, UATD, UAWD, UAWS
FORMAT (6(1X,I6))

where UAPR = atmospheric pressure (millibars), multiplied by 10
UAHT = height above ground level (meters)
UATT = dry bulb temperature (°C), multiplied by 10
UAWD = wind direction (degrees from north)
UAWS = wind speed (meters/second), multiplied by 10

All values on the upper air pathway are written as integers. Several of the values were multiplied by 10, as noted above, to retain one significant digit after the decimal point prior to rounding the result to the nearest whole number. The values are divided by 10 prior to any usage in Stage 3.

C.2 SURFACE OBSERVATIONS

Each hourly surface observation in both the EXTRACT and QA files is written as two records. As with the upper air data, all values are reported as integers with several variables multiplied by 10 or 100 to retain significant digits. Several of the variables are two variables combined and stored as one integer value. These are recognized by the // in the variable name and units below.

The first record of a surface observation is written as follows:

READ( ) *year, month, day, hour*, PRCP, SLVP, PRES, CLHT, TSKC, C2C3,
CLC1, CLC2, CLC3, CLC4
FORMAT (1X, 4I2, 4(1X,I5), 6(1X,I5.5))

where *hour* = hour in LST

PRCP = precipitation amount (millimeters), multiplied by 1000

SLVP = sea level pressure (millibars), multiplied by 10

PRES = station pressure (millibars), multiplied by 10

CLHT = cloud ceiling height (kilometers), multiplied by 10

TSKC = sky cover, total//opaque (tenths//tenths)

C2C3 = sky cover, 2//3 layers (tenths//tenths)

CLC*n* = sky condition//coverage, layer *n* = 1,2,3,4 (- -//tenths)

The second record of a surface observation is written as follows:

READ( )	CLT1, CLT2, CLT3, CLT4, PWTH, HZVS, TMPD, TMPW, DPTP, RHUM, WDIR, WSPD, ASOSFLG
FORMAT	(8X, 5(1X,I5.5), 7(1X,I5),2X,A1)

where CLT*n* = cloud type//height, *n*=1,2,3,4 (- -//kilometers), multiplied by 10

PWTH = present weather, liquid//frozen (no units, see codes below)

HZVS = horizontal visibility (kilometers), multiplied by 10

TMPD = dry bulb temperature (°C), multiplied by 10

TMPW = wet bulb temperature (°C), multiplied by 10

DPTP = dew-point temperature (°C), multiplied by 10

RHUM = relative humidity (percent)

WDIR = wind direction (tens of degrees from north)

WSPD = wind speed (meters/second), multiplied by 10

ASOSFLG = flag indicating whether observation is ASOS ('A') or non-ASOS ('N')

All reports of sky conditions (CLC*n*), cloud types or obscuring phenomena (CLT*n*) and present weather (PWTH) are stored using the TD-3280 numeric codes. This requires converting the appropriate variables in the CD-144 formatted file as a part of the extraction process. Since SCRAM uses the same convention, this discussion applies to that format as well. The following

tables relate the TD-3280 codes to the CD-144 codes. Overpunch characters in the tables below for the CD-144 formats are represented by an ASCII character, which also appears in the data file. An "n.e." indicates that there is "no equivalent" in the CD-144 format. Only weather producing liquid and/or frozen precipitation are reported in the PWTH variable.

TABLE C-1

SKY CONDITIONS

TD-3280	CD-144	Description of Sky Conditions
00	0	clear or less than 0.1 coverage
01	1	thin scattered 0.1 to 0.5 coverage
02	2	scattered 0.1 to 0.5 coverage
03	4	thin broken 0.6 to 0.9 coverage
04	5	broken 0.6 to 0.9 coverage
05	7	thin overcast 1.0 coverage
06	8	overcast 1.0 coverage
07	X or -	obscuration 1.0 coverage
08	Blank	partial obscuration <1.0 coverage
09		unknown

TABLE C-2

CLOUD TYPES

TD-3280	CD-144	Description of Cloud Types
00	0	none
11	4	cumulus
12	n.e.	towering cumulus
13	K	stratus fractus
14	n.e.	stratus cumulus lenticular
15	3	stratus cumulus
16	2	stratus
17	M	cumulus fractus
18	5	cumulonimbus
19	N	cumulonimbus mammatus
21	6	altostratus
22	O	nimbostratus
23	7	altocumulus
24	n.e.	altocumulus lenticular
28	P	altocumulus castellanus
29	n.e	altocumulus mammatus
32	8	cirrus
35	n.e.	cirrocumulus lenticular
37	9	cirrostratus
39	R	cirrocumulus

TABLE C-3

OBSCURING PHENOMENA

TD-3280	CD-144 (cols. 30, 31)	Description of Obscuring Phenomena
01	6	blowing spray
03	3	smoke and haze
04	1	smoke
05	2	haze
06	4	dust
07	4	blowing dust
30	5	blowing sand
36	5	blowing snow
44	3	ground fog
45	1	fog
48	2	ice fog
50	n.e.	drizzle
60	n.e.	rain
70	n.e.	snow
76	n.e.	ice crystals
98	X or -	obscuring phenomena other than fog (prior to 1984)

The code definitions for present weather conditions (PWTH) are presented below. They are divided into nine general categories that are subdivided into specific weather conditions. Dashes in a field indicate that there is no definition for that code. The 8-digit CD-144 format for weather conditions is converted to the 2-digit TD-3280 categories. Up to two different types of weather may be stored in the PWTH variable in AERMET; however, only weather producing liquid (codes 20-39) and/or frozen (codes 40-69) precipitation are retained in the PWTH variable as liquid//frozen precipitation. The SAMSON codes for present weather are identical to the TD-3280 codes.

TABLE C-4

PRESENT WEATHER

TD-3280	CD-144 (col. 24)	Thunderstorm, Tornado, Squall
10	1	thunderstorm - lightning and thunder
11	2	severe thunderstorm - frequent intense lightning and thunder
12	3	report of tornado or water spout
13	5	light squall
14	n.e.	moderate squall
15	n.e.	heavy squall
16	n.e.	water spout
17	n.e.	funnel cloud
18	n.e.	tornado
19	n.e.	unknown
TD-3280	CD-144 (col. 25)	Rain, Rain Shower, Freezing Rain
20	1	light rain
21	2	moderate rain
22	3	heavy rain
23	4	light rain showers
24	5	moderate rain showers
25	6	heavy rain showers
26	7	light freezing rain
27	8	moderate freezing rain
28	9	heavy freezing rain
29	n.e.	unknown
TD-3280	CD-144 (col. 26)	Rain Squall, Drizzle, Freezing Drizzle
30	n.e.	light rain squalls
31	n.e.	moderate rain squalls
32	n.e	heavy rain squalls
33	4	light drizzle
34	5	moderate drizzle
35	6	heavy drizzle
36	7	light freezing drizzle
37	8	moderate freezing drizzle
38	9	heavy freezing drizzle
39	n.e.	unknown

TABLE C-4, continued

PRESENT WEATHER

TD-3280	CD-144 (col. 27)	Snow, Snow Pellets, Ice Crystals
40	1	light snow
41	2	moderate snow
42	3	heavy snow
43	4	light snow pellets
44	5	moderate snow pellets
45	6	heavy snow pellets
46	n.e.	light snow crystals
47	8	moderate snow crystals
48	n.e.	heavy snow crystals
49	n.e.	unknown
TD-3280	CD-144 (col 28)	Snow Shower, Snow Squalls, Snow Grains
50	1	light snow showers
51	2	moderate snow showers
52	3	heavy snow showers
53	n.e.	light snow squalls
54	n.e.	moderate snow squalls
55	n.e.	heavy snow squalls
56	7	light snow grains
57	8	moderate snow grains
58	9	heavy snow grains
59	n.e.	unknown
TD-3280	CD-144 (col. 29)	Sleet, Sleet Shower, Hail
60	n.e.	light ice pellet showers
61	n.e.	moderate ice pellet showers
62	n.e.	heavy ice pellet showers
63	n.e.	light hail
64	5	moderate hail
65	n.e.	heavy hail
66	8	light small hail
67	n.e.	moderate small hail
68	n.e.	heavy small hail
69	n.e.	unknown

TABLE C-4, continued

PRESENT WEATHER

TD-3280	CD-144 (col. 30)	Fog, Blowing Dust, Blowing Sand
70	1	fog
71	2	ice fog
72	3	ground fog
73	4	blowing dust
74	5	blowing sand
75	n.e.	heavy fog
76	n.e.	glaze
77	n.e.	heavy ice fog
78	n.e.	heavy ground fog
79	n.e.	unknown
TD-3280	CD-144 (col. 31)	Smoke, Haze, Blowing Snow, Blowing Spray, Dust
80	1	smoke
81	2	haze
82	3	smoke and haze
83	4	dust
84	5	blowing snow
85	6	blowing spray
86	n.e.	dust storm
87		- -
88		- -
89	n.e.	unknown
TD-3280	CD-144 (col. 29)	Ice Pellets, Hail Showers, Small Hail/Snow Pellet Showers, Fog
90	1	light ice pellets
91	2	moderate ice pellets
92	3	heavy ice pellets
93		hail showers (begins July 1996)
94		small hail/snow pellet showers (begins7/96)
95		partial fog (begins 7/96)
96		patches fog (begins 7/96)
97		low drifting snow (begins 7/96)
98		- -
99	n.e.	unknown

C.3 MERGE OUTPUT

The merged data file contains a block of records that are the cumulative header records of all input files to Stage 2. These records are followed by blocks of records for each day of observations. Each block of records contains a header record identifying how many records there are in the block for each of the three types of data present. Each block is subdivided into three blocks of records, where each sub-block contains all of the observations for that day for a particular type of data.

The records within a block are written with an 8(I8,1X) format, except for the multi-level site-specific records that are written with a 6(F14.6,1X) format. The 22 NWS surface variables, plus the date and time, for each hour are split across four records. Also, if there are more than eight single-level or six multi-level variables on a particular READ statement, then these records will also be divided across more than one record.

Daily Master Header Record

READ( )	*year, month, day, j_day, n_ua, n_sfc, n_os*
FORMAT	(7(I8,1X))

where *j_day* = the Julian date for *year/month/day*.
n_ua = number of NWS upper air observations.
n_sfc = number of NWS surface observations.
n_os = number of site-specific observations.

Upper Air Records

Upper air data are stored in the same order as in upper air extract/QA files (see D.1).

Surface Records

For each hour, there is a header record with the year, month, day and hour followed by three data records. The 22 variables are written in the same order as shown in D.2, with a maximum of 8 variables per record.

Site-specific Records

Single-level Variables

These are written in the same order and on multiple records just as they were given on the READ statements, but using an 8(I8,1x) format instead of that given on the corresponding FORMAT statements.

Multi-level Variables

Like the single-level variables, these are also written in the same order and on multiple records just as they were given on the READ statements, but using a 6(F14.6,1x) format.

C.4 AERMOD FILES

Two files are produced for input to the AERMOD dispersion model. The surface OUTPUT contains observed and calculated surface variable, one record per hour. The PROFILE file contains the observations made at each level of a site-specific tower, or the one level observations taken from NWS data, one record per level per hour. The contents of these files can also be written to the general report by including a LIST statement in the METPREP block.

SURFACE OUTPUT

Header record:

READ( ) *latitude, longitude, UA identifier, SF identifier, OS identifier, Version date*

FORMAT (2(2X,A8), 8X,' UA_ID: ',A8, ' SF_ID: ',A8, ' OS_ID: ',A8, T85, 'VERSION:', A6)

where *latitude* = latitude specified in Stage 1 for primary surface station

longitude = longitude specified in Stage 1 for primary surface station

UA identifier = station identifier for upper air data; usually the WBAN number used to extract the data from an archive data set

SF identifier = station identifier for hourly surface observations; usually the WBAN number used in extracting the data

OS identifier = site-specific identifier

Version date = AERMET version date; this date also appears in the banner on each page of the summary reports

Note that the ' ??_ID: ' fields in the FORMAT statement above include two spaces before the 2-character pathway ID and one space after the colon.

Data records:

READ( ) *year, month, day, j_day, hour, H, u_* , w_* , VPTG, Zic, Zim, L, z_o , B_o , r, W_s , W_d , z_{ref} , temp, z_{temp}, ipcode, pamt, rh, pres, ccvr, WSADJ*

FORMAT (3(I2,1X), I3,1X, I2,1X, F6.1,1X, 3(F6.3,1X), 2(F5.0,1X), F8.1,1X, F7.4,1X, 2(F6.2,1X), F7.2,1X, F5.0, 3(1X,F6.1), 1X,I5, 1X,F6.2, 2(1X, F6.0), 1X, I5, 1X, A7)

where *j_day* = Julian day

H = sensible heat flux (W/m^2)

u_* = surface friction velocity (m/s)

w_* = convective velocity scale (m/s)

VPTG = vertical potential temperature gradient above *Zic* (K/m)

Zic = height of convectively-generated boundary layer (m)

Zim = height of mechanically-generated boundary layer (m)

L = Monin-Obukhov length (m)

z_0	=	surface roughness length (m)
B_0	=	Bowen ratio
r	=	Albedo
W_s	=	reference wind speed (m/s)
W_d	=	reference wind direction (degrees)
z_{ref}	=	reference height for wind (m)
temp	=	reference temperature (K)
z_{temp}	=	reference height for temperature (m)
ipcode	=	precipitation type code (0=none, 11=liquid, 22=frozen, 99=missing)
pamt	=	precipitation amount (mm/hr)
rh	=	relative humidity (percent)
pres	=	station pressure (mb)
ccvr	=	cloud cover (tenths)
WSADJ	=	wind speed adjustment and data source flag

When site-specific data are included in the data base, the definition of the reference height wind speed and direction are subject to the following restrictions:

- the wind speed, W_s, must be greater than or equal to the site-specific data threshold wind speed;
- the measurement height must be at or above $7*z_0$, where z_0 is the surface roughness length;
- the height must be less than or equal to 100 meters;

If AERMET is run only with NWS data, i.e. no site-specific data are in the data base, then the restrictions above do not apply and the reference winds are taken to be the NWS winds independent of the height at which the winds were measured.

Ambient air temperature is subject to a similar, but less restrictive, selection process:

- the measurement height must be above z_0; and
- the height must be less than or equal to 100 meters.

PROFILE OUTPUT

READ( ) *year, month, day , hour*, height, top, WD*nn*, WS*nn*, TT*nn*, SA*nn*, SW*nn*

FORMAT (4(I2,1X), F7.1,1X, I1,1X, F7.1,1X, F8.2,1X, F8.2,1X, F8.2,1X, F8.2)

where, height = measurement height (m)
top = 1, if this is the last (highest) level for this *hour*, or 0 otherwise
WD*nn* = wind direction at the current level (degrees)
WS*nn* = wind speed at the current level (m/s)
TT*nn* = temperature at the current level (°C)
SA*nn* = σ_θ (degrees)
SW*nn* = σ_w (m/s)

APPENDIX D. SUMMARY OF MESSAGES

During the processing of the runstream input and data files, AERMET writes messages to the file defined through the MESSAGES keyword on the JOB pathway. Each message has the form:

n block a1n1n2 ssssss: message

where

n	= counter, date (in the form yymmdd), or blank
block	= program block name
a1n1n2	= message code
ssssss:	= subroutine name in which the message was generated
message	= message (limited to 48 characters)

The counter *n* is either the sequence number of the keyword statement generating the message, zero when irrelevant, the Julian day plus the hour of an observation with a QA violation or the number of observations when processing is completed. If it is a sequence number, it may be relative to either the current runstream file or to the header statements of a file.

The message code is composed of a letter (a1) and a 2 digit code (n1n2). The letter can be one of the following:

E Indicates a fatal error; if the error occurs during processing of keyword statements, the remaining statements are processed for syntax only. If the error occurs during the processing of data, processing ceases for the run.

W Indicates a potential problem that the user should check. Runstream and data processing continues.

I Provides information on the status of the processing; these messages report on the progress of an AERMET run.

Q Indicates a quality assessment violation; a value for a variable was either outside the interval defined by the upper and lower bounds or it was missing.

The 2 digit codes are grouped into general categories corresponding to the processing in Stages 1, 2, and 3. These categories are:

00 – 29	Input statement processing, file header and general processing that is applicable to all pathways;
30 – 39	Upper air sounding processing (Stage 1);
40 – 49	Surface observation processing (Stage 1);
50 – 59	On-site observation processing (Stage 1);
60 – 69	Merge processing (Stage2);
70 – 89	Stage 3 processing

These codes only provide an indication of the processing (runstream or data) that was occurring. They cannot completely specify the reason for the message. Further explanation is left to the 48 character message.

D.1 INTERPRETING ERROR MESSAGES

AERMET can generate many messages in a single run. This section discusses the interpretation of a few of the error messages.

Anyone who has written software knows that a single syntax error in the source code can generate several error messages when the program is compiled. AERMET also may generate several error messages for an error in a runstream. The following is an example of such a situation that could occur in defining the surface characteristics in Stage 3.

Runstream fragment for the METPREP pathway:

```
FREQ_SECT    ANNUAL       1
SECTOR                    1      0      360
CHARS              1      1      0.250 0.750 0.006
```

The message file would contain something like:

```
16    METPREP     E03   ST3SET:     KEYWORD UNKNOWN:  CHARS
      METPREP     I19   ST3SET:     "END OF FILE" ON UNIT 5 AFTER RECORD #
      16

      METPREP     E29   MPTEST:     EXPECTED 1 SITE_CHAR KEYWORD; 0 PROCESSED
      METPREP     E29   MPTEST:     ERROR FOR PERIOD 1, SECTOR 1
```

The correct keyword was not used to define the surface characteristics: CHARS instead of SITE_CHAR. As each runstream record is processed, AERMET checks to make sure that it conforms to all the rules of syntax. The first message indicates that an unknown keyword was detected (by subroutine ST3SET) at record 16 in the runstream. Once the runstream is completely processed, as noted by the "END OF FILE" message, AERMET checks to be sure it has enough information to process the data. It is during this portion of the setup processing, in subroutine MPTEST, that AERMET detects additional problems. Based on the FREQ_SECT keyword, AERMET expected a single SITE_CHAR keyword (annual, one sector covering all wind directions) to define the surface characteristics, but it did not find any valid SITE_CHAR keywords (third message). The final message indicates that there was some kind of error with the first period for sector 1 and is tied to the third message.

One might argue that the number of error messages is excessive for such a minimal configuration for the surface characteristics. Remember that there can be up to 12 SECTOR keywords and 144 SITE_CHAR keywords, so AERMET provides the user with additional information to assist in identifying the exact location of the problem.

Another error that causes multiple error messages occurs when a pathway is misspelled. Depending on the location in the runstream, AERMET reports it as an unknown pathway/keyword (the syntax and structure of the runstream makes it impossible to determine which). Since the pathway is not correctly defined, the keywords that follow it would be reported as invalid for the previous pathway.

Another error that a user could introduce is a misspelling of an input data file name. AERMET opens and processes file headers, if any, before processing any data. If a nonexistent

file is opened, the file is created and is 0 bytes long. If there is critical information that is to be reprocessed from the header records of the correctly spelled file, then AERMET will not find that information in the incorrectly spelled file and report an error. Unfortunately, the message resulting from such an error is misleading. There is no way to recognize a 'zero-length' file using ANSI-standard Fortran at the point AERMET checks for sufficient information to process the data. For example, in merging data, if the input file name for the site-specific data (specified on the keyword QAOUT) is misspelled, then AERMET creates the (misspelled) file, reads from the file (and immediately encounters an end of file), and reports that there are no READ/FORMAT keywords to define the data structure.

Most error messages are reasonably straightforward to interpret. However, from these few examples, one can see that is may take a little more than a casual glance at the message file if AERMET detects any errors during setup.

In the discussion of the error messages, the term >decode= (or a variant) is used. In Fortran, this term means that the program is translating data and transferring data between variables in internal storage rather than transferring data from an external file to variables. The term >internal read= may also be seen in this context.

D.2 RUNSTREAM AND FILE HEADER PROCESSING, 00 – 29

Any messages that pertain to the setup of a run are included in this category.

ERRORS

E00 Reserved - this code is used to report internal programming errors.

E01 AERMET was not able to read a record in the runstream.

E02 Error defining the pathway - the conditions that may result in this error are:
1) Subr.FDPATH, in a call to subr.GETWRD, was not able to determine the pathway for the runstream record number indicated;
2) Invalid pathway for the stage of processing;

3) Duplicate pathway specified.

The message identifies which condition was encountered.

E03 Error defining a keyword - the conditions that may result in this error are:

1) The keyword did not match any of the 26 keywords recognized by AERMET. This error is independent of pathway;
2) The keyword is not valid for the pathway;
3) The keyword was duplicated for the pathway; only selected keywords are repeatable.

The message identifies which condition was encountered. See the tables in Appendix A for the list of keywords by pathway.

E04 Incomplete or superfluous information for a keyword. See the tables in Appendix A for the syntax of the keyword.

E05 <not used>

E06 The parameter associated with a keyword is in error. This error can be generated for multiple reasons. For example, if AERMET could not match a variable name on a keyword with the list of valid variable names, then this error code is used. Also, if AERMET has a 'decoding' error, then this code is used. A parameter on a keyword statement is not within bounds, is not known, or does not match any of the valid secondary keywords or parameters for this keyword.

E07 An error occurred in subroutine GETWRD or an error condition was returned to the calling routine. This subroutine retrieves the value of a field, whether it be a pathway, keyword, or parameter field, for additional processing.

E08 Error opening a file or the file name was previously specified for another file that is already open.

E12 Processing cannot be completed because a required keyword statement for the specified block is either missing or in error.

E15 A problem was encountered with the site-specific surface characteristics defined in Stage 3. A possible error is that the keywords were not specified in the correct order. While most keywords can appear in any order for a pathway, the surface characteristics must appear in a particular order. See Section 4.7.7 for a discussion of the keywords.

E19 The chronological day was not computed correctly from the year, month and day (in SUBR.CHROND); or the year, month and day was not computed correctly from the chronological day (in SUBR.ICHRND).

E20 Error reading a header record from a file (including temporary files). This error could occur while reading through the header records of a file in an attempt to locate the first data record.

E21 Error writing a header record to a file.

E22 End of file encountered reading and existing file's header records. This condition indicates that there are no data to process.

E23 Error re-reading an existing file's header records written that had been written to an output file.

E24 Error conditions were detected for the JOB pathway; this message is issued during the final check after the setup processing.

E25 Error conditions were detected for the UPPERAIR pathway; this message is issued during the final check after the setup processing.

E26 Error conditions were detected for the SURFACE pathway; this message is issued during the final check after the setup processing.

E27 Error conditions were detected for the ONSITE pathway; this message is issued during the final check after the setup processing.

E28 Error conditions were detected for the MERGE pathway; this message is issued during the final check after the setup processing.

E29 Error conditions were detected for the METPREP pathway; this message is issued during the final check after the setup processing.

WARNINGS

W06 Value on an input statement may be unreasonable, but processing continues with this value.

W10 A non fatal error while attempting to write to a temporary file.

W12 An input statement for the block may be missing or in error; this message depends on the processing requested.

W15 Auditing a variable for QA is disabled for the on site variable specified. The variable appeared on an AUDIT keyword statement but did not appear with any READ keywords.

W22 An end of file was encountered while reading the headers on an input file; data will not be processed for this block. This is likely a fatal error but is treated as a nonfatal error so the remainder of the data can be processed.

INFORMATIONAL

I25 No data are to be extracted, QA'd, or merged for UPPERAIR pathway.

I26 No data are to be extracted, QA'd, or merged for SURFACE pathway.

I27 No data are to be QA'd or merged for ONSITE pathway.

I19 End of file encountered on the input runstream file.

D.3 UPPER AIR PROCESSING, 30 – 39

Any messages that pertain to the UPPERAIR pathway and issued after the input statements are processed are in this category. A word of caution: if a problem requires examining the unprocessed TD-6201 (archive) data, be very careful if you edit the file with a text editor. Some editors could potentially modify the structure, rendering the file unreadable by AERMET. A better option would be to use a file viewer that cannot alter a file.

ERRORS

E31 No soundings were extracted and there were no errors that did not allow AERMET to extract any of the soundings specified in the runstream. Compare the station ID and the dates in the runstream to the station and dates in the input data file.

E32 An error occurred reading a block of data. A block of data contains all or part of a single sounding. Depending on the data structure of the archive data (fixed- or variable-length block), there can be up to 2876 characters in one block of data. An error reading a block is considered severe enough to stop processing the upper air data since the nature of the error cannot be ascertained very easily. The user will have to carefully examine the data to determine the cause of the error.

E33 An error was encountered decoding the portion of the block that contains the station identifier and date group, or an error occurred decoding a level of data in the sounding. In the former case, AERMET will stop processing the upper air data. In the latter case, AERMET will allow up to five such errors decoding sounding levels before processing of upper air data ceases. If AERMET cannot decode a sounding level, then it continues to the next level.

E34 The first character of the station ID is blank in the archive data file, indicating that the entire field likely is blank in the file. In the archive file, the station ID is supposed to fill the entire 8-character field, with leading 0's to fill out the field if the ID is shorter than eight characters. Either the process of reading the data is no longer synchronized with the data, or the station ID field is not what AERMET expects.

E35 At least one sounding was extracted, but error(s) occurred that did not allow AERMET to finish extracting all the soundings specified in the runstream.

E36 No soundings were extracted and error(s) occurred that did not allow AERMET to extract any of the soundings specified in the runstream.

E38 An error occurred while reading a sounding during the QA process. The data in the input file for QA should already be in a standard AERMET format (see Appendix C.1), but AERMET was unable to read the data from the file. Since AERMET reads and writes one sounding at a time, check the output file to see where the error occurred (the sounding after the last one in the file being written by the QA process).

E39 AERMET was not able to compute the range of heights required for the QA. Since the heights reported vary from sounding to sounding based on the structure of the atmosphere, AERMET constructs height intervals into which the QA results are categorized. This error should never occur since the height intervals are computed internally based on a layer thickness defined within the software and not the sounding data.

WARNINGS

W33 Error decoding a level of data, but the maximum number of errors allowed (five) has not been exceeded.

W33 Surface elevation (elevation of the first sounding level) is missing or less than zero. The sounding levels in the archive file are reported as height above mean sea level. AERMET adjusts all soundings to be referenced relative to the local elevation rather than sea level. If AERMET cannot determine the surface elevation because it is missing (or below mean sea level), then this message is issued. Once the surface elevation is determined, that elevation is used to adjust all subsequent soundings.

W35 The process of decoding the levels of data in a sounding failed at the first level. It is likely that only a header record is present in the output file from the extract process. The user will have to examine the input data more closely to determine the cause of the problem.

INFORMATIONAL AND QA

I30 Beginning UPPERAIR data processing.

I31 Data modifications for upper air soundings is enabled. See Section 5 for a discussion of these modifications.

I32 With the data modifications enabled, a level of data was deleted or modified from a sounding.

I39 End of file was encountered on the input file.

Q34 A vertical gradient cannot be computed at because at least one of the heights are missing.

Q35 The difference between the reported height and recomputed height exceeds 50 meters.

Q36 The heights have not been recomputed due to missing data.

Q37 A lower bound quality assessment violation for the variable indicated.

Q38 An upper bound quality assessment violation for the variable indicated.

Q39 The data value for this period and variable is missing.

D.4 SURFACE OBSERVATIONS PROCESSING, 40 – 49

Any messages that pertain to the SURFACE pathway and issued after the input statements are processed are in this category.

ERRORS

E41 An end of file was encountered in the input file and no hourly observations were extracted. Compare the station ID and dates in the runstream to the station and dates in the input file to determine if there is a mismatch.

E42 The maximum number of errors allowed reading a block of data from the archive data file has been exceeded. The limit is five errors.

E43 An internal read (decode) failed while trying to resolve the station ID or date group in the archive input data.

E44 The first character of the station ID is blank in the archive data file, indicating that the entire field likely is blank. Check the input file and make sure the file structure conforms to the format specified on the DATA card (e.g., if CD144 is specified on the DATA keyword, then the format of the file is the 80-character per observation format).

E45 No data fields useful to AERMET were defined when data were retrieved from the SAMSON CD. AERMET expects that the data the user retrieved from the SAMSON CD contains information that is required to calculate boundary layer parameters. This message is issued during the setup phase of the processing.

E46 An error occurred converting the variable ID number in a SAMSON input file from a string to an integer. The second record of the data retrieved from the SAMSON CD contains a list of integers that correspond to the weather variables that appear in the file. The integers range from 1 through 21. Without a correct interpretation of these integers, AERMET cannot process the data.

E47 The station ID in the SAMSON file does not match the station ID on the LOCATION keyword. See also E41; since the SAMSON data are processed slightly differently than the CD144 and SCRAM formats, a separate message is issued when no data are retrieved.

E48 An error was encountered while reading the hourly observation from the QA input file. Since AERMET reads and writes one observation at a time, check the output file to see where the error occurred (the observation after the last one in the file being written by the QA process).

WARNINGS

W42 Error reading/decoding the hourly observations, but the maximum number of errors allowed was not exceeded.

W43 An error occurred decoding an overpunch character; the missing value code for that variable will be substituted in the output file. See Section 4.3.1 for a discussion on overpunches. The number of the overpunch is reported (there are 35 overpunches possible, but AERMET does not examine all of them), and the table in Section 4.3.1.1 can be used to identify the position in the record that caused the error.

W44 The element name could not be located among the list of possible names (defined in the array VNAMES) for the TD-3280 data. The names of the variables in Table B-2 are the names used in the TD-3280 data format. A mismatch at this point likely indicates that either the names in the TD-3280 file have been changed, the names in AERMET have been changed, or the data file is corrupted. Processing continues, but the output might not be complete. Check the documentation for the TD-3280 format to see if the names were updated after AERMET was written. Recompiling and relinking STAGE1N2 could eliminate the error if the executable became corrupted.

W46 AERMET has encountered a second set of SAMSON header records (the records beginning with the tilde (~)). These header records are not processed and the extraction of hourly surface observations stops.

W47 An error occurred converting the station ID on the 'LOCATION' keyword from character to integer; processing will continue, blindly assuming that the data in the file are what the user wants. AERMET makes an integer to integer comparison of the station IDs when SAMSON data are processed, not a comparison of character variables as for the other formats supported by AERMET.

INFORMATIONAL AND QA

I40 Processing of the SURFACE data can begin.

I47 The SAMSON data identified with this message were modeled rather than observed when the data were imprinted on the CD.

I49 End of file was encountered on the input file.

Q47 A lower bound quality assessment violation for the variable indicated.

Q48 An upper bound quality assessment violation for the variable indicated.

Q49 The data value for this period and variable is missing.

D.5 ON SITE DATA PROCESSING, 50 – 59

Any messages that pertain to the ONSITE pathway and issued after the input statements are processed are in this category.

ERRORS

E50 Error reading an input file header.

E51 Error reading input file header record. This message would occur only if a file is QA'd more than once since there isn't an extract process for site-specific data and there usually aren't any headers in the site-specific data file prior to the first time the data are QA'd.

E52 The maximum number of errors allowed reading/decoding the input data has been exceeded. The limit is five errors.

E53 Error writing data to the output file defined on the QAOUT keyword statement.

E54 The observations are not sequential in time.

E55 The number of observations exceeds the number expected for the hour (by default, 1 or the value specified on the OBS/HOUR keyword statement).

E56 End of file on the input data was encountered before a complete observation (block of records) was read.

WARNINGS

W52 Error reading/decoding the input data, but the maximum number of errors allowed was not exceeded.

INFORMATIONAL

I57 An intra hour observation violated a quality assessment lower bound for the variable specified.

I58 An intra hour observation violated a quality assessment upper bound for the variable specified.

I59 An end of file was encountered on the input file.

Q57 A lower bound quality assessment violation for the variable specified (for more than one observation per hour, this check is made after the subhourly values have been averaged).

Q58 An upper bound quality assessment violation for the variable specified (for more than one observation per hour, this check is made after the subhourly values have been averaged).

Q59 The data value for this variable and observation period is missing.

D.6 MERGE PROCESSING, 60 – 69

Any messages pertaining to merging the three data types and issued after the input statements are processed are in this category.

ERRORS

E60 Error computing the chronological day from Julian day and year.

E61 Error computing the Julian day and year from the chronological day.

E62 Error reading the UPPERAIR data.

E63 Error reading the SURFACE data.

E64 Error reading the ONSITE data.

E65 Error writing the ONSITE QA'd data to the OUTPUT file.

E66 Error processing an input file's headers.

E67 No data to merge - either the merge program or the setup have determined that there are no data to merge. AERMET will 'merge' data even if there is only one type of data (upper air, surface, or site-specific), but

INFORMATIONAL

I67 No XDATES statement the beginning chronological day was computed as the earliest available date on the three pathways, and the ending chronological day was computed as the beginning day + 367. Without an XDATES keyword, AERMET has no knowledge of what data are in the input file(s), therefore, the zeroes are displayed in the report file for the dates to merge.

D.7 STAGE 3 PROCESSING, 70 – 89

Any messages that pertain to Stage 3 processing and issued after the input statements are processed are in this category.

ERRORS

E70 Error reading the master header from the merged data file for the Julian day shown. In the merged data file, there is a master header that precedes the data for each 24-hour block of data. AERMET was unable to read this record.

E71 There was an end-of file or error encountered reading the merged upper air data.

E72 There was an end-of file or error encountered reading the merged hourly surface observations.

E73 There was an end-of file or error encountered reading the merged site-specific data.

E74 The data are not on a 1to-24 hour clock. This message can appear for surface or site-specific data. Although the program to merge the data should write the data on a 1-to-24 hour clock, there appears to be an hour outside this window, possibly an hour labeled 0.

E75 There was an error converting the latitude and longitude in the runstream file from character to numeric.

E76 The hour in the merged data is defined as missing. For an unknown reason, the value for the hour was set to -9 in the merged data file.

E77 Bad wind sector specified (this is a second check on the wind direction sector).

WARNINGS

W70 The LST to GMT conversion appears to be incorrect. Based on the longitude provided, the (elementary) computation of the time zone does not agree with the conversion parameter (tadjust) on the LOCATION keyword.

W71 Missing data. There are several possibilities for this warning code:
- no data for the day;
- the scheme to define the reference wind speed and temperature for the hour could not locate valid values because one of the criteria could not satisfied, including no NWS data substitution when the site-specific dat do not satisfy the criteria;
- calm winds.

W72 The upper air sounding cannot be extended because
- the maximum number of levels are in the sounding;
- the top of the sounding is too low (< 600 meters);

- could not identify two levels with which to calculate the potential temperature gradient required to extend the sounding.

W73 Convective boundary layer parameters not computed because

- no upper air data, especially the 12Z sounding, reported on this day
- other data required for the computation of the daytime planetary boundary layer height are missing.

W74 Cloud clover is missing for a nighttime hour or both cloud cover (NWS) and net radiation (site-specific) are missing for a daytime hour, prohibiting calculation of all boundary layer parameters in AERMET.

W75 The sounding was extended and the computed convective mixing height calculates the mixing height to be between the top of the original sounding and the top of the extended sounding.

W76 Calculated or site-specific value for incoming solar radiation, net radiation, surface friction velocity, or surface heat flux is out of range (relative to the QA lower and upper bounds).

W77 Net radiation is negative during a daytime hour or positive during the nighttime (relative to sunrise and sunset).

W78 Calculated value for density or surface albedo is out of range (relative to lower and upper bounds specified at the point this check is made).

W79 Site-specific mixing heights are in the data base, but are missing for the hour; AERMET will calculate the mixing height.

W80 The conditions that produce this message are:
1) The reference wind speed from the site-specific data are above the threshold wind speed but less than $2^{½} * \sigma_{v,min}$ (where $\sigma_{v,min} = 0.2$ m s^{-1}), or
2) The reference wind speed height is above $7z_0$ but below $20z_0$, where z_0 is the surface roughness length. See the Site-specific Meteorological Program Guidance (EPA, 1987) for additional discussion on specifying the height to use in calculating boundary layer parameters.

W81 The reference wind speed from the NWS data are above the threshold wind speed but less than $2^{½} * \sigma_{v,min}$ (where $\sigma_{v,min} = 0.2$ m s^{-1}). This condition is not likely to occur unless 1-minute ASOS wind data are used, since the minimum wind speed routinely reported by NWS is 3 knots (about 1.5 m s^{-1}), excluding calm winds.

W82 The default pressure of 1013.25 mb is being used since there were no site-specific or NWS pressure reported.

<u>INFORMATIONAL</u>

I70 Hour 23 data was swapped in for hour 24 data for NWS surface data.

I71 NWS data were substituted in the profile. All site-specific data are missing for the hour; one-level profiles consisting of NWS winds and temperature are being substituted (but only if the user specified NWS substitution in the runstream with the METHOD SUBNWS keyword).

I79 The end of the processing window, defined by the XDATES statement for the METPREP block, was encountered or, if no window was specified, the end of file was encountered.

I81 In defining the reference wind speed, there were no site-specific winds that met the criteria and NWS winds were used for the reference wind speed.

I82 In defining the reference temperature, there was no site-specific temperature that met the criteria and NWS temperature was used for the reference wind speed.

I83 In defining the station pressure, there was no site-specific pressure and NWS winds were used for the reference wind speed. This message is seen only if the user indicates that there is pressure in the data base.