EARTH RADIATION BUDGET EXPERIMENT

(ERBE)

DATA MANAGEMENT SYSTEM

REFERENCE MANUAL

VOLUME VI

SECTION 6.1 DAILY DATA BASE

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SECTION 6.2 MONTHLY TIME/SPACE AVERAGING

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PREFACE

This document describes the final release of the ERBE Data Management System. It represents the combined efforts of the ERBE Data Management Team along with inputs from members of the ERBE Science Team. The document is an update of the Release 3 Design Document and reflects final changes which resulted from coding and testing of the flight data processing system.

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The reference manual is separated into nine volumes. Each volume is the work of a subsystem design team which developed specifications, designed the subsystem, and reviewed the design before a panel of Data Management and Science Team Representatives.

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6.1 DAILY DATA BASE

6.1.1 OVERVIEW OF THE DAILY DATA BASE SUBSYSTEM

The main function of the Daily Data Base (DDB) Subsystem is to create and maintain a regionally sorted data base containing one month of data using time-sorted, inverted data which comes in on 24-hour tapes from the Inversion Subsystem. A separate data base is created for each satellite (NOAA 9, ERBS, and NOAA 10). Within each satellite data set there is a separate data base for scanner data (2.5° resolution) and two data bases for nonscanner data: numerical filter (5.0° resolution) and shape factor (10.0° resolution).

The scanner data base for one month and for one satellite is quite large, comprising approximately two million records. The two nonscanner data bases are smaller, each comprising approximately 87,000 records. The disparity in the number of records stored for the scanner data base caused some problems during the testing and development stage of the DDB Subsystem.

Originally, the method currently used to store the nonscanner data base was used for all three data bases. However, during the course of testing, it was found that using this method causes the access time for the scanner data base in the Monthly Time/Space Averaging (MTSA) Subsystem to be unacceptably long. Therefore, a new method has been devised for storage and retrieval of the scanner data base. The differences in these storage and retrieval methods are described below.

6.1.1.1 Scanner DDB Overview. The new approach for the scanner DDB is to take the time-sequenced data from the Inversion Subsystem and sort it so that the data is physically stored in regional order. This allows MTSA to access several records from the output device with a single read and decreases the time required to process the data.

The sorting process is accomplished in two steps: a pre-sort and a final sort. The pre-sort is performed on a daily basis. As each day’s data from

Inversion is processed, individual records are written to one of 36 files based on region number. By the end of the month, each file contains data from two latitudinal bands only. While these records are still randomly distributed as far as region number is concerned, the 36 smaller files can be sorted more quickly than one large file.

The final sort is performed by a monthly post-processor. The post-processor uses the Sort/Merge utility routine (Reference 1) from the Control Data Corporation (CDC) system library to sort each of the 36 latitudinal files. Since MTSA processes data on a latitudinal band basis, these 36 files can be used to read data sequentially in larger blocks and to reduce the processing time.

6.1.1.2 Nonscanner DDB Overview. The approach for the nonscanner data base is to keep the data in time-sequenced order but to use a singly-linked list file structure to access records in regional order. A separate head pointer list is maintained for each region. These head pointers point to the last record added to the file for a region. A link pointer is stored as part of each data record which points to the previous record added for a region. To access data for any region, the chain of link pointers is followed backwards through the file until a zero pointer is encountered which signals the end of the data records for that region. The nonscanner files are updated on a daily basis and no monthly post-processor is required.

6.1.1.3 Processing Overview. The scanner portion of the DDB Subsystem is composed of seven separate programs. The nonscanner portion of the DDB Subsystem is composed of six separate programs. The DDB Subsystem programs are summarized in Table 6.1-1. Table 6.1-1 lists each of the program source file names and provides a description for each program name along with the module name prefix and module number prefix. Each program has a unique module name and number prefix to distinguish the modules from the different programs.

Table 6.1-1 DDB Subsystem Programs

Source File/ Program Name	Module Name Prefix	Module Number Prefix	Instrument	Description
SDSINT	SI	6.1.1	Scanner	Initialization
SDSUPD	SU	6.1.2	Scanner	Daily Update
SDSUER	SUE	6.1.3	Scanner	Update-Extra Records
SDSSRT	SS	6.1.4	Scanner	Sort
SDSDRC	SD	6.1.5	Scanner	Record Deletion
SDSDER	SDE	6.1.6	Scanner	Record Deletion - Extra Records
SDSHDS	SH	6.1.7	Scanner	Display Housekeeping
SDNINT	NI	6.1.8	Nonscanner	Initialization
SDNUPD	NU	6.1.9	Nonscanner	Daily Update
SDNUER	NUE	6.1.10	Nonscanner	Update-Extra Records
SDNDRC	ND	6.1.11	Nonscanner	Record Deletion
SDNDER	NDE	6.1.12	Nonscanner	Record Deletion - Extra Records
SDNHDS	NH	6.1.13	Nonscanner	Display Housekeeping

The first four programs listed for the scanner and the first three listed for the nonscanner comprise the on-line portion of the subsystem. The programs are discussed in further detail in Sections 6.1.2 - 6.1.5. The other programs are run off-line as needed and are discussed in further detail in Section 6.1.6.

Both the scanner and nonscanner processes require an initialization procedure which is run once a month before any of the daily updates for any data base can be processed. Figure 6.1-1 illustrates the Scanner Initialization Structure Diagram for module SDSINT (6.1.1.1) and Figure 6.1-2 illustrates the Nonscanner Initialization Structure Diagram for module SDNINT (6.1.8.1).

The daily processing for the scanner and nonscanner data bases is performed by four separate programs. The first two programs (one for the scanner data base and one for the two nonscanner data bases) are run every day. The other two programs (one for each instrument) are run only on the first and last day of a month. The special first/last day of a month processing is needed because some of the Inversion data for the first day of a month actually belongs on the previous month's data base while some of the Inversion data for the last day of a month belongs on the next month's data base. (See Section 6.1.4.3.) The last two programs take the overlap records which have been stored on temporary disk files by the daiy processing and place the records on the appropriate data base. The daily processing is described in further detail in Section 6.1.4.

The structure diagram for module SDSUPD (6.1.2.1), which performs the daily update for the scanner, is shown in Figure 6.1-3. The structure diagram for module SDSUER (6.1.3.1), which performs the special first/last day of a month update for the scanner (i.e., updating extra records), is shown in Figure 6.1-4. The structure diagrams for the two nonscanner modules (daily update, module SDNUPD (6.1.9.1), and first/last day of a month update, module SDNUER (6.1.10.1)) are shown in Figures 6.1-5 and 6.1-6 respectively.

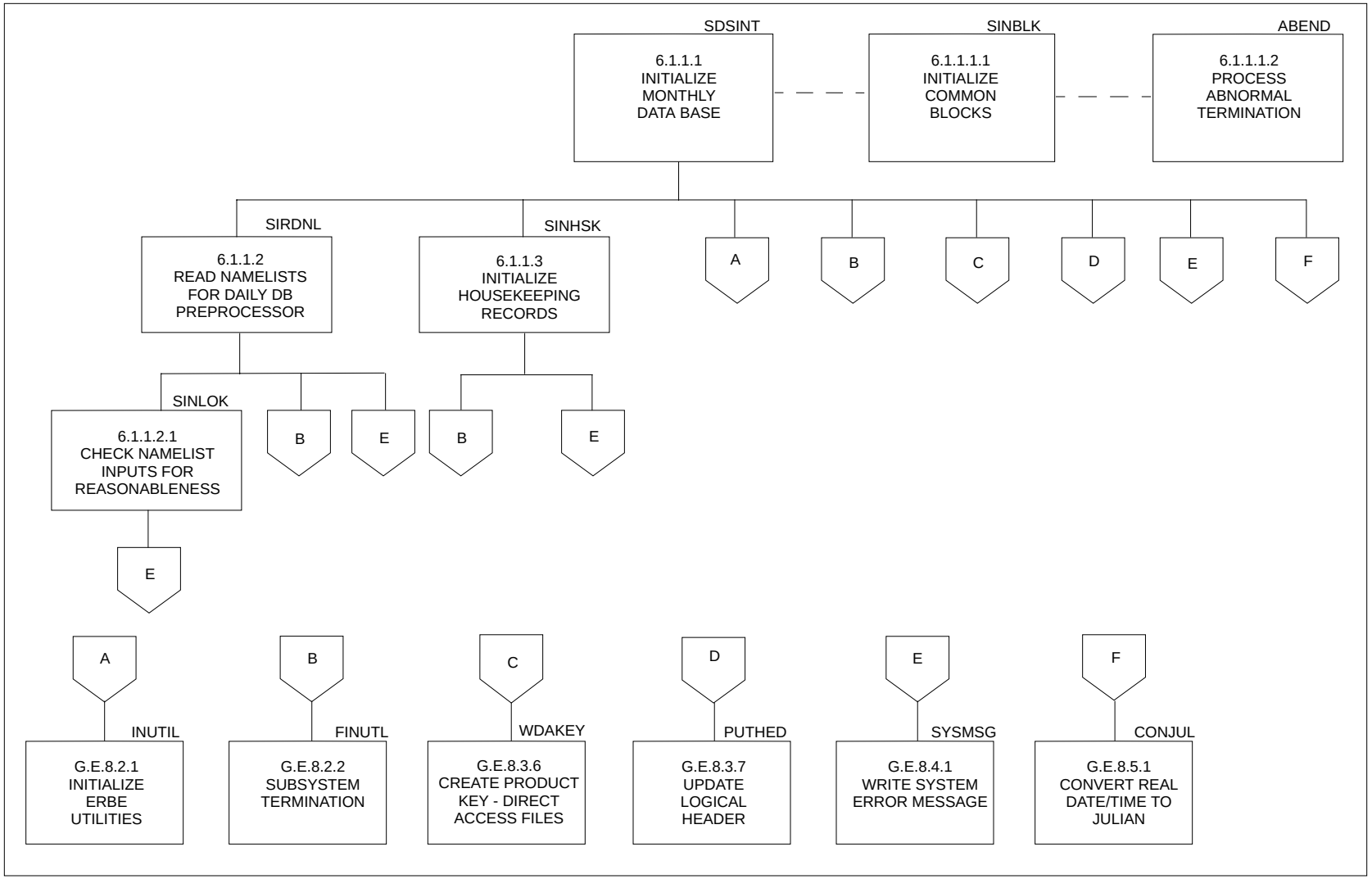


Figure 6.1-1. Scanner Initialization (SDSINT) Structure Diagram

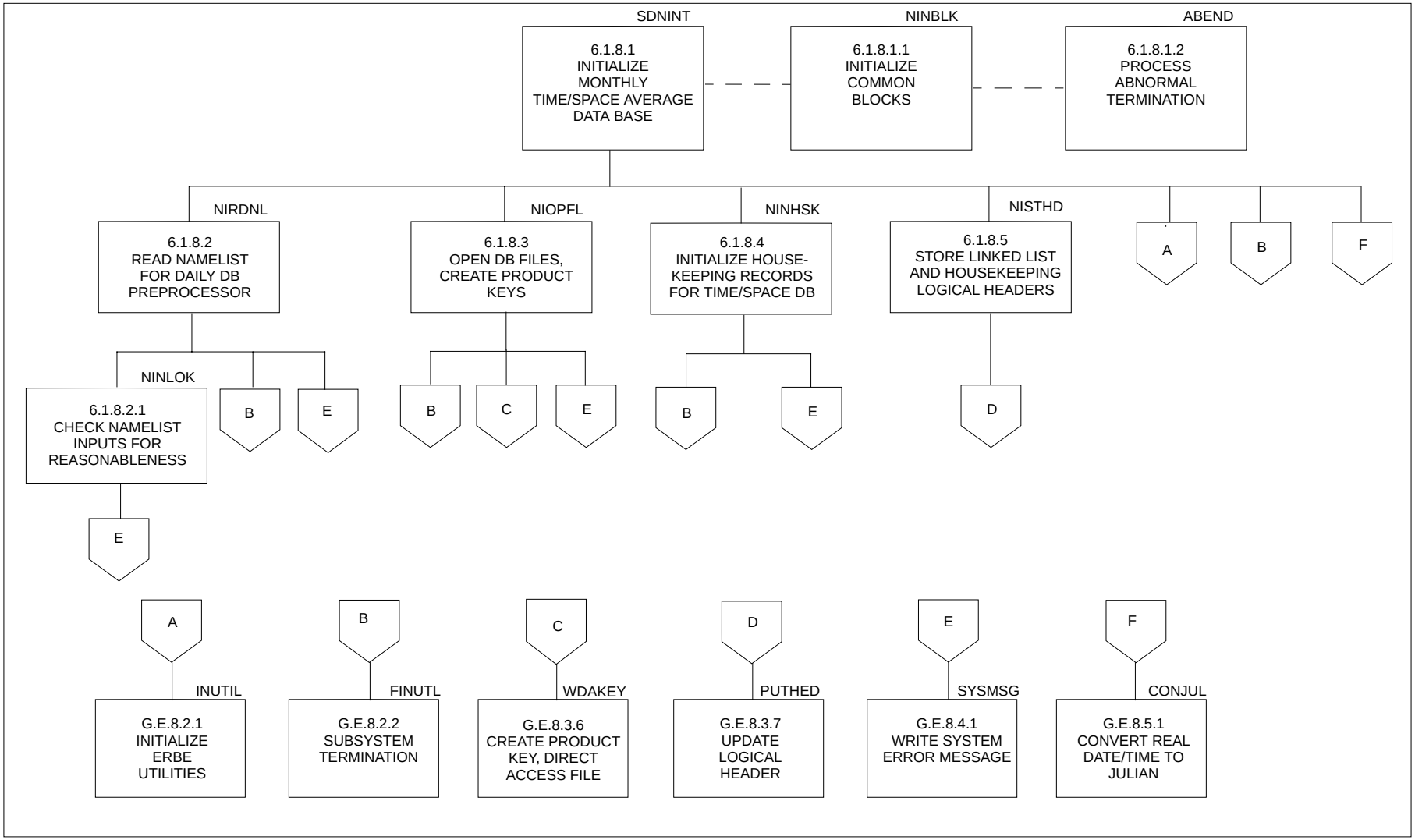


Figure 6.1-2. Nonscanner Initialization (SDNINT) Structure Diagram

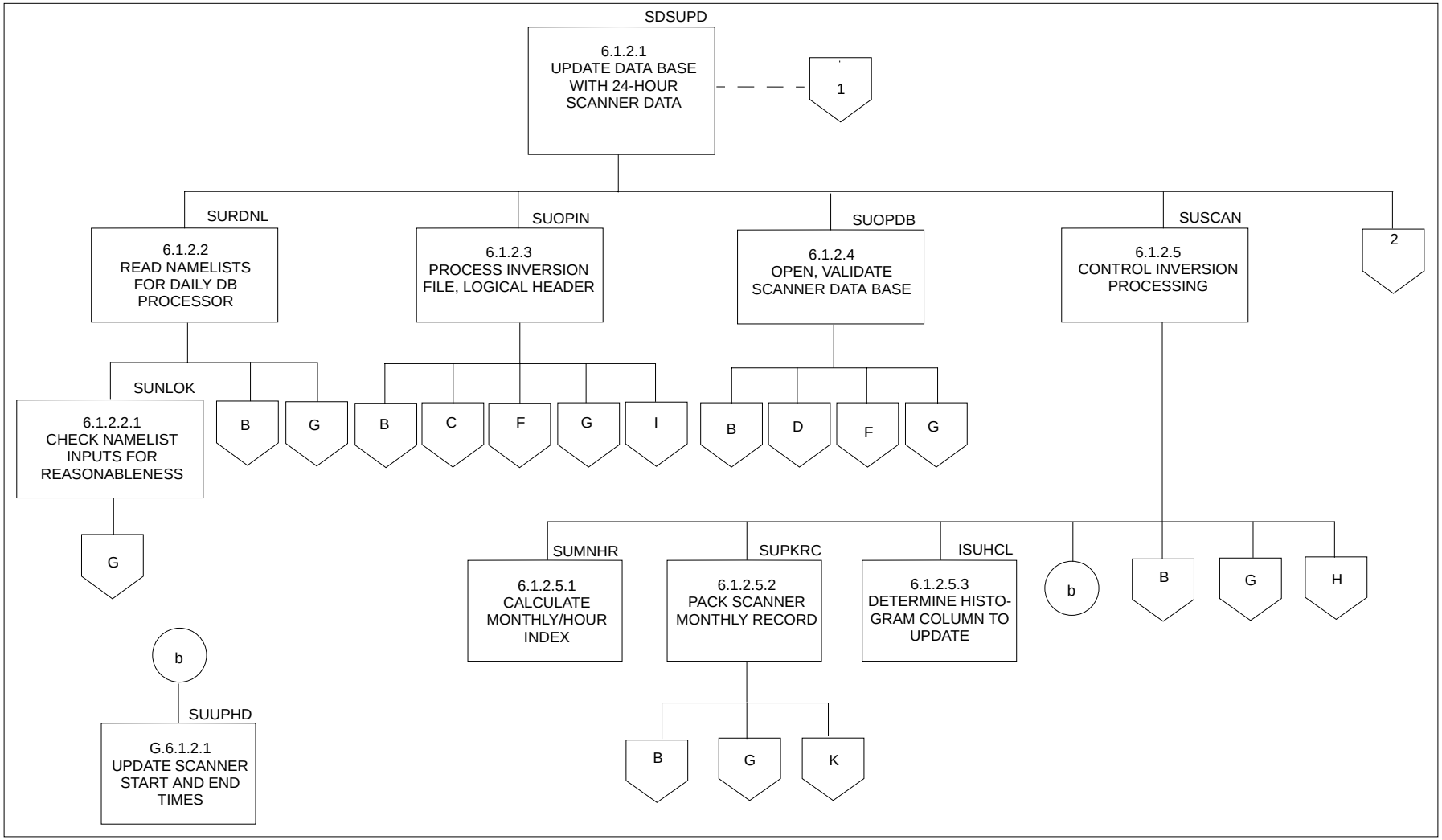


Figure 6.1-3. Scanner Daily Update (SDSUPD) Structure Diagram (1 of 2)

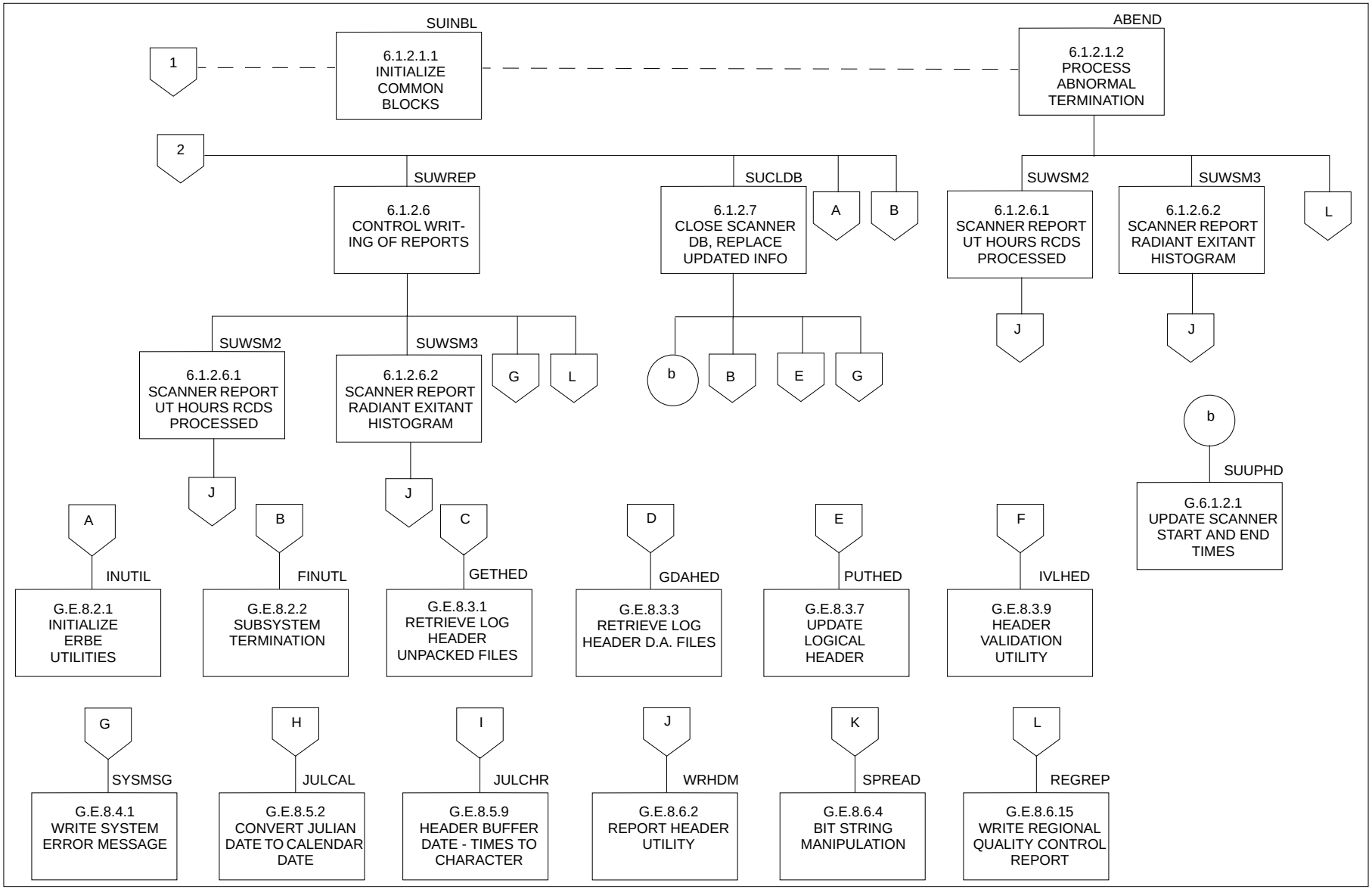


Figure 6.1-3. Scanner Daily Update (SDSUPD) Structure Diagram (2 of 2)

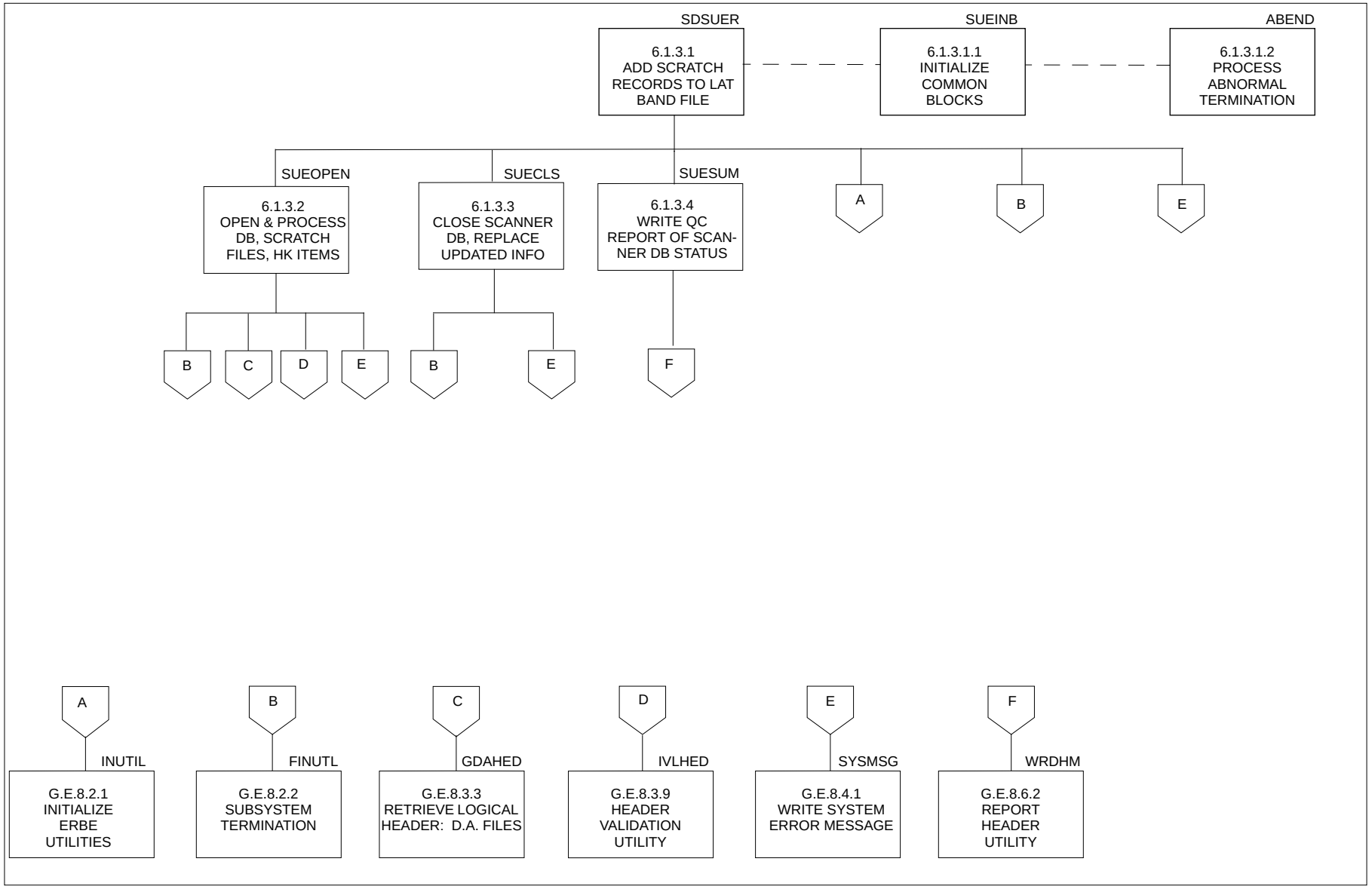


Figure 6.1-4. Scanner Update Extra Records (SDSUER) Structure Diagram

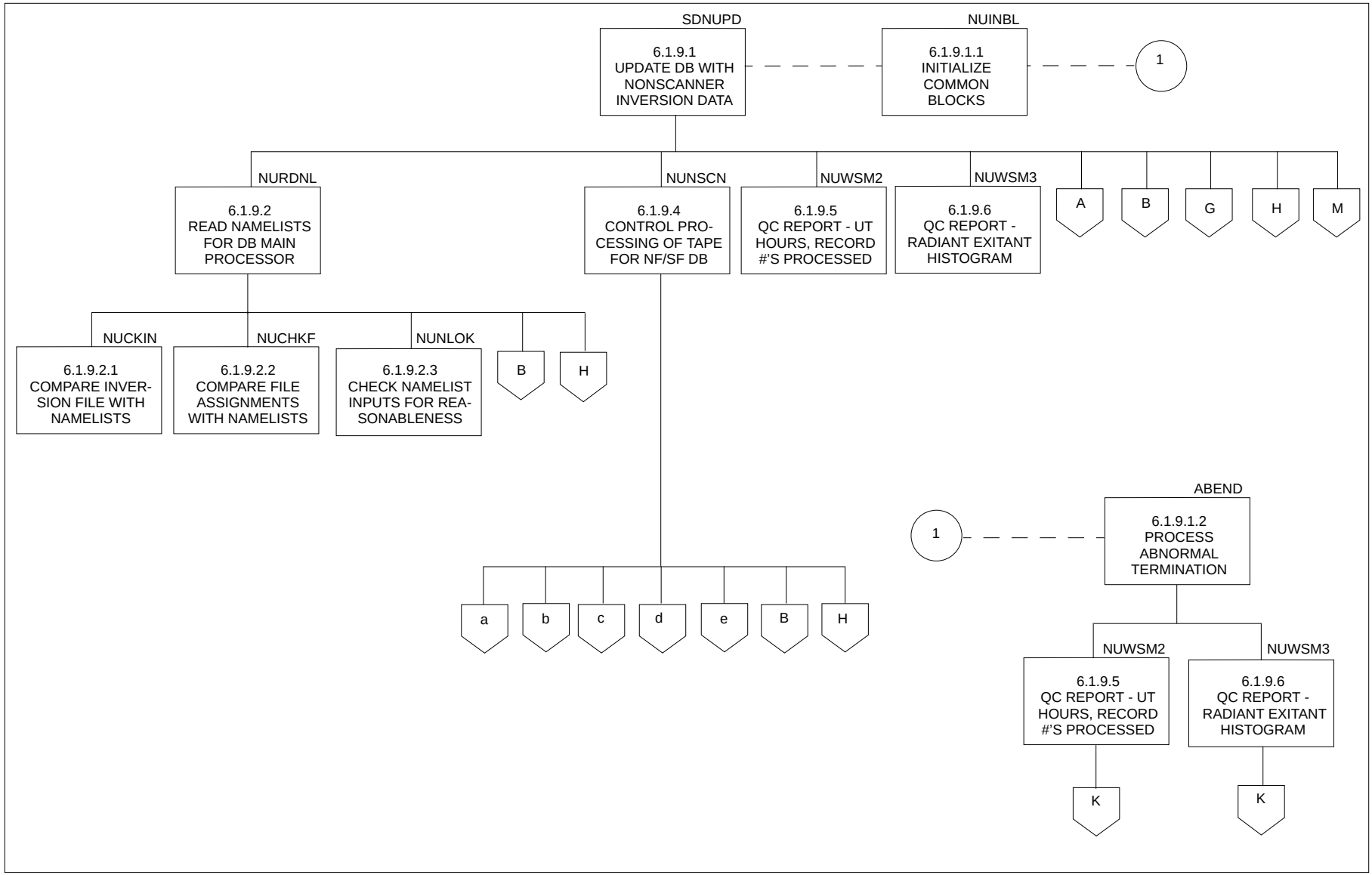


Figure 6.1-5. Nonscanner Daily Update (SDNUPD) Structure Diagram (1 of 2)

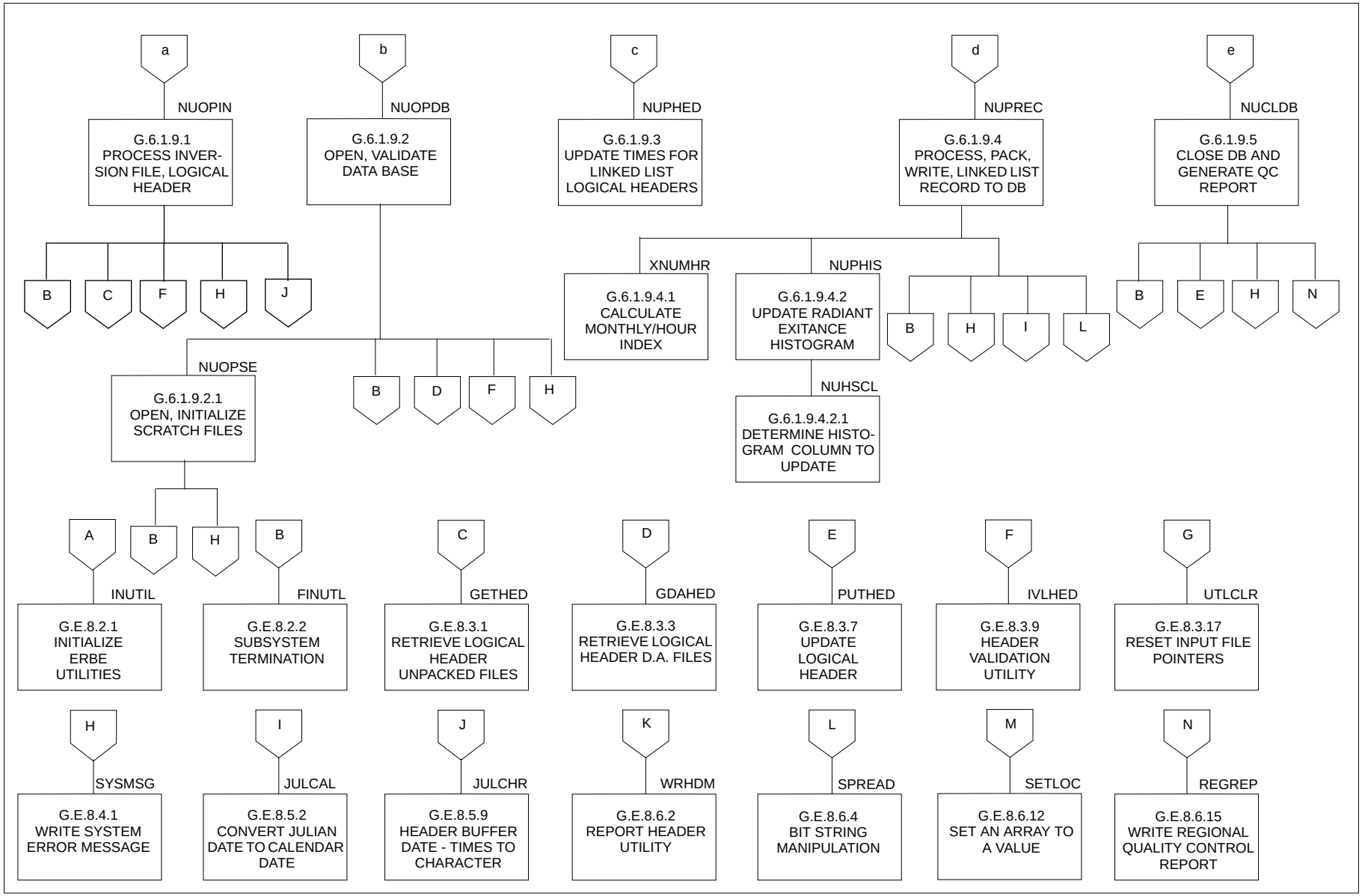


Figure 6.1-5. Nonscanner Daily Update (SDNUPD) Structure Diagram (2 of 2)

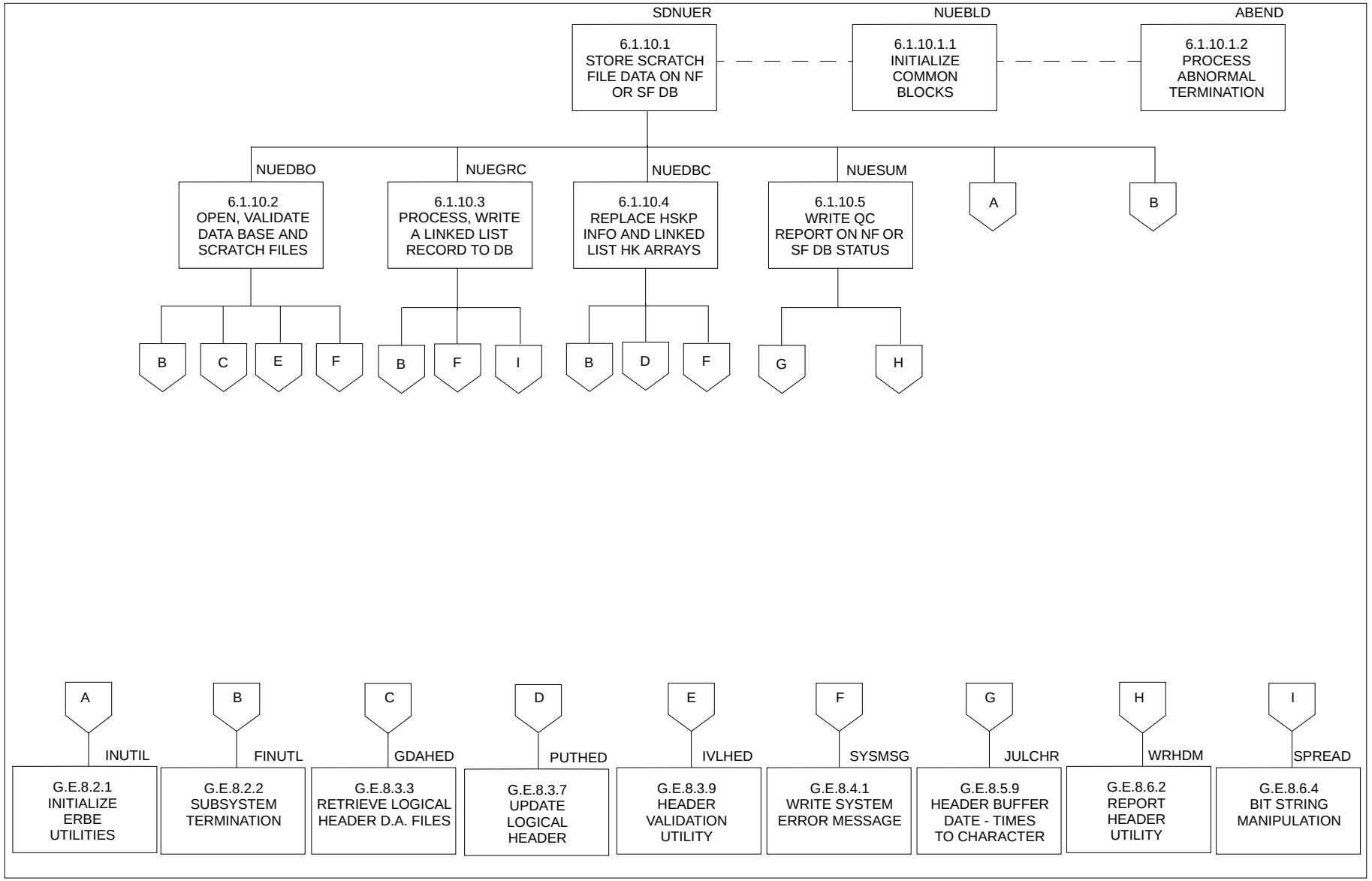


Figure 6.1-6. Nonscanner Update Extra Records (SDNUER) Structure Diagram

The final portion of the on-line DDB Subsystem is the program which performs the final sorting of the scanner data base. This program is used once after all the daily Inversion data has been accumulated on the monthly pre-sorted scanner data base. The structure diagram for the scanner sort program, module SDSSRT (6.1.4.1), is shown in Figure 6.1-7.

A generalized processing flowchart for the DDB Subsystem is shown in Figure 6.1-8. The flowchart illustrates the processing flow for both the scanner and nonscanner data bases. The dashed lines on the flowchart indicate major processing breakpoints. A major processing breakpoint is either a program boundary or a point in the processing where an operator has to make a decision. The breakpoints are identified on the flowchart in brackets to the left.

6.1.2 I/O INTERFACES

6.1.2.1 Inversion Input. The input to the DDB Subsystem comes from the Inversion Subsystem in the form of two sequential magnetic tapes per day. The first tape contains data from the scanner instrument. The scanner inversion record format is shown in Table 6.1-2. Some data items contain place holders to signal MTSA that the data items should not be used. The dummy values vary depending on the type of data items.

The nonscanner inversion record format is shown in Table 6.1-3. The numerical filter and shape factor data are combined in the record, and are separated and stored on the different data bases by the DDB Subsystem.

6.1.2.2 Scanner Data Base Structure. The approach for the scanner data base is to take the data from the Inversion Subsystem and sort it so that the data is physically stored in regional order. Scanner Inversion data is nominally time-sequenced; however, in some cases the data may be out of order. (See Reference 6.) Storing the data in regional order allows MTSA to access several records from the disk with a single read and thus decrease the time required to process the data.

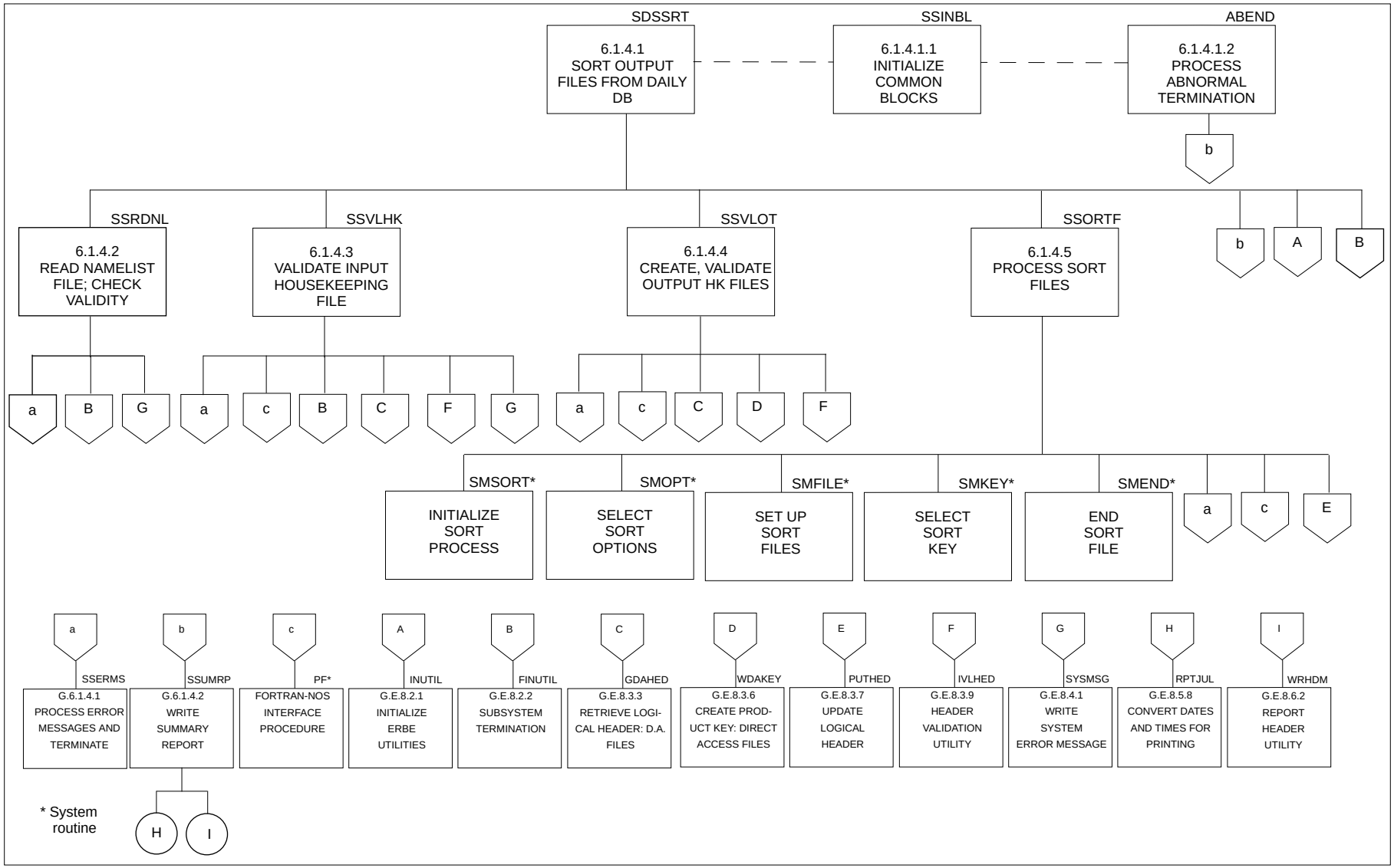


Figure 6.1-7. Scanner Sort (SDSSRT) Structure Diagram

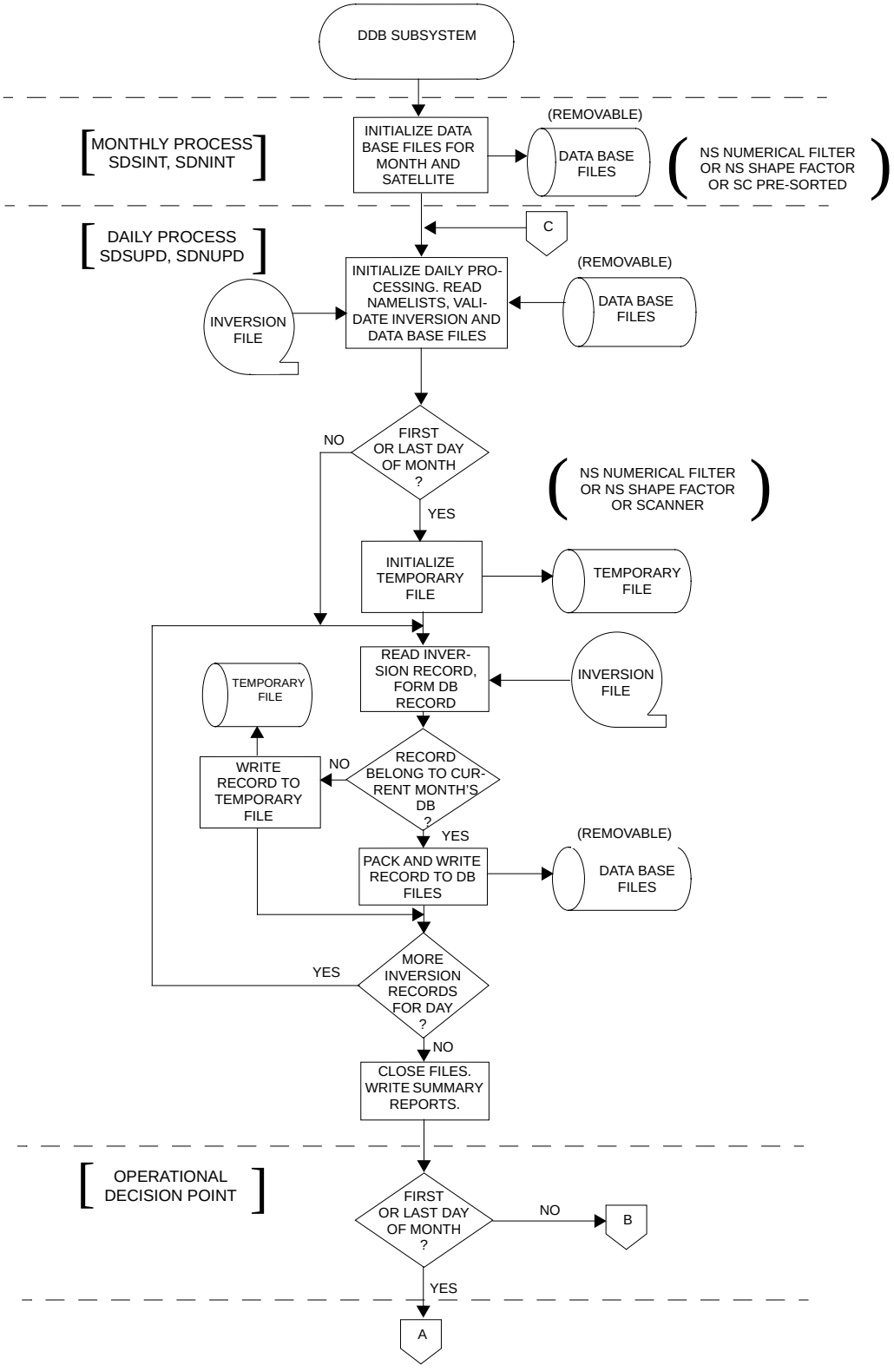


Figure 6.1-8. DDB Subsystem Flowchart (1 of 2)

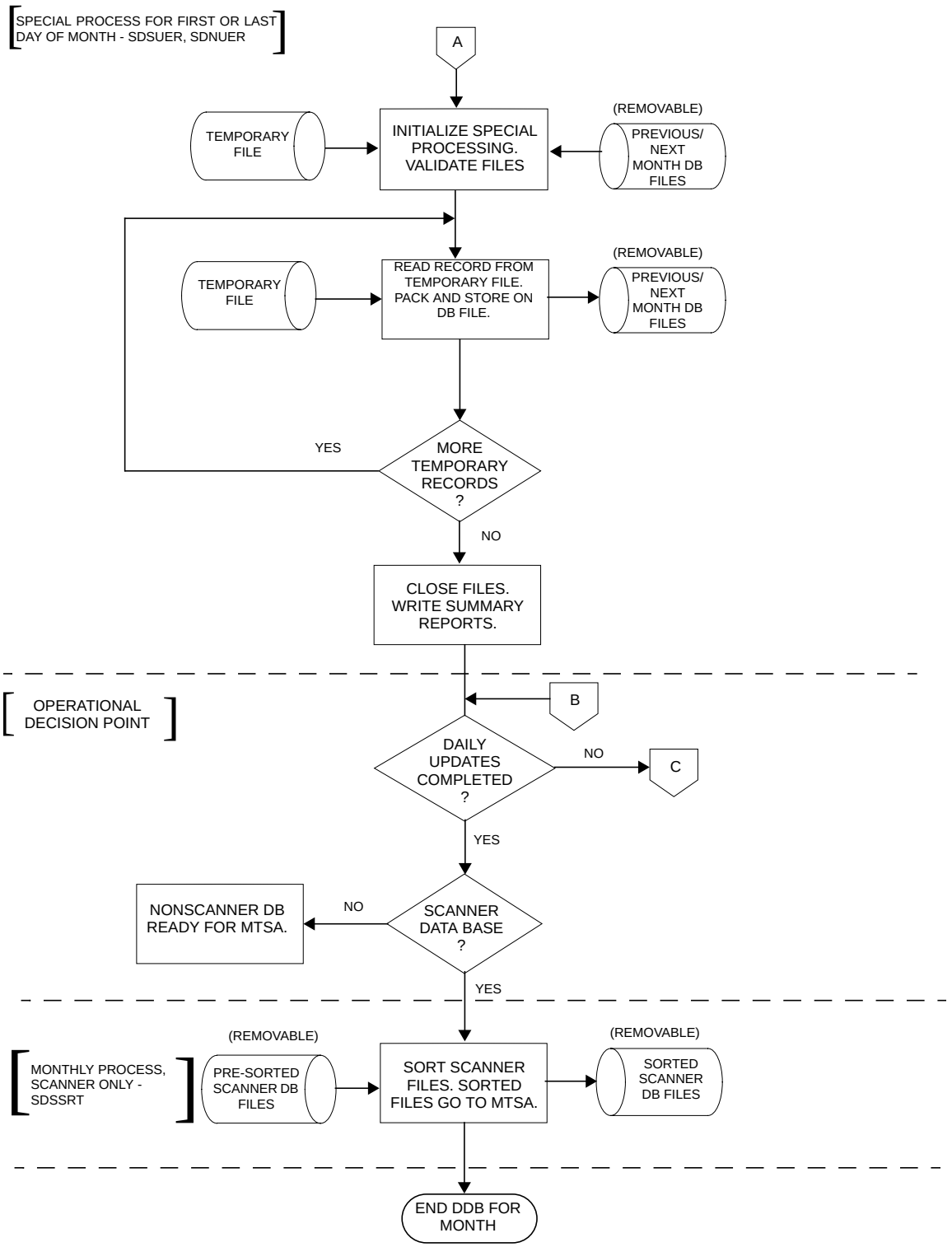


Figure 6.1-8. DDB Subsystem Flowchart (2 of 2)

Table 6.1-2 Scanner Inversion Record Format (1 of 2)

INDEX	DESCRIPTION
1	Region number
2	Average of whole Julian days
3	Average of fractional Julian days
4	Estimate of average SW radiant exitances
5	Estimate of average LW radiant exitances
6	Number of individual short wave estimates
7	Standard deviation of individual SW estimates
8	Minimum individual SW estimate
9	Maximum individual SW estimate
10	Number of individual LW estimates
11	Standard deviation of individual LW estimates
12	Minimum individual LW estimate
13	Maximum individual LW estimate
14	Geographic scene type
15	Fraction of clear areas
16	Fraction of partly cloudy areas
17	Fraction of mostly cloudy areas
18	Fraction of overcast areas
19	Albedo of clear areas
20	Albedo of partly cloudy areas
21	Albedo of mostly cloudy areas
22	Albedo of overcast areas

Table 6.1-2 Scanner Inversion Record Format (2 of 2)

INDEX	DESCRIPTION
23	Average of individual cosines of solar zenith angles at target point for all SW estimates
24	Average of individual zenith angles of satellite from target point for all estimates
25	Average of individual relative azimuth angles at target point from direction of forward solar scatter to satellite direction for SW estimates
26	Standard deviation of clear sky albedos
27	Average of clear sky, LW radiant exitances
28	Standard deviation of clear sky, LW radiant exitances
29	Number of individual LW estimates for clear sky areas
30	Spare
31	Spare

Table 6.1-3 Nonscanner Inversion Record Format (1 of 4)

INDEX	DESCRIPTION
1	5.0° region number
2	10.0° region number
3	Whole Julian Date
4	Fractional Julian Date
5	MFOV numerical filter estimate of average SW radiant exitance adjusted to center of 5° nadir region
6	WFOV numerical filter estimate of average LW radiant exitance over 5.0° nadir region
7	WFOV numerical filter estimate of average SW radiant exitance adjusted to center of 5.0° nadir region
8	WFOV numerical filter estimate of average LW radiant exitance over 5.0° nadir region
9	Cosine of solar zenith angle at center of 5.0° nadir region
10	Zenith angle of satellite from center of 5.0° nadir region
11	Azimuth angle at center of 5.0° nadir region from negative sun direction to satellite direction
12	Fraction of ocean for 5.0° nadir region
13	Fraction of land for 5.0° nadir region
14	Fraction of snow for 5.0° nadir region
15	Fraction of desert for 5.0° nadir region
16	Fraction of partly cloudy over ocean for 5.0° nadir region
17	Fraction of partly cloudy over land or desert for 5.0° nadir region
18	Fraction of mostly cloudy over ocean for 5.0° nadir region

Table 6.1-3 Nonscanner Inversion Record Format (2 of 4)

INDEX	DESCRIPTION
19	Fraction of mostly cloudy over land or desert for 5.0° nadir region
20	Fraction of overcast for 5.0° nadir region
21	Normalized albedo for fraction of ocean for 5.0° region
22	Normalized albedo for fraction of land for 5.0° region
23	Normalized albedo for fraction of snow for 5.0° region
24	Normalized albedo for fraction of desert for 5.0° region
25	Normalized albedo for fraction of partly cloudy over ocean for 5.0° region
26	Normalized albedo for fraction of mostly cloudy over land or desert for 5.0° region
27	Normalized albedo for fraction of mostly cloudy over ocean for 5.0° region
28	Normalized albedo for fraction of mostly cloudy over land or desert for 5.0° region
29	Normalized albedo for fraction of overcast for 5.0° region
30	Geo-land (land + desert) fraction for 5.0° nadir region
31	For internal use by the Inversion Subsystem
32	For internal use by the Inversion Subsystem
33	For internal use by the Inversion Subsystem
34	MFOV shape factor estimate of average SW radiant exitance adjusted to the center of 10.0° nadir region
35	MFOV shape factor estimate of average LW radiant exitance over 10.0° nadir region
36	WFOV shape factor estimate of average SW radiant exitance adjusted to the center of 10.0° nadir region

Table 6.1-3 Nonscanner Inversion Record Format (3 of 4)

INDEX	DESCRIPTION
37	WFOV shape factor estimate of average LW radiant exitance over 10.0° nadir region
38	Cosine of solar zenith angle at center of 10.0° nadir region
39	Zenith angle of satellite from center at 10.0° nadir region
40	Azimuth angle at center 10.0° nadir region from negative sun direction to satellite direction
41	Fraction of ocean for 10.0° nadir region
42	Fraction of land for 10.0° nadir region
43	Fraction of snow for 10.0° nadir region
44	Fraction of desert for 10.0° nadir region
45	Fraction of partly cloudy over ocean for 10.0° nadir region
46	Fraction of partly cloudy over land or desert for 10.0° nadir region
47	Fraction of mostly cloudy over ocean for 10.0° nadir region
48	Fraction of partly cloudy over land or desert for 10.0° nadir region
49	Fraction of overcast for 10.0° nadir region
50	Normalized albedo for fraction of ocean for 10.0° region
51	Normalized albedo for fraction of land for 10.0° region
52	Normalized albedo for fraction of snow for 10.0° region
53	Normalized albedo for fraction of desert for 10.0° region
54	Normalized albedo for fraction of partly cloudy over ocean for 10.0° region
55	Normalized albedo for fraction of partly cloudy over land or desert for 10.0° region

Table 6.1-3 Nonscanner Inversion Record Format (4 of 4)

INDEX	DESCRIPTION
56	Normalized albedo for fraction of mostly cloudy over ocean for 10.0° region
57	Normalized albedo for fraction of mostly cloudy over land or desert for 10.0° region
58	Normalized albedo for fraction of overcast for 10.0° region
59	Geo-land (land + desert) fraction for 10.0° nadir region
60	For internal use by the Inversion Subsystem
61	For internal use by the Inversion Subsystem
62	Spare

The sorting process is accomplished in two steps: a pre-sort and a final sort. The pre-sort is performed by a program called SDSUPD (6.1.2). As each day's data from Inversion is processed, individual records are written to one of 36 files based on region number. By the end of the month, each file contains data from two latitudinal bands only. While these records are still randomly distributed as far as region number is concerned, the 36 smaller files can be sorted more quickly than one large file.

The final sort is performed by a post-processor program called SDSSRT (6.1.4). SDSSRT uses the Sort/Merge utility routine (Reference 1) from the CDC system library to sort each of the 36 latitudinal band files. Since MTSA processes data on a latitudinal band basis, the 36 files can be used to read data sequentially in larger blocks. This reduces the time required to access data from the storage device and thus reduces the overall processing time in MTSA. Details of SDSSRT processing are discussed in Section 6.1.5.

The pre-sorted scanner data is stored on a dual-density removable disk pack. The pack holds 37 files. One file is called the housekeeping file and stores information about the other files. The other 36 files are sequential files and contain the actual data records. The scanner housekeeping file is a FORTRAN direct (random) access type file whose record format is outlined in Table 6.1-4. The actual manipulation of the housekeeping file is described in Section 6.1.5.

The content of the data records on the 36 latitudinal band files is shown in Table 6.1-5. The 32 data items are packed into ten CDC 60-bit words. Each item is scaled by the factor shown in the last column on Table 6.1-5, converted to an integer, and then packed into ten 60-bit words with 18 bits per word. Further details on the packing process are provided in Section 6.1.4.3. The sorting program, SDSSRT, operates on these packed records and communicates to the Sort/Merge utility routines the position of the 18 bits representing the region number in the packed record which is used as the sort key.

Table 6.1-4 Scanner Housekeeping File Record Format

RECORD	CONTENT
1	Number of records per region (144)
•	•
•	•
•	•
72	Number of records per region (144)
73	ERBE product key (1)
74	Scale factors (45)
75	Days with data information (34)
76	File sorted flags (36)
77	Julian start date/times from Inversion headers (33)
78	Julian end date/times from Inversion headers(33)
79	ERBE product key from Inversion headers (33)

Notes:

1. Numbers in parenthesis are array dimensions.
2. Records 1-72 represent cumulative totals for the month.
3. Record 75 contains the following array:
   (1) Locations 1-31 contain a flag which is set if the Inversion tape for this day has been processed.
   (2) Location 32 contains a flag which is set if the last day of the previous month's local records have been added.
   (3) Location 33 contains a flag which is set if the first day of the next month's local time records have been added.
   (4) Location 34 contains a count of the total number of Inversion tapes which have been processed; the count ranges from 0-33.
4. Record 76 contains flags set by the post-processor to indicate which files have been sorted.
5. Records 77-79 contain information used by the record deletion program to keep the logical header array current. Array positions 1-31 store information for each day of the month, position 32 stores information from the last day of the previous month. Position 33 stores information from the first day of the next month.
6. Records 77-79 do not appear on the output housekeeping file.

Table 6.1-5 Scanner Monthly Data Base Record (1 of 2)

INDEX	DESCRIPTION	EXPECTED RANGE	UNITS	SCALE FACTOR
1	Region number	1-10368	------	1
2	Hour/day number index	1-744	------	1
3	Average of whole Julian Date	2.4-2.5*1E06	days	1
4	Average of fractional Julian Date	0-1	days	100000
5	Estimate of average SW radiant exitance	0-1400	wm^{-2}	100
6	Estimate of average LW radiant exitance	0-400	wm^{-2}	100
7	Number of individual SW estimates	0-200	------	1
8	Standard deviation of individual SW estimates	0-999	wm^{-2}	100
9	Minimum individual SW estimate	0-1400	wm^{-2}	100
10	Maximum individual SW estimate	0-1400	wm^{-2}	100
11	Number of individual LW estimates	0-200	------	1
12	Standard deviation of individual LW	0-400	wm^{-2}	100
13	Minimum individual LW estimate	0-400	wm^{-2}	100
14	Maximum individual LW estimate	0-400	wm^{-2}	100
15	Geographic scene type	1-5	------	1
16	Fraction of clear areas	0-1	------	1000
17	Fraction of partly cloudy areas	0-1	------	1000
18	Fraction of mostly cloudy areas	0-1	------	1000
19	Fraction of overcast areas	0-1	------	1000
20	Albedo of clear areas	0-1	------	1000
21	Albedo of partly cloudy areas	0-1	------	1000

Table 6.1-5 Scanner Monthly Data Base Record (2 of 2)

INDEX	DESCRIPTION	EXPECTED RANGE	UNITS	SCALE FACTOR
22	Albedo of mostly cloudy areas	0-1	------	1000
23	Albedo of overcast areas	0-1	------	1000
24	Average of individual cosines of solar zenith angles at target point for all SW estimates	0-1	------	1000
25	Average of individual zenith angles of satellite from target point for all estimates	0-90	degrees	100
26	Average of individual relative azimuth angles at target point from negative sun direction to satellite direction for SW estimates	0-180	degrees	100
27	Standard deviation of clear sky albedos	0-1	------	1000
28	Average of clear sky, LW radiant exitances	0-400	wm^{-2}	100
29	Standard deviation of clear sky LW radiant exitances	0-400	wm^{-2}	100
30	Number of individual LW estimates for clear sky areas	0-200	------	1
31	Spare			
32	Spare			

To save space on the removable pack, the data records are written to the files without system control words. To accomplish this, it is necessary to use a FILE card with certain parameters in the Job Control Language (JCL) as well as to specify the buffer length in the FORTRAN OPEN for each file. Details on the JCL used to run the DDB Subsystem are discussed in Section 6.1.6.2.

Since the Sort/Merge utility routines require a separate storage area for the sorted files, two removable packs are used by the sort program, SDSSRT (6.1.4). The input pack contains the pre-sorted data from the daily update portion of the subsystem. The output pack contains the sorted data files. The housekeeping file is transferred from one pack to another with some modifications which are described in Section 6.1.5. The file names used to identify the pre-sorted and sorted files on both the input and output packs are shown in Table 6.1-6.

6.1.2.3 Nonscanner Data Base Structure. The nonscanner data base actually consists of two separate data bases. The numerical filter data base contains records associated with the 5° spatial resolution. The shape factor data base contains records associated with the 10° spatial resolution. Both sets of data come into the DDB Subsystem on one Inversion record (see Table 6.1-3) and are separated into the records for the two nonscanner data bases. The format of the numerical filter (5°) data records is outlined in Table 6.1-7. The format of the shape factor (10°) data records is outlined in Table 6.1-8. The expected range, units, and scale factors for each of the data items are shown on both tables. Details of processing the data items on the linked list record are discussed in Section 6.1.4.

The two data bases for the nonscanner are each stored on a FORTRAN direct (random) access type file set up as a singly-linked list with multiple head pointers. Each record for a particular region is linked to the previous record for that region by a pointer. If the pointer to the last record added to the linked list is known, all other records for that region are accessed simply by following the pointers back through the file. The pointer for the

Table 6.1-6 Pre-sorted and Sorted File Names

PRE-SORTED FILE	SORTED FILE	DESCRIPTION
PSCHSK	SSCHSK	Scanner housekeeping file
PLTF01	SLTF01	File containing data for latitudinal bands 1 and 2
PLTF02	SLTF02	File containing data for latitudinal bands 3 and 4
PLTF03	SLTF03	File containing data for latitudinal bands 5 and 6
•	•	•
•	•	•
•	•	•
•	•	•
•	•	•
•	•	•
PLTF36	SLTF36	File containing data for latitudinal bands 71 and 72

Table 6.1-7 Numerical Filter (5.0°) Linked List Record (1 of 2)

INDEX	DESCRIPTION	EXPECTED RANGE	UNITS	SCALE FACTOR
1	Region number	1-2592	------	1
2	Hour/day number index	1-744	------	1
3	Whole Julian Date	2.4-2.5*1E06	days	1
4	Fractional Julian Date	0-1	days	100000
5	MFOV numerical filter estimate of average SW radiant exitance over 5.0° nadir region	0-1400	wm^{-2}	100
6	MFOV numerical filter estimate of average LW radiant exitance over 5.0° nadir region	0-400	wm^{-2}	100
7	WFOV numerical filter estimate of average SW radiant exitance over 5.0° nadir region	0-1400	wm^{-2}	100
8	WFOV numerical filter estimate of average LW radiant exitance over 5.0° nadir region	0-400	wm^{-2}	100
9	Cosine of solar zenith angle at center of 5.0° nadir region	0-1	------	1000
10	Zenith angle of satellite from center of 5.0° nadir region	0-90	degrees	100
11	Azimuth angle at center of 5.0° nadir region from negative sun direction to satellite direction	0-180	degrees	100
12	Fraction of ocean for 5.0° region	0-1	------	1000
13	Fraction of land for 5.0° region	0-1	------	1000
14	Fraction of snow for 5.0° region	0-1	------	1000
15	Fraction of desert for 5.0° region	0-1	------	1000
16	Fraction of partly cloudy over ocean for 5.0° region	0-1	------	1000

Table 6.1-7 Numerical Filter (5.0°) Linked List Record (2 of 2)

INDEX	DESCRIPTION	EXPECTED RANGE	UNITS	SCALE FACTOR
17	Fraction of partly cloudy over land for 5.0° region	0-1	------	1000
18	Fraction of mostly cloudy over ocean for 5.0° region	0-1	------	1000
19	Fraction of mostly cloudy over land or desert for 5.0° region	0-1	------	1000
20	Fraction of overcast for 5.0° region	0-1	------	1000
21	Normalized albedo for fraction of ocean	0-1.3	------	1000
22	Normalized albedo for fraction of land	0-1.3	------	1000
23	Normalized albedo for fraction of snow	0-1.3	------	1000
24	Normalized albedo for fraction of desert	0-1.3	------	1000
25	Normalized albedo for fraction of partly cloudy over ocean	0-1.3	------	1000
26	Normalized albedo for fraction of partly cloudy over land or desert	0-1.3	------	1000
27	Normalized albedo for fraction of mostly cloudy over ocean	0-1.3	------	1000
28	Normalized albedo for fraction of mostly cloudy over land or desert	0-1.3	------	1000
29	Normalized albedo for fraction of overcast	0-1.3	------	1000
30	Geo-land (land + desert) fraction for 5.0° nadir region	0-1	------	1000
31	Spare			
32	Spare			
33	Spare			
34	Link pointer	1-87000	------	----

Table 6.1-8 Shape Factor (10.0°) Linked List Record (1 of 2)

INDEX	DESCRIPTION	EXPECTED RANGE	UNITS	SCALE FACTOR
1	Region number	1-648	------	1
2	Hour/day number index	1-744	------	1
3	Whole Julian Date	2.4-2.5*1E06	days	1
4	Fractional Julian Date	0-1	days	100000
5	MFOV shape factor estimate of average SW radiant exitance over 10.0° nadir region	0-1400	wm^{-2}	100
6	MFOV shape factor estimate of average LW radiant exitance over 10.0° nadir region	0-400	wm^{-2}	100
7	WFOV shape factor estimate of average SW radiant exitance over 10.0° nadir region	0-1400	wm^{-2}	100
8	WFOV shape factor estimate of average LW radiant exitance over 10.0° nadir region	0-400	wm^{-2}	100
9	Cosine of solar zenith angle at center of 10.0° nadir region	0-1	------	1000
10	Zenith angle of satellite from center of 10.0° nadir region	0-90	degrees	100
11	Azimuth angle at center of 10.0° nadir region from negative sun direction to satellite direction	0-180	degrees	100
12	Fraction of ocean for 10.0° region	0-1	------	1000
13	Fraction of land for 10.0° region	0-1	------	1000
14	Fraction of snow for 10.0° region	0-1	------	1000
15	Fraction of desert for 10.0° region	0-1	------	1000
16	Fraction of partly cloudy over ocean for 10.0° region	0-1	------	1000

Table 6.1-8 Shape Factor (10.0°) Linked List Record (2 of 2)

INDEX	DESCRIPTION	EXPECTED RANGE	UNITS	SCALE FACTOR
17	Fraction of partly cloudy over land for 10.0° region	0-1	------	1000
18	Fraction of mostly cloudy over ocean for 10.0° region	0-1	------	1000
19	Fraction of mostly cloudy over land or desert for 10.0° region	0-1	------	1000
20	Fraction of overcast for 10.0° region	0-1	------	1000
21	Normalized albedo for fraction of ocean	0-1.3	------	1000
22	Normalized albedo for fraction of land	0-1.3	------	1000
23	Normalized albedo for fraction of snow	0-1.3	------	1000
24	Normalized albedo for fraction of desert	0-1.3	------	1000
25	Normalized albedo for fraction of partly cloudy over ocean	0-1.3	------	1000
26	Normalized albedo for fraction of partly cloudy over land or desert	0-1.3	------	1000
27	Normalized albedo for fraction of mostly cloudy over ocean	0-1.3	------	1000
28	Normalized albedo for fraction of mostly cloudy over land or desert	0-1.3	------	1000
29	Normalized albedo for fraction of overcast	0-1.3	------	1000
30	Geo-land (land + desert) fraction for 10.0° nadir region	0-1	------	1000
31	Spare			
32	Spare			
33	Spare			
34	Link pointer	1-87000	------	----

first record written on the file for a region is set to zero to indicate that there is no more data for that region on the linked list.

The pointers to the last record added to the linked list for each region are called the head pointers. The head pointers are stored on a separate housekeeping file. The linked list and its associated housekeeping file for each nonscanner spacecraft-resolution are part of the primary input to the Monthly Time/Space Averaging Subsystem.

An example of adding a day's worth of Inversion data to a nonscanner linked list is described next. Figure 6.1-9 illustrates a sample of the sequential Inversion input tapes for four days. The input record number is not part of the data stream but is included to aid in tracking the records through the discussion. The day and region numbers are part of the data vector and are the significant items used to add or delete data on the linked list. It should be noted that the day is really part of the Julian Date but is expressed as an integer corresponding to a day of the month to make the discussion easier to follow.

Figure 6.1-10 illustrates the condition of all the pointers and the linked list after each record from the first Inversion input tape is added. Once again, the Inversion record numbers are not part of the actual linked list file. The linked list record number is also not part of the actual data vector. However, the linked list pointer is physically part of the data record. It should also be noted that the ERBE product key is stored as the first record on the linked list so that the actual data records do not begin until linked list record 2.

The first frame on Figure 6.1-10 shows the initial condition of all the pointers and the linked list before the first Inversion record has been stored. The ERBE key is in record 1. The next pointer is initialized to the starting value from the empty block pointer array. The integer day value and the next pointer are stored in the filled block pointer array so that the

INPUT RECORD NUMBER	INVERSION DATA VECTOR			
	REGION	DAY	INVERSION DATA	
1	1	1	---------	INVERSION TAPE 1
2	2	1	---------	
3	3	1	---------	
4	1	1	---------	
5	2	1	---------	
6	3	1	---------	
7	1	1	---------	
1	3	2	---------	INVERSION TAPE 2
2	1	2	---------	
3	2	2	---------	
4	3	2	---------	
5	1	2	---------	
6	2	2	---------	
7	3	2	---------	
8	1	2	---------	
9	3	2	---------	
10	2	2	---------	
1	3	3	---------	INVERSION TAPE 3
2	1	3	---------	
3	2	3	---------	
4	2	3	---------	
5	3	3	---------	
6	1	3	---------	
7	2	3	---------	
8	3	3	---------	
9	1	3	---------	
1	1	4	---------	INVERSION TAPE 4
2	2	4	---------	
3	3	4	---------	
4	1	4	---------	
5	2	4	---------	
6	3	4	---------	
7	2	4	---------	
8	3	4	---------	

Figure 6.1-9. Sample of Several Sequential Inversion Tapes

Frame 1: Initial Condition

LINKED LIST

LINK RCD	INV. RCD	REGN	DAY	INV. DATA	LINK POINTER
1		ERBE KEY			
2					
3					
4					
5					
6					
7					
8					
•	•	•	•	•	•
•	•	•	•	•	•
•	•	•	•	•	•
MAX					

NEXT POINTER
2

EMPTY BLOCK POINTERS	
START	END
2	MAX
0	0
0	0
0	0
0	0
0	0
•	•
•	•
•	•
0	0

HEAD POINTERS		
REGN 1	REGN 2	REGN 3
0	0	0

FILLED BLOCK POINTERS		
DAY	START	END
1	2	0
0	0	0
0	0	0
0	0	0
0	0	0
•	•	•
•	•	•
•	•	•
0	0	0

Frame 2: After First Inversion Record is Added

LINKED LIST

LINK RCD	INV. RCD	REGN	DAY	INV. DATA	LINK POINTER
1		ERBE KEY			
2	1	1	1	DATA	0
3					
4					
5					
6					
7					
8					
•	•	•	•	•	•
•	•	•	•	•	•
•	•	•	•	•	•
MAX					

NEXT POINTER
3

EMPTY BLOCK POINTERS	
START	END
2	MAX
0	0
0	0
0	0
0	0
0	0
•	•
•	•
•	•
0	0

HEAD POINTERS		
REGN 1	REGN 2	REGN 3
2	0	0

FILLED BLOCK POINTERS		
DAY	START	END
1	2	2
0	0	0
0	0	0
0	0	0
0	0	0
•	•	•
•	•	•
•	•	•
0	0	0

Figure 6.1-10. Adding Records to the Linked List (1 of 4)

Frame 3: After Second Inversion Record is Added

LINKED LIST

LINK RCD	INV. RCD	REGN	DAY	INV. DATA	LINK POINTER
1		ERBE KEY			
2	1	1	1	DATA	0
3	2	2	1	DATA	0
4					
5					
6					
7					
8					
•	•	•	•	•	•
•	•	•	•	•	•
•	•	•	•	•	•
MAX					

NEXT POINTER
4

HEAD POINTERS		
REGN 1	REGN 2	REGN 3
2	3	0

EMPTY BLOCK POINTERS	
START	END
2	MAX
0	0
0	0
0	0
0	0
•	•
•	•
•	•
0	0

FILLED BLOCK POINTERS		
DAY	START	END
1	2	3
0	0	0
0	0	0
0	0	0
0	0	0
•	•	•
•	•	•
•	•	•
0	0	0

Frame 4: After Third Inversion Record is Added

LINKED LIST

LINK RCD	INV. RCD	REGN	DAY	INV. DATA	LINK POINTER
1		ERBE KEY			
2	1	1	1	DATA	0
3	2	2	1	DATA	0
4	3	3	1	DATA	0
5					
6					
7					
8					
•	•	•	•	•	•
•	•	•	•	•	•
•	•	•	•	•	•
MAX					

NEXT POINTER
5

HEAD POINTERS		
REGN 1	REGN 2	REGN 3
2	3	4

EMPTY BLOCK POINTERS	
START	END
2	MAX
0	0
0	0
0	0
0	0
•	•
•	•
•	•
0	0

FILLED BLOCK POINTERS		
DAY	START	END
1	2	4
0	0	0
0	0	0
0	0	0
0	0	0
•	•	•
•	•	•
•	•	•
0	0	0

Figure 6.1-10. Adding Records to the Linked List (2 of 4)

Frame 5: After Fourth Inversion Record is Added

LINKED LIST

LINK RCD	INV. RCD	REGN	DAY	INV. DATA	LINK POINTER
1		ERBE KEY			
2	1	1	1	DATA	0
3	2	2	1	DATA	0
4	3	3	1	DATA	0
5	4	1	1	DATA	2
6					
7					
8					
•	•	•	•	•	•
•	•	•	•	•	•
•	•	•	•	•	•
MAX					

NEXT POINTER
6

EMPTY BLOCK POINTERS	
START	END
2	MAX
0	0
0	0
0	0
0	0
•	•
•	•
•	•
0	0

HEAD POINTERS		
REGN 1	REGN 2	REGN 3
5	3	4

FILLED BLOCK POINTERS		
DAY	START	END
1	2	5
0	0	0
0	0	0
0	0	0
0	0	0
•	•	•
•	•	•
•	•	•
0	0	0

Frame 6: After Fifth Inversion Record is Added

LINKED LIST

LINK RCD	INV. RCD	REGN	DAY	INV. DATA	LINK POINTER
1		ERBE KEY			
2	1	1	1	DATA	0
3	2	2	1	DATA	0
4	3	3	1	DATA	0
5	4	1	1	DATA	2
6	5	2	1	DATA	3
7					
8					
•	•	•	•	•	•
•	•	•	•	•	•
•	•	•	•	•	•
MAX					

NEXT POINTER
7

EMPTY BLOCK POINTERS	
START	END
2	MAX
0	0
0	0
0	0
0	0
•	•
•	•
•	•
0	0

HEAD POINTERS		
REGN 1	REGN 2	REGN 3
5	6	4

FILLED BLOCK POINTERS		
DAY	START	END
1	2	6
0	0	0
0	0	0
0	0	0
0	0	0
•	•	•
•	•	•
•	•	•
0	0	0

Figure 6.1-10. Adding Records to the Linked List (3 of 4)

Frame 7: After Sixth Inversion Record is Added

LINKED LIST

LINK RCD	INV. RCD	REGN	DAY	INV. DATA	LINK POINTER
1		ERBE KEY			
2	1	1	1	DATA	0
3	2	2	1	DATA	0
4	3	3	1	DATA	0
5	4	1	1	DATA	2
6	5	2	1	DATA	3
7	6	3	1	DATA	4
8					
•	•	•	•	•	•
•	•	•	•	•	•
•	•	•	•	•	•
MAX					

NEXT POINTER
8

EMPTY BLOCK POINTERS	
START	END
2	MAX
0	0
0	0
0	0
0	0
•	•
•	•
•	•
0	0

HEAD POINTERS		
REGN 1	REGN 2	REGN 3
5	6	7

FILLED BLOCK POINTERS		
DAY	START	END
1	2	7
0	0	0
0	0	0
0	0	0
0	0	0
•	•	•
•	•	•
•	•	•
0	0	0

Frame 8: After Last Inversion Record is Added

LINKED LIST

LINK RCD	INV. RCD	REGN	DAY	INV. DATA	LINK POINTER
1		ERBE KEY			
2	1	1	1	DATA	0
3	2	2	1	DATA	0
4	3	3	1	DATA	0
5	4	1	1	DATA	2
6	5	2	1	DATA	3
7	6	3	1	DATA	4
8	7	1	1	DATA	5
•	•	•	•	•	•
•	•	•	•	•	•
•	•	•	•	•	•
MAX					

NEXT POINTER
9

EMPTY BLOCK POINTERS	
START	END
9	MAX
0	0
0	0
0	0
0	0
•	•
•	•
•	•
0	0

HEAD POINTERS		
REGN 1	REGN 2	REGN 3
8	6	7

FILLED BLOCK POINTERS		
DAY	START	END
1	2	8
0	0	0
0	0	0
0	0	0
0	0	0
•	•	•
•	•	•
•	•	•
0	0	0

Figure 6.1-10. Adding Records to the Linked List (4 of 4)

beginning of the block of data for day 1 is remembered. The empty and filled block pointers are used in off-line maintenance procedures to delete individual days off the data base. This process is discussed in Section 6.1.6.1.

The second frame on Figure 6.1-10 shows the condition of the linked list and pointers after the first Inversion record has been added to the file. The first Inversion record contains data for region 1. The head pointer value for region 1 from the previous frame becomes the linked list pointer which is part of the data vector. Since this is the first record for this region, the linked list pointer is zero. Subsequent records for region 1 will have nonzero linked list pointers. The next pointer from the previous frame is stored in the head pointer position for region 1. The data vector is then stored on the linked list file in the record indicated by the new head pointer. The record number is stored in the end position of the filled block pointer array. The final step is to increment the next pointer to indicate the linked list record for the second Inversion record.

The third frame on Figure 6.1-10 shows the condition of the linked list and pointers after adding the second Inversion record. The second Inversion record contains data for region 2. The head pointer value from the previous frame for region 2 becomes part of the data vector. The next pointer from the previous frame becomes the new head pointer for region 2 and the linked list record number. The data vector is added to the linked list, the record number is stored in the filled block pointer array, and the next pointer is incremented.

The same procedure is followed for the rest of the Inversion data until all records for day 1 have been stored. The condition of the linked list and pointers after each record is added to the file is shown in Figure 6.1-10.

After the last Inversion record has been stored, the information in the empty block array is updated. The next pointer replaces the value for the start of the empty block pointer array so that the first available empty record on the

linked list is known for the next input tape. The filled block pointers show that the block of records between 2 and 8 inclusive on the linked list file contain data for day 1.

The housekeeping file for the nonscanner data bases is also a FORTRAN direct (random) access file. Table 6.1-9 illustrates the structure of the housekeeping file. The head pointers, and both the empty and filled block pointers have already been mentioned. The scale factors are used when data is stored on the linked list file. Refer to Section 6.1.4.5 for a more detailed description of how the scale factors are used.

The days with data information contain separate counters for the number of records which are processed for any particular day. If no records have been processed for the day, or the day has been deleted and not replaced, the value is zero. The final element of the days with a data array is a counter for the total number of Inversion tapes which have been processed for the month. This information is used to update the total number of records processed on the linked list logical header, and also to validate files in the Monthly Time/Space Averaging Subsystem.

The ERBE product keys from the Inversion input tapes are used to update the linked list logical header. The ERBE product key retrieves the housekeeping logical header which ensures the correct housekeeping file is being used.

6.1.3 SUBSYSTEM INITIALIZATION

At the beginning of each month, the DDB files on the removable disk packs for the scanner pre-sorted and the two nonscanner data bases must be initialized. The files on the removable disk pack for the scanner sorted data base are initialized during the monthly post-processor run. (See Section 6.1.5.1) Because the data base structures for the scanner and nonscanner are different, two initialization procedures are used.

Table 6.1-9 Structure of Numerical Filter and Shape Factor (Nonscanner) Direct Access Housekeeping File

RECORD	CONTENT
Record 1 • • • Record NLAT[2]	Head pointers (144)[1]
Record (NLAT + 1)	ERBE product key (1)
Record (NLAT + 2)	Scale factors (45)
Record (NLAT + 3)	Days with data information (32)
Record (NLAT + 4)	Julian date/time from Inversion header (31)
Record (NLAT + 5)	Julian ending date/time from Inversion header (31)
Record (NLAT + 6)	ERBE product keys from Inversion header (31)
Record (NLAT + 7)	Start and end of empty block pointers (2, 72)
Record (NLAT + 8)	Day indicator for filled blocks (144)
Record (NLAT + 9)	Start of filled block pointers (144)
Record (NLAT + 10)	End of filled block pointers (144)

Notes:
1. Dimension(s) for array which holds the information in core.
2. NLAT differs for each resolution as follows:
   NLAT = 36 for 5.0° resolution; and
   NLAT = 18 for 10.0° resolution.

6.1.3.1 Scanner Data Base Initialization. Scanner initialization takes place by running a program called SDSINT (6.1.1). The structure diagram for SDSINT is depicted in Figure 6.1-1. Processing starts with writing a logical header to the ERBE header file and storing the ERBE key on the housekeeping file. (See the Utilities User's Guide, Reference 2, for a discussion of the ERBE keys and the logical header array.)

Since the scanner data base is a monthly file, the beginning date in the logical header array should ultimately reflect the beginning Julian Date for the first day with data on the file. The ending date in the logical header array should ultimately reflect the ending Julian Date for the final day with data on the file. To ensure that the dates are correctly updated during the course of daily processing, the beginning date locations in the logical header array are initialized to a maximum (the 28th day of the month) and the ending date locations are initialized to a minimum (the first day of the month). See Sections 6.1.4.2 and 6.1.4.6 for a discussion of logical header processing during the daily updates.

The ERBE key for the file is always created using the date for the first day of the month. The key, which is stored on the housekeeping file, is the only ERBE key associated with the scanner data base. The 36 latitudinal band files do not have individual keys or logical header arrays.

In addition to the ERBE key and the initial values for the beginning and ending dates, the other logical header parameters set in SDSINT are the following:

1) the spacecraft ID in location 2;
2) the number of files in location 7; and
3) the number of records per file in location 8.

The number of files is set to 37 to account for the 36 latitudinal band files and the housekeeping file. The number of records per file is set to one since there is a variable number of records in each of the 36 latitudinal band

files. (See Section 6.1.5 for a discussion of how to determine the number of records per file for the scanner data base.)

In addition to creating the logical header, SDSINT also creates and stores on the housekeeping file the scale factors for the scanner data base. (See Table 6.1-5 for a list of the scale factors.) SDSINT also initializes all the other records on the housekeeping file by storing an array of zeros with the correct dimension in each record. (See Table 6.1-4.) The 36 latitudinal band files are initialized by the JCL; however, no initialization is required in SDSINT. (See Section 6.1.6.3 for further details on the DDB JCL.)

6.1.3.2 Nonscanner Data Base Initialization. Nonscanner data base initialization is processed by SDNINT (6.1.8). The structure diagram for SDNINT is depicted in Figure 6.1-2. Unlike the scanner data base, the linked lists and housekeeping files for the nonscanner data bases have individual ERBE keys and logical header arrays.

The beginning and ending date locations in the nonscanner logical header arrays are initialized in the same manner as for the scanner logical header. Since each nonscanner header represents one file only, location 7 is set to one. The number of records per file in location 8 is set to 46 for the numerical filter housekeeping file header and to 28 for the shape factor file header. (See Table 6.1-9 for the structure of the numerical filter and shape factor direct access housekeeping file.) For the numerical filter and shape factor linked list headers, this location is initialized to zero. The number of records in each linked list file is accumulated with each daily update.

In addition to logical header file initialization, the scale factors for the nonscanner data base are created and stored on the housekeeping file by SDNINT. (See Tables 6.1-7 and 6.1-8.) The pointer records on the two nonscanner data base housekeeping files are initialized to zero with the exception of the first “end of empty block” location. (See Table 6.1-9.) This is initialized to the maximum number of records which can be stored on a nonscanner data base, i.e., 87,000 records.

Initialization of the two nonscanner data bases is conditional. Both the numerical filter and shape factor data bases can be initialized together or separately. Processing the initialization for a particular nonscanner data base is controlled by software switches, which are set in the NAMELIST. (See Section 6.1.6.2 for further details on setting NAMELIST switches.) Initialization processing of the two data bases is handled by a set of generalized modules which perform the required functions. The main driver, SDNINT, calls these modules with the appropriate parameters for the data base being processed. (See Figure 6.1-2 for the nonscanner initialization structure diagram.)

6.1.4 PROCESSING DAILY UPDATES

After the initialization program for each data base has been run, the daily update processing begins. Daily updates for the scanner data base are processed by a program called SDSUPD (6.1.2). Special processing, which occurs on the first and last day of the month only, is performed by a program called SDSUER (6.1.3). The structure diagrams for both SDSUPD and SDSUER are depicted in Figures 6.1-3 and 6.1-4, respectively. The nonscanner data bases are processed by SDNUPD (6.1.9), the daily update program; and SDNUER (6.1.10), the special first/last day of a month processing program. The structure diagrams for both SDNUPD and SDNUER are depicted in Figures 6.1-5 and 6.1-6, respectively.

The daily update programs for the two nonscanner data bases are handled in a similar manner to the nonscanner initialization, which was discussed in Section 6.1.3.2. Data base processing is conditional based on the value of the software switches which are input through the NAMELIST. A high-level driver calls generalized modules with parameters for a specific data base. The conditional data base processing is discussed in further detail in the following sections.

Although the data base structures for the scanner and the two nonscanner data bases are different, the processing steps are basically the same. The processing steps for all the daily update programs are discussed in a general

way in the following sections. The processing differences due to the different data base structures are pointed out as they apply.

6.1.4.1 Daily Initialization and File Validation. There are four initialization steps that the daily update programs (SDSUPD and SDNUPD) go through each time an update is processed. These steps are:

1) initialize the ERBE utilities;
2) process the NAMELIST inputs;
3) open and validate the Inversion input file; and
4) open, validate, and initialize the data base files.

The first step is performed by a call to the ERBE system utility routine, INUTIL (G.E.8.2.1). Refer to Reference 2, Utilities User's Guide (Section 9.2.1), for a more detailed description of INUTIL processing.

The second step in the daily initialization phase is to open the NAMELIST files and read in the NAMELIST values. For both the scanner and nonscanner data bases, the three key NAMELIST parameters are the data date in the form of year, month, day; the spacecraft ID; and the report switches. Details of NAMELIST manipulation are provided in Section 6.1.6.2. Additional switches are stored on the nonscanner NAMELIST, which determines whether or not to process both the numerical filter and shape factor data bases. Failure to successfully open the NAMELIST file or read in the NAMELISTS causes abnormal termination of the program. Abnormal termination processing is discussed in Section 6.1.4.6.

Once the NAMELIST values are read in, they are checked for reasonableness. In order to be reasonable, a NAMELIST value must be within an expected range. If any NAMELIST value is out of range, an abnormal termination results. All NAMELIST values are checked before the termination so that all NAMELIST problems can be identified at once. After the DDB NAMELIST values are processed, the ERBE system constants NAMELIST, $NAMGLB, is read. $NAMGLB is described in the Utilities User's Guide, Reference 2 in Section 9.1.4.

The final phase of NAMELIST processing is to reset the last day pointer for February, if it is a leap year. This step is necessary for local hour conversion which is discussed in Section 6.1.4.2, and for special overlap data processing which is discussed in Section 6.1.4.7.

At this point in the processing, the nonscanner program, SDNUPD, performs some consistency checking to ensure that the removable disk packs were properly attached to the job and to ensure that the nonscanner Inversion tape was mounted. These checks are performed before any files are opened or validated, and are used to ensure that the physical storage devices (removable pack, magnetic tape) are attached to the job.

The next step in the initialization and validation phase of the daily update process is to open and validate the Inversion input tape. After the file is opened, the logical header is retrieved using the ERBE system utility routine GETHED (G.E.8.3.1). (See the Utilities User's Guide, Section 9.3.1.) Validation is accomplished using the ERBE system utility routine IVLHED (G.E.8.3.9) and the two DDB NAMELIST parameters (year, month, day; and spacecraft ID). Abnormal termination results if an error occurs while opening the file, retrieving the logical header, or validating the header.

The final phase of daily update initialization is to open the data base files, to perform validation to ensure the correct removable disk packs are being used, and to perform some program initialization tasks. This phase in relation to the scanner data base is discussed first. The nonscanner is discussed in regards to the differences in processing due to the structural differences in the data base files.

The first step in scanner data base initialization is to open the housekeeping file and to retrieve the ERBE logical header. This is accomplished by a call to the ERBE system utility routine GDAHED (G.E.8.3.3), since the scanner housekeeping file is a FORTRAN direct (random) access type file. The header is then validated by using IVLHED, and by using the processing parameters from the NAMELIST. A failure to open, to retrieve the header, or to validate the header results in abnormal termination.

The next step is to read the days with the data information off the appropriate record on the housekeeping file. (See Table 6.1-4 for the record format of the scanner housekeeping file.) If the counter for the day to be processed is zero, everything is all right. If if is nonzero, it means that the day has already been processed, and an abnormal termination results.

At this point in the initialization phase, some special processing takes place if the day to be added to the data base is the first or last day of a month. Specifically, the temporary disk file, which stores the overlap data, must be initialized.

The temporary disk file is actually created as two separate files in the FORTRAN program. These files are appended together in the JCL after completion of the daily update run. Further detail on the JCL handling of the two temporary disk files is found in Section 6.1.6.2. This section discusses only the FORTRAN manipulation of the two separate disk files.

The first file is a header file. The header file contains two records. The first record stores the year, month, day; and spacecraft ID for the actual month that the overlap data belongs to. If the first day of a month is being processed, then the overlap data belongs to the last day of the previous month. If the last day of a month is being processed, then the overlap data belongs to the first day of the next month. If the month is January or December, then the year parameter for the overlap data header must also be changed.

The second record on the header file contains the number of overlap data records found for the day. This is not known in advance, so this record is written after processing for the day is completed. At this stage, a counter is initialized to track the number of overlap data records found. The actual overlap data records are stored on a separate file which is opened in the initialization phase for the first/last day of a month overlap processing.

The next step is to read the number of records per region counters into core from the housekeeping file. These counters track the total number of records

stored on the scanner data base for each 2.5-degree region. They are used primarily in retrieving data from the data base in MTSA (see Section 6.2.5.5.1) and are updated as each day of Inversion data is added to the data base (see Section 6.1.4.5).

Initialization for the scanner data base is completed by reading the scale factors to be used in packing the data records into core from the appropriate record on the housekeeping file, and opening the 36 latitudinal band files for storage of Inversion data. A failure to successfully open one or more of the latitudinal band files results in subsystem termination.

The nonscanner data base file initialization proceeds in the same manner as the scanner data base file initialization except for two points. First, the numerical filter and shape factor linked list files, which store the data base records, have their own ERBE logical headers which must be retrieved and validated in the same way as the housekeeping file headers. The linked lists are also FORTRAN direct (random) access files; therefore, system utility GDAHED (G.E.8.3.3) is used.

In addition to the scale factors, the pointers for linked list manipulation must be read from the housekeeping file into core. The head pointers are read first. Next, the empty block pointers are read into core. The next pointer is initialized to the beginning of the first available empty block in the file. The last pointer is initialized to the end of the first empty block. (See Sections 6.1.2.3, 6.1.4.5, and 6.1.6.1.2 (see top of next page) for details of the nonscanner pointer manipulation.) If no empty blocks are available, then the linked list is out of space, and the program terminates abnormally. This type of error is generally attributable to a damaged pack.

Finally, the filled block pointers are read into core. The date field is set to the day being processed and the start field is set to the initial value of the next pointer. (See Figure 6.1-10 to see how records are added to the linked list.) The number of blocks into which the linked list can be subdivided is limited to avoid excessive segmentation which results in excessive data access times. If the number of filled blocks exceed this

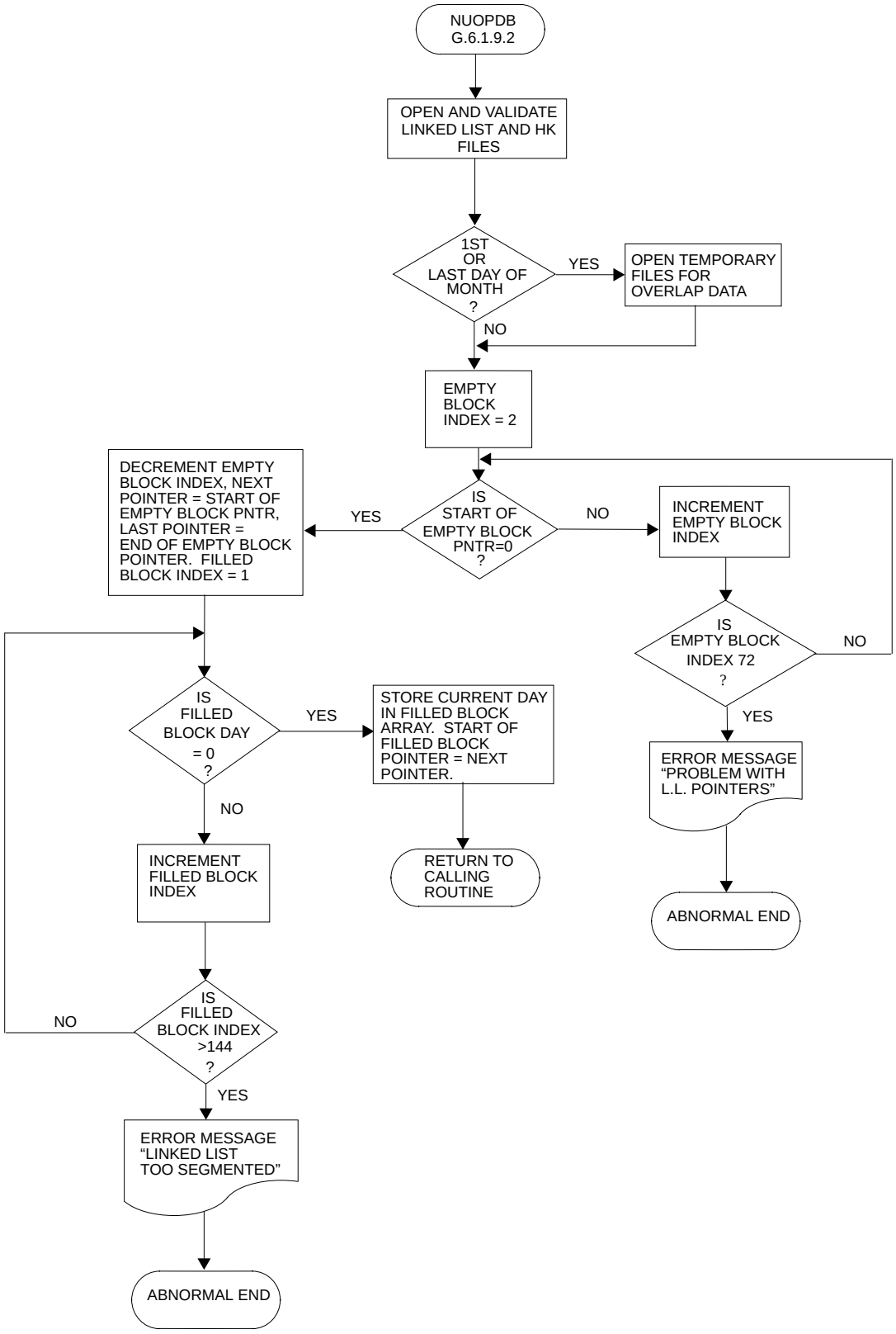
limit, then the program is terminated. Segmentation of the nonscanner linked lists is discussed in Section 6.1.6.1.2 (There is no “Section 6.1.6.1.2” in this document - we (the editors in converting the document to FM) leave it in to be consistent with the original). A flowchart for initializing nonscanner pointers is shown in Figure .

6.1.4.2 Creating the Data Base Record. After the daily processing is initialized, and the Inversion and data base files are opened and validated, the next step is to create the data base record. First, an Inversion record is read, and the Julian time is converted to calendar format by the ERBE system utility routine JULCAL (G.E.8.5.2). The calendar format for the date is used later in the processing but is not stored on the monthly data bases. The region number for each data base is checked to see if it is within the correct range. If the region number is out of range, an informative message is written to the message log and the record is discarded.

For the first Inversion record, some special processing is required to update the beginning date in the logical header array. By the end of the month, the beginning date location in the logical header arrays should reflect the starting Julian Date of the first record from the earliest day of the month. (Refer to Section 6.1.3.) Since Inversion tapes may be processed in any order, the first Julian Date from each daily tape must be checked against the Julian Date currently stored in the logical header. If the data date is earlier than the date in the header, then it replaces the header date. The starting date is initialized to a maximum to ensure that it is replaced the first time through. (Refer to Section 6.1.3.)

Logical header date processing is handled by a module called SUUPHD (G.6.1.2.1) in the scanner program, SDSUPD. For the nonscanner program, SDNUPD, the processing is handled by a module called NUPHED (G.6.1.9.3). The modules are identical except that the scanner module processes one header (for the housekeeping file) while the nonscanner module processes two headers (one for the housekeeping file, and the other for the linked list file.

For scanner processing, creation of the data base record from the Inversion record is relatively simple. A comparison of the scanner Inversion record format (Table 6.1-2) and the scanner monthly data base record (Table 6.1-5)



Initialize Nonscanner Pointers, NUOPDB (G.6.1.9.2)

reveals that these two records are identical with the exception of item #2 on the monthly data base record (hour/day number index). The monthly data base record is created by storing the region number in the first location of the array and shifting all other items back one location. The location for the hour/day number index is left open to be filled in later in the processing. (See Section 6.1.4.3.)

For nonscanner processing, creation of the numerical filter and shape factor monthly data base records from the nonscanner Inversion record (Table 6.1-3) is somewhat more complicated. In the first place, data items for the two nonscanner data bases must be separated into two arrays. (See Tables 6.1-7 and 6.1-8.) Locations in the two arrays must be reserved for the hour/day number indices.

Location 34 in each nonscanner record is reserved for the link pointer. The link pointer is not part of the data vector but is used to access data in the correct order. (See Section 6.1.2.3.) The use of the link pointer in storing data on the nonscanner files is discussed in Section 6.1.4.5.

Since the two nonscanner data base records are derived from a single source (the nonscanner Inversion record), the possibility exists that the top of the atmosphere (TOA) estimates (locations 5 - 8) for one of the two records contains only fill data. If it does, the record should be discarded. Part of the processing, which takes place in the creation of the nonscanner data base records, is to determine whether either of the records is a fill record to be discarded. In addition to discarding the data, counters are kept, which are displayed on the processing summary, to show the number of records discarded for each data base. (See Section 6.1.4.6.)

6.1.4.3 Hour/Day Index Calculation for MTSA. The hour/day index in location 2 of the data base records is an index into an array dimensioned at 31 x 24. (See Tables 6.1-5, 6.1-7, and 6.1-8.) The row dimension represents the days in a month, the column dimension represents the hours in a day. The hour/day index is the resolution of the row and column index for a specific location

into a single number. This array is used in the MTSA Subsystem (see Section 6.2.3.2); the index into the array is calculated in the DDB Subsystem.

The assignment of the hour portion of the hour/day index is based upon the local hour for a particular location. The time that is associated with each record is universal time (UT). Therefore, before the hour/day index can be calculated, the UT, which comes with the record, must be converted to local time. In the process of this conversion, the day may be shifted up or back by one unit. If this shift occurs on the first or last day of a month, then the record actually belongs to the previous or next month's data base. This is the reason why extra processing is required on the first and last day of each month.

Conversion to local time and calculation of the hour/day index takes place in module SUMNHR (6.1.2.5.1) for the scanner update program, SDSUPD. It takes place in module XNUMHR (G.6.1.9.4.1) in the nonscanner update program, SDNUPD. These two modules are identical except for resolution specific parameters which are passed through the calling argument. The exact values of the parameters do not affect the basic algorithm and the discussion continues with no distinctions drawn between scanner and nonscanner processing.

The first step in the processing is to decompose the ERBE region number (from the first location in the data base record) to its row and column grid coordinates. Refer to Reference 3 for a more detailed description of the ERBE grid system. The following equations are used:

$$LAT_S = INT[(B_S - 1)/n] + 1 \quad (1)$$

$$LON_S = B_S - (LAT_S - 1)n \quad (2)$$

where,

LAT_S = row grid coordinate for s = 2.5, 5.0, or 10.0 degree resolution;

B_S = ERBE region number for s = 2.5, 5.0, or 10.0 degree resolution;

n = number of regions in a latitude band for resolution being processed; and

LON_S = column grid coordinate for s = 2.5, 5.0, or 10.0 degree resolution.

Next, it is necessary to find the center longitude (midpoint) of the region box:

$$L_{mid} = (LON_S - 1)s + s/2 \quad (3)$$

where,

L_{mid} = midpoint of longitude for region box;

LON_S = column grid coordinate calculated in equation (2); and

s = spatial resolution in degrees.

The center longitude calculated above is in the range $0^\circ < L_{mid} < 360^\circ$. To correctly determine the local hour, this range must be shifted to $-180^\circ < L_{mid} < 180^\circ$. The amount by which the universal time must be shifted is determined by:

$$TSHIFT = INT\ (L_{mid} + SIGN(1., L_{mid})7.5)/15.) \quad (4)$$

The FORTRAN function SIGN is used to give the result the correct sign so that the shift is made in the proper direction.

The actual local time conversion is made in two steps. First, the local day is determined by using the following equation:

$$LDAY = UDAY + (UHOUR + TSHIFT + 24)/24 - 1 \quad (5)$$

where,

LDAY = local day;

UDAY = universal day (derived from Julian time earlier in the processing);

UHOUR = universal hour derived from Julian time; and

TSHIFT = amount of time shift which is calculated by equation (4).

Then, the local hour is determined as follows:

$$LHOUR = MOD[(UHOUR + TSHIFT + 24), 24] \quad (6)$$

where,

LHOUR = local hour (a value between 0 and 23); and

UHOUR, TSHIFT = universal hour and time shift.

After the conversion to local time has been made and before the hour/day index is calculated, a test must be made to see if the record has been shifted into another month. If the local day is equal to zero, then the record has been shifted into the previous month, and the local day is set to the last day of the previous month. If the local day is greater than the last day of the month, then the record has been shifted into the next month and the local day is set to one.

Finally, the hour/day index is calculated by using the following equation:

$$INDEX_{HD} = LHOUR + (LDAY - 1)24 + 1 \quad (7)$$

If the record belongs to the previous or next month's data base, the hour/day index is made negative. The negative value indicates how to store the data base records for later wrap-up processing. (See Section 6.1.4.5.)

6.1.4.4 Collecting Data for Processing Summaries. The next step in the processing of the daily updates is to collect data for the DDB quality control (QC) reports. Two types of QC reports are produced by the DDB Subsystem. The first type provides information about the daily Inversion data. The second type provides information about the status of the monthly data base. Information for the first set of reports is gathered as the daily update is being processed. All the reports are written in the wrap-up portion of the processing which is discussed in Section 6.1.4.6.

The first report summarizes the number of Inversion records processed for each hour. Figure 6.1-11 shows a sample of this report for the nonscanner data bases, which are generated by the SDNUPD program. The scanner portion of this report is unused because scanner processing is now done in a separate program called SDSUPD. The information for the scanner report is the same as that shown in Figure 6.1-11, except that the nonscanner portion is eliminated from the report.

Collecting data for this report requires using the calendar UT hour associated with each Inversion record as an index into a 24-element counter vector. The percentages are calculated at wrap-up time. The number of records per hour should be fairly evenly distributed across the day (excluding periods of data dropout).

The second report is the radiant exitant histogram report. The radiant exitant histogram shows the percentage of measurements which fall into intervals over the expected normal range of longwave (LW) and shortwave (SW) values as well as the percentage of data which is outside this range or fill. Figure 6.1-12 shows a sample of this report for the nonscanner data bases, which are generated by the SDNUPD program. The scanner radiant exitant histogram report is produced by SDSUPD and is identical to the nonscanner report except that the nonscanner portion is eliminated from the report.

The manner in which data is collected for each data base is the same. Data is stored in an array whose rows correspond to the radiometric data values stored on the data base records. (Refer to items 5 and 6 in the scanner data base

PAGE: 1

ERBE PRODUCT: QC-11
DATE PROCESSED: 95/12/04.
SATELLITE: ERBS
TEMPORAL SPAN: 94/09/26 0000 - 94/09/26 1301
INSTRUMENT: NONSCANNER
SYSTEM RELEASE: 3
CHANNEL: TIME
SOFTWARE VERSION: 11
UNITS: NUMBER OF RECORDS/HOUR
DATA ALTITUDE: REFERENCE LEVEL

HOURS	1	2	3	4	5	6	7	8	9	10	11	12
NONSCANNER	265	271	269	267	269	265	268	276	189	0	0	12
PERCENTAGE	10.79	11.03	10.95	10.87	10.95	10.79	10.91	11.23	7.69	0.00	0.00	0.49

HOURS	13	14	15	16	17	18	19	20	21	22	23	24
NONSCANNER	102	4	0	0	0	0	0	0	0	0	0	0
PERCENTAGE	4.15	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DAILY TOTALS: HOURS FILLED OUT OF 24 NUMBER OF RECORDS PROCESSED

Figure 6.1-11. Summary of Number of Inversion Records Processed Per Hour

DAILY DATA BASE RADIANT EXITANCE HISTOGRAM

PAGE: 1 — ERBE PRODUCT: QC-12
DATE PROCESSED: 95/12/04.
SATELLITE: ERBS — TEMPORAL SPAN: 94/09/26 0000 - 94/09/26 1301
INSTRUMENT: NONSCANNER — SYSTEM RELEASE: 3
CHANNEL: RADIANT EXITANCE — SOFTWARE VERSION: 11
UNITS: NUMBER OF OCCURRENCES — DATA ALTITUDE: REFERENCE LEVEL

SW EXITANCE / LW EXITANCE	0- 74 / 0- 39	75- 149 / 40- 79	150- 224 / 80- 119	225- 299 / 120- 159	300- 374 / 160- 199	375- 449 / 200- 239	450- 524 / 240- 279	525- 599 / 280- 319	600-1400 / 320- 600	BAD VALUES	DEFAULT VALUES	TOTAL VALUES
NONSCANNER: NUMERICAL FILTER												
MFOV-SW	5	281	380	220	111	42	13	6	9	0	1354	2421
PERCENTAGE	0.21	11.61	15.70	9.09	4.58	1.73	0.54	0.25	0.37	0.00	55.93	
MFOV-LW	0	0	0	3	126	943	877	364	49	0	59	2421
PERCENTAGE	0.00	0.00	0.00	0.12	5.20	38.95	36.22	15.04	2.02	0.00	2.44	
WFOV-SW	7	226	355	226	107	33	0	0	0	0	1467	2421
PERCENTAGE	0.29	9.33	14.66	9.33	4.42	1.36	0.00	0.00	0.00	0.00	60.59	
WFOV-LW	0	0	0	0	83	705	784	323	29	0	497	2421
PERCENTAGE	0.00	0.00	0.00	0.00	3.43	29.12	32.38	13.34	1.20	0.00	20.53	
NONSCANNER: SHAPE FACTOR												
MFOV-SW	21	145	186	114	55	15	5	4	0	0	504	1049
PERCENTAGE	2.00	13.82	17.73	10.87	5.24	1.43	0.48	0.38	0.00	0.00	48.05	
MFOV-LW	0	0	0	0	61	425	393	147	21	0	2	1049
PERCENTAGE	0.00	0.00	0.00	0.00	5.82	40.51	37.46	14.01	2.00	0.00	0.19	
WFOV-SW	22	92	232	132	45	11	4	0	0	0	511	1049
PERCENTAGE	2.10	8.77	22.12	12.58	4.29	1.05	0.38	0.00	0.00	0.00	48.71	
WFOV-LW	0	0	0	0	36	431	427	118	5	0	32	1049
PERCENTAGE	0.00	0.00	0.00	0.00	3.43	41.09	40.71	11.25	0.48	0.00	3.05	

Figure 6.1-12. Radiant Exitant Histogram Report

record, as shown in Table 6.1-5; and items 5 - 8 on the nonscanner data base records, as shown in Tables 6.1-7 and 6.1-8). The columns of the array correspond to the expected range of the radiometric values. Note that there are two ranges, one for SW exitance value and one for LW exitance values. (See Figure 6.1-12.)

Data collection for the nonscanner radiant exitant histogram report is driven by module NUPHIS (G.6.1.9.4.2). Refer to Figure 6.1-5 for the structure diagram of the nonscanner daily update program, SDNUPD. NUPHIS first determines which data base is being processed (numerical filter or shape factor), and initializes the histogram matrix row index accordingly. Then, for each row that applies to the data base being processed, NUPHIS calls NUHSCL (G.6.1.9.4.2.1) to determine the column index.

NUHSCL has several input values: 1) the TOA estimates, 2) the increment between normal values, and 3) the maximum acceptable value. The last two parameters will differ depending on whether a LW or SW estimate is being processed. NUHSCL first checks to see if the TOA estimate is equal to the fill value. If it is, then the default column index is returned. Next, the TOA estimate is checked to see if it exceeds the maximum acceptable value. If it does, then the column index for bad values is returned. Refer to Figure 6.1-12 for both the default values and bad values columns.

The column immediately to the left of the bad values column contains the percentage of data which is above the normal range but not high enough to be unacceptable. The lower end of this range is determined by multiplying the increment passed through the parameter list by the number of intervals in the normal range. The upper end is the maximum acceptable value which was also passed through the parameter list. If the TOA estimate is within the normal range, the column index is calculated as follows:

$$\text{column index} = \text{TOA estimate} / \text{increment} + 1 \qquad (8)$$

The results of the division are truncated before the offset is added.

Once the correct column index is determined, the counter in the histogram matrix array is incremented. The percentages are calculated in the wrap-up portion of the program. Note that approximately half of the SW estimates end up in the default column when the SW radiant exitance drops to zero at night.

Data for the scanner radiant exitant histogram report is collected in a similar manner. Since there are only two categories in the scanner histogram matrix, the separate driver for data collection is eliminated. The scanner module which determines the column index is ISUHCL (6.1.2.5.3) and is called directly from the higher-level driver, SUSCAN (6.1.2.5), which controls the scanner processing after initialization. (See Figure 6.1-3 for the structure diagram of the scanner daily update program, SDSUPD.) ISUHCL is identical to the nonscanner module NUHSCL, which determines the column index for the nonscanner radiant exitant histogram report.

The last QC report, for which data is accumulated during the processing, is the regions filled summary. This is a summary of the number of records filled for each region during the 24-hour observing period. Figure 6.1-13 shows the format for the scanner version of this report. Data for this report is stored in a vector dimensioned to the total number of regions for each resolution. The region number in the first location of each data base record is used to index into the vector.

Figure 6.1-13. Regions Filled Summary - Scanner

6.1.4.5 Updating the Data Base Files. Due to the difference in structure between the scanner and nonscanner data bases, storing data records on each data base is quite different. Scanner data storage is relatively simple and is discussed first.

The 36 latitudinal band files which comprise the scanner data base are sequential files. Each data record is stored at the end of a file and the relationship between data records within a file is of no concern to the scanner daily update program. Before each daily update is processed, the 36 latitudinal band files are positioned to the end-of-file mark by the JCL and so are ready for records to be added to the end of each file.

The first step in the process is to determine which of the 36 latitudinal band files the record belongs in. The unit number for the file can be calculated from the region number stored in the first location of the data record in a two-step process. (See Table 6.1-8 for the data record.) First, the 2.5-degree latitudinal band number is determined by using the following equation (see Reference 3):

$$LAT_S = [INT(B_S - 1)/n] + 1 \quad (9)$$

where,

LAT_S = 2.5-degree latitudinal band number:

B_S = 2.5-degree region number; and

n = 144 regions per 2.5-degree latitudinal band.

The latitudinal band number, which ranges from 1 - 72, is then converted into a unit number, which ranges from 1 - 36, by using the following equation:

$$\text{unit number} = INT[(LAT_S - 1)/2] + 1 \quad (10)$$

After the unit number has been determined, the hour/box index calculation is calculated as described in Section 6.1.4.3, Hour/Day Index Calculation for

MTSA. A positive hour/box index indicates that the record belongs on the current month's data base. In this case, the hour/box index is stored in location 2 of the data base record array. The record is then packed.

Packing takes place in module SUPKRC (6.1.2.5.2). First, the three most significant digits (2.44E06) are subtracted from the whole Julian Date in location 3 in the data base record array. This is necessary because the whole Julian Date does not fit into the 18 bits reserved for each packed data word. Each data word is scaled and stored in an integer array (scale factors are not applied to default values). This array is then passed to the ERBELIB routine, SPREAD, which does the actual packing. The resulting packed array consists of 10 60-bit CDC words which contain the data items stored as 18-bit scaled integers. The final step in SUPKRC is to restore the top 3 digits to the whole Julian Date so that it is used later in the processing.

After the record is packed, it is written to the correct latitudinal band file and the number of records per region counter for the region is incremented. The number of records per region counter is stored on the scanner housekeeping file (see Table 6.1-4) and is used to retrieve records from the scanner data base. (See Section 6.2.5.5.1.)

A negative hour/box index indicates that the record belongs on the previous or next month's data base and is written to the temporary file which was created by the daily initialization portion of SDSUPD. (See Section 6.1.4.1.) Note that this occurs only for a limited number of records on the first and last day of a month.

The first step in processing an overlap data record is to store the absolute value of the hour/box index in location 2 of the data base record array. The record is packed as described above. The latitudinal band file unit number, the region number, and the packed data record are then written to the temporary file reserved for storage of overlap data records. The unit number is saved so that it does not have to be recalculated by the program (SDSUER, see Section 6.1.4.7) which stores the overlap data on the correct data base.

The region number is also used by SDSUER and is stored in unpacked integer form so that it does not have to be extracted from the packed data record.

As described in Section 6.1.2.3, nonscanner data base records are stored on a singly-linked list connected through the region numbers. A flowchart illustrating the process of adding records to a nonscanner data base is shown in Figure 6.1-14. This processing is driven by module NUPREC (G.6.1.9.4). Since all nonscanner data base records are stored on a single file, it is not necessary to calculate a unit number as is done for the scanner data base records. The hour/box index is determined as described in Section 6.1.4.3 and, as with scanner processing, two separate paths are taken based on the sign of the hour/box index.

A positive hour/box index indicates that the record belongs on the current month's data base. The hour/box index is stored in location 2 of the appropriate data base record array. The head pointer for the region being processed is stored in the last location of the packed data base record array (the head pointer thus becomes the link to the record previously stored for that region). The current value of the next pointer is stored as the new head pointer for the region.

The data record is then packed. As with the scanner data base record, the top three digits of the whole Julian Date are removed. Scale factors are applied to all data items except for default values, and the link pointer is stored in the last location of the packed data array. Finally, all data items up to the link pointer are packed into 10 CDC 60-bit words as 18-bit scaled integers by the ERBELIB routine SPREAD. The packed data record and the link pointer are written to the numerical filter or the shape factor direct access data base file using the next pointer as the record number.

The current value of the next pointer is stored at the end of the filled block pointer array. The next pointer is then incremented. A comparison of the next pointer variable is made to the last pointer variable to see if all available space in the current filled block has been used. This happens only if data has been deleted from the data base as described in Section 6.1.6.1.

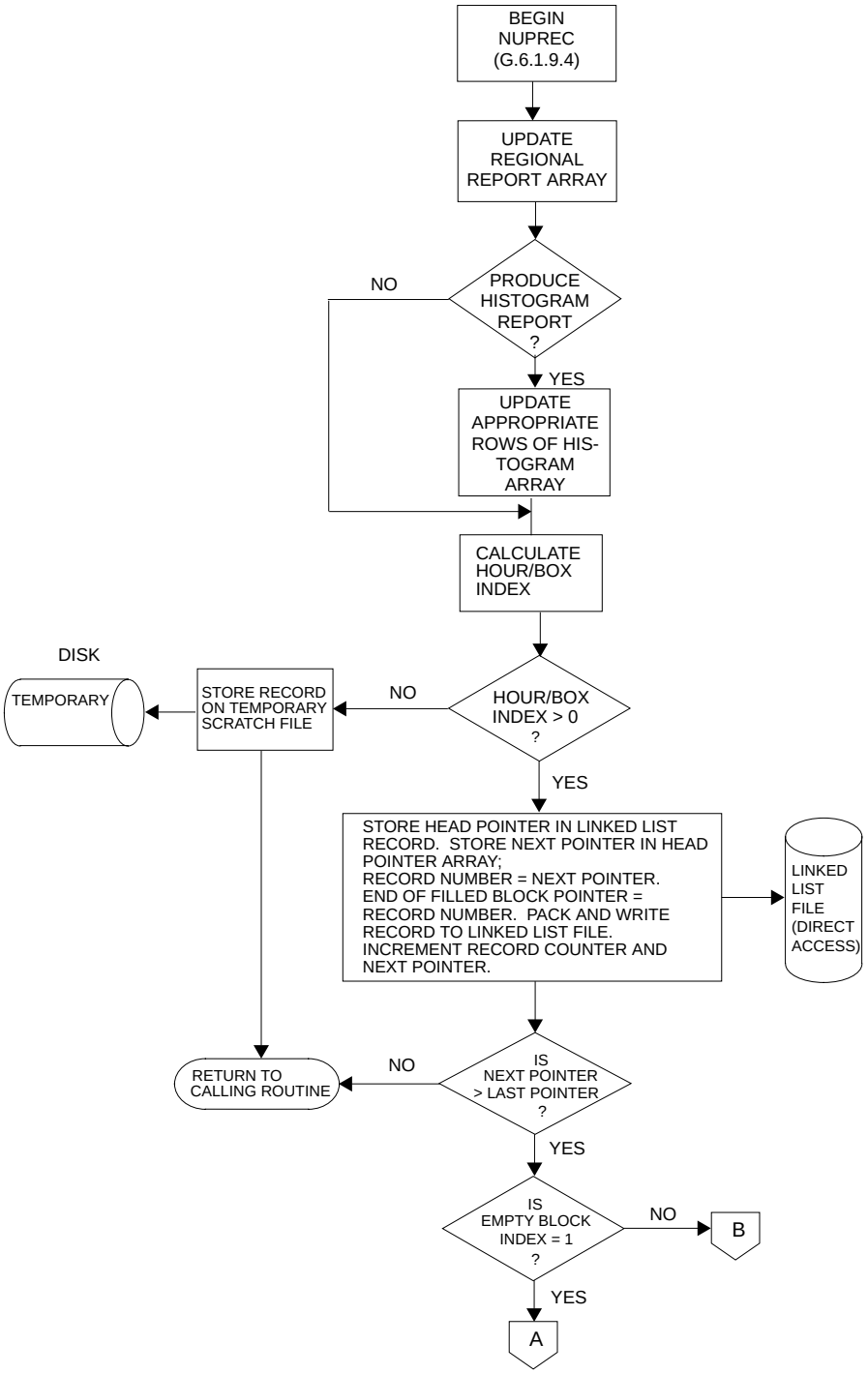


Figure 6.1-14. Adding Records to a Nonscanner Data Base (1 of 2), NUPREC (G.6.1.9.4)

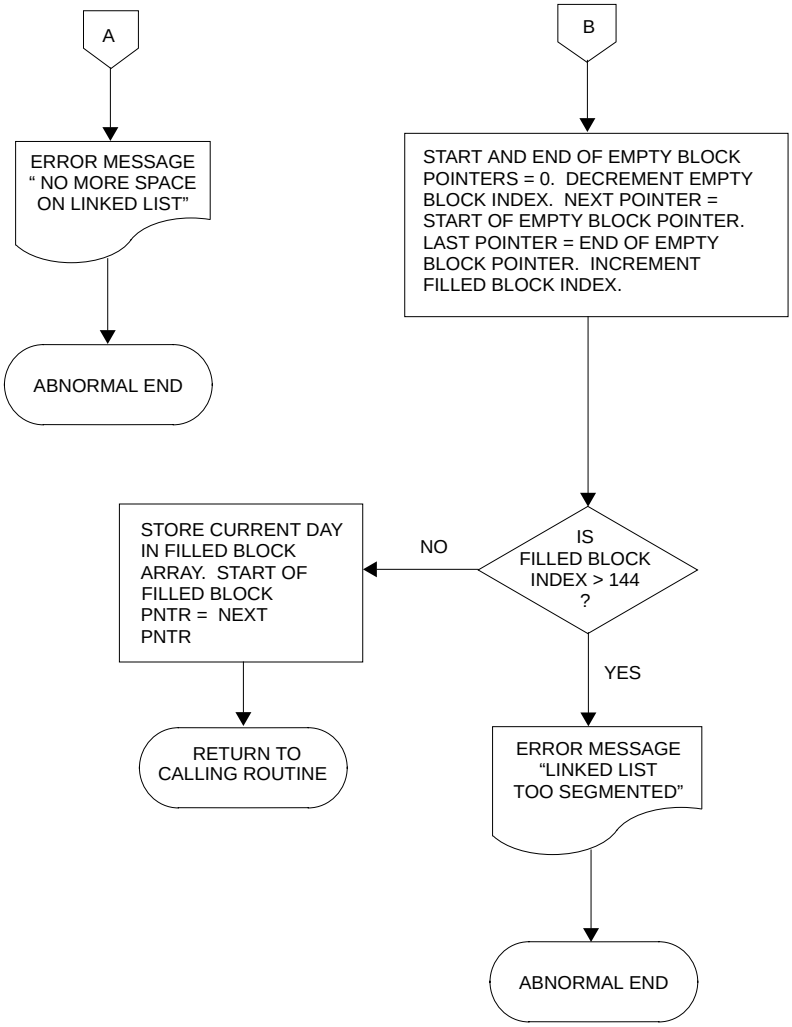


Figure 6.1-14. Adding Records to a Nonscanner Data Base (2 of 2), NUPREC (G.6.1.9.4)

If the empty block has been filled, then the pointers to this block must be removed from the empty block pointer array. A new set of pointers to the next empty block on the file are transferred from the empty block pointer array to the next and last pointer variables. The index into the filled block pointer array is incremented, and the day and current next pointer are stored in the filled block pointer array to mark the beginning of a new filled block on the linked list. (See Figure 6.1-14.)

As with the scanner, a negative hour/box index indicates that the record belongs on the previous or next month's data base. Since the linked list pointers are not added to the record until it is ready to be written to the data base file, most of the nonscanner processing described above is bypassed. The absolute value of the hour/box index is stored in the data record which is written to the temporary file for later processing. (See Section 6.1.4.7.)

6.1.4.6 Wrap-up Processing. Two types of wrap-up processing paths are used in the daily update programs. The normal termination path occurs after all the data records on the Inversion tape are read and added to the appropriate data base or temporary file. The abnormal termination path occurs when some types of controllable errors are encountered.

The main tasks of normal termination processing are to write the processing summaries, update the information on the housekeeping files, and to replace the ERBE logical headers. The main tasks of abnormal termination processing are to identify where the abnormal termination occurred, to dump data from all available working arrays, and to write out the processing summaries, if possible.

Report writing for the scanner daily update program is driven by module SUWREP (6.1.2.6). SUWREP sets up information for the ERBE system report header utility WRHDM (G.E.8.6.2), which is used on all scanner reports. SUWREP then calls the modules which actually write the reports.

The “Regions Filled Summary,” shown in Figure 6.1-13, is written by system utility REGREP (G.E.8.6.15), which is called from SUWREP. The “Hours Filled Summary,” shown in Figure 6.1-11, is written by module SUWSM2 (6.1.2.6.1). This module calculates daily totals and hourly percentages based on the information accumulated during processing. This module also adds to the “Hours Filled Summary” information the current status of the scanner data base. (See Figure 6.1-15.) The information for this portion of the report comes from counters accumulated during the processing and from information stored on the housekeeping file. The “Radiant Exitant Histogram” report, shown in Figure 6.1-12, is written by module SUWSM3 (6.1.2.6.2).

Housekeeping file updates and final logical header processing for the scanner are performed in module SUCLDB (6.1.2.7). If any overlap data is found for the day, then a second header record is written to the temporary overlap data header record file. This record contains the following information:

1) the number of data records stored on the temporary file;
2) the ERBE key from the scanner Inversion input file;
3) the beginning whole data Julian Date;
4) the beginning fractional data Julian Date;
5) the ending whole data Julian Date; and
6) the ending fractional data Julian Date.

(Temporary overlap data file processing is described in Section 6.1.4.7.)

Scanner housekeeping file updates proceed by replacing the revised number of records per region counters in the first 72 records on the file. (See Table 6.1-4.) Next, the days with data information are updated and replaced on record 75. The starting and ending Julian Dates for the day and the ERBE key from the scanner Inversion input file is updated and replaced on records 77 - 79 of the housekeeping file. This information is needed primarily for use by the off-line record deletion program discussed in Section 6.1.6.1.

The last step in scanner data base wrap-up is to close all the data base files, to update the ending dates in the logical header array using the DDB

Figure 6.1-15. Scanner Hours Filled and Current Data Base Status Summary

utility, SUUPHD (see Section 6.1.4.2), and to replace the logical header array using the ERBE system utility PUTHED (G.E.8.3.7).

Normal termination processing for the nonscanner data bases are set up basically the same way as for the scanner data base normal termination processing, but the order is slightly different. The major portion of nonscanner wrap-up processing is driven by module NUCLDB (G.6.1.9.5). NUCLDB is called twice, once for the numerical filter data base and once for the shape factor data base. NUCLDB sets up common parameters for the ERBE system report header utility WRHDM. NUCLDB then calls the ERBE system utility REGREP (G.E.8.6.15) to write the “Region Filled Summary” for the correct spatial resolution. (See Figure 6.1-13.) If any records have been written to the temporary overlap data file, then the second header record for the overlap data file is written. This record consists only of the number of records stored on the temporary file and is used by the program which processes the overlap data. (See Section 6.1.4.7.)

The next step in nonscanner wrap-up processing is to update the information on the housekeeping file. (See Table 6.1-9 for the structure of the nonscanner housekeeping file.) First, the revised head pointers are replaced. Next, the days with data information is updated and replaced. The start and end Julian Dates and the Inversion product key, which is used in the record deletion process (see Section 6.1.6.1), are sorted on the housekeeping file.

Finally, the empty and filled block pointers are updated and replaced. Empty block pointers are updated by storing the current next pointer in the current “start of empty block” pointer location. (See Figure 6.1-10.) The revised empty block pointer array is then replaced on the housekeeping file. The filled block pointers are maintained during the processing. It is only necessary to check if a filled block has been assigned but not used. This is a possible but not a likely occurrence which is compensated for by zeroing out the day and “start of filled block” pointers, which have been assigned. The revised filled block pointer arrays are then replaced on the housekeeping file.

The last part of nonscanner data base wrap-up is to replace the ERBE logical header arrays using ERBE system utility PUTHED. PUTHED must be called twice for each nonscanner data base since both the housekeeping file and the linked list file have individual keys and logical headers.

The “Hours Filled Summary” and the “Radiant Exitant Histogram” report, shown in Figures 6.1-11 and 6.1-12, respectively, are written after the data base files have been closed. The “Hours Filled Summary” is written by module NUWSM2 (6.1.9.4). This module is very similar to the scanner module described above. A second page written by this module shows the current status of both nonscanner data bases. This report is shown in 6.1-16. The “Radiant Exitance Histogram” report is written by module NUWSM3 (6.1.9.5) and is similar to the scanner version.

Abnormal termination is processed by module ABEND (6.1.2.1.2) in the scanner program, SDSUPD; and by module ABEND (6.1.9.1.2) in the nonscanner program, SDNUPD. Abnormal termination in both programs can occur on any of the following conditions:

1) a problem opening or reading the NAMELIST file;
2) unreasonable values on the NAMELIST file;
3) a problem opening or reading the Inversion input file;
4) an inconsistency in file assignments (nonscanner program only);
5) a problem opening, reading, or writing data on the housekeeping file;
6) a problem opening, packing, or writing to the data base files; and/or
7) a problem in the ERBE utilities.

If abnormal termination occurs at initialization time, the ABEND modules provide detailed information on what caused the problem. If abnormal termination occurs during processing, then the working data arrays are dumped to the message log and the summary report modules are called. If abnormal termination for the nonscanner occurs during shape factor processing but after the numerical filter data base has been successfully updated and closed, then the variable, ITERM, which communicates with the ERBE header file processing, is set to a special value so the numerical filter data base logical headers

DAILY DATABASE NUMBER OF RECORDS PROCESSED

PAGE: 2 ERBE PRODUCT: QC-11
DATE PROCESSED: 95/12/04.
SATELLITE: ERBS TEMPORAL SPAN: 94/09/26 0000 - 94/09/26 1301
INSTRUMENT: NONSCANNER SYSTEM RELEASE: 3
CHANNEL: TIME SOFTWARE VERSION: 11
UNITS: NUMBER OF RECORDS DATA ALTITUDE: REFERENCE LEVEL

NUMBER OF INVERSION RECORDS PROCESSED: 2457
NUMBER OF RECORDS ADDED TO NUMERICAL FILTER DATABASE: 2421
NUMBER OF RECORDS ADDED TO SHAPE FACTOR DATABASE: 1049
NUMBER OF RECORDS ADDED TO NUMERICAL FILTER PREVIOUS/NEXT MONTH SCRATCH FILE: -1
NUMBER OF RECORDS ADDED TO SHAPE FACTOR PREVIOUS/NEXT MONTH SCRATCH FILE: -1
NUMBER NONSCANNER RECORDS CONTAINING NUMERICAL FILTER DATA BUT NO SHAPE FACTOR DATA: 0
NUMBER NONSCANNER RECORDS CONTAINING SHAPE FACTOR DATA BUT NO NUMERICAL FILTER DATA: 36
NUMBER NONSCANNER RECORDS CONTAINING NO USEABLE DATA 0
NUMERICAL FILTER DATABASE CUMULATIVE TOTALS:

# RECORDS DAYS 1 - 10:	5349	6344	6378	6417	6385	6337	6441	6434	6431	6441	
# RECORDS DAYS 11 - 20:	6463	6412	6446	5388	6407	6392	6403	6392	6378	6413	
# RECORDS DAYS 21 - 31:	6389	6396	6444	6439	6413	2421	0	0	0	0	0

RECORDS FROM PREVIOUS MONTH: 0
RECORDS FROM NEXT MONTH: 0
OF DAYS ON DATABASE: 26
OF RECORDS ON DATABASE: 160553

SHAPE FACTOR DATABASE CUMULATIVE TOTALS:

# RECORDS DAYS 1 - 10:	2300	2700	2700	2700	2700	2700	2700	2700	2700	2700	
# RECORDS DAYS 11 - 20:	2700	2700	2700	2283	2700	2700	2700	2700	2700	2699	
# RECORDS DAYS 21 - 31:	2700	2700	2700	2700	2700	1049	0	0	0	0	0

RECORDS FROM PREVIOUS MONTH: 0
RECORDS FROM NEXT MONTH: 0
OF DAYS ON DATABASE: 26
OF RECORDS ON DATABASE: 67731

Figure 6.1-16. Nonscanner Current Data Base Status Summary

are replaced. (See FINUTL processing in Reference 2.) A discussion of the analysis and procedures for abnormal termination is provided in Section 6.1.6.1.

6.1.4.7 Overlap Data Processing. As mentioned previously, special processing is required on the first and last day of a month to place records which overlap to the previous or next month on the appropriate data base. Detection of overlap data records is described in Section 6.1.4.3. Once the overlap data records are detected, they are stored on a temporary file (see Section 6.1.4.5) which becomes the input to a FORTRAN program which stores the data on the appropriate data base.

Scanner overlap data is processed by module SDSUER (6.1.3.1). The structure diagram for this program is shown in Figure 6.1-5. The overlap data for the two nonscanner data bases is processed by module SDNUER (6.1.10.1). The structure diagram for this program is shown in Figure 6.1-6. Unlike the nonscanner daily update program, which processes both the numerical filter and the shape factor data bases together, the overlap data program must be run separately for each data base.

The decision as to whether or not to run these two programs is made at the operational level. (See Figure 6.1-8.) Overlap data cannot be automatically stored on the correct data base because data may not be processed in chronological order. The removable disk pack for the previous or next month's data base may not be available at the time the current month is being processed. In this case, the temporary files are saved and the overlap data programs, SDSUER and SDNUER, are run later when the appropriate data base removable disk packs are available.

The scanner overlap data file structure is shown in Table 6.1-10. The first step in scanner processing is to open the temporary file and to read the two header records. The number of records on the file counter from the second header record is checked to make sure there is at least one data record on the file. It is possible, though unlikely, that no overlap data records were found for a particular month. If this is the case, a message is written to

Table 6.1-10 Scanner Overlap Data File Structure

Record Number	Record Type	Record Structure	Data Type
1	Header	Year, month, day; spacecraft ID	Integer
2	Header	Number of data records on file, Inversion ERBE key, beginning whole Julian Date, beginning fractional Julian Date, ending whole Julian Date, ending fractional Julian Date	First 2 items are integer, last 4 items are real
3	Data	Latitudinal band file unit number, region number, packed data base record (See Table 6.1-3 and Section 6.1.4.5)	2 integers followed by 10-element integer array
•	•		
•	•		
•	•		
N	Data		

the ERBE message log indicating that no overlap data records were found and the program terminates normally.

If processing is to continue, then the scanner housekeeping file is opened and the logical header is retrieved. Validation is performed by using the information stored in the first header record on the file and in the ERBE system file validation utility IVLHED (G.E.8.3.9). Subsystem termination results if there is a discrepancy between the information stored on the ERBE logical header and the temporary file header.

Next, housekeeping data is read into core from the housekeeping file. (See Table 6.1-4.) The days with data information, as described in Section 6.1.4.1, are checked to make sure that the overlap data has not already been stored. Abnormal termination results if it has. The number of records per region counters are read so that they can be updated as the overlap data is added to the data base. The final initialization task is to open the 36 latitudinal band files which have been positioned to the end-of-file mark by the JCL. (See Section 6.1.6.2.)

Adding data records to the data base is relatively simple since the records are packed and the latitudinal band file unit number is predetermined by the daily update program. The region number is also included as part of the overlap data record. Overlap data records are read, written to the appropriate latitudinal band file, and the correct number of records per region counter is incremented.

Final updating of the housekeeping file is the same as for the daily update program. (See Section 6.1.4.6.) The revised number of records per region counters are stored. The days with data information is updated and stored. The Inversion key and Julian start and end dates from the second header record are stored to be used, if needed, by the record deletion program. (See Section 6.1.6.1.)

The only processing summary written by this program is the second portion of the scanner report shown in Figure 6.1-15, which shows the cumulative totals

for the current status of the scanner data base. An ABEND module is included to process abnormal termination. ABEND processing includes identifying the point at which abnormal termination occurs and dumping the contents of the available data arrays and variables.

The nonscanner overlap data file structure is shown in Table 6.1-11. The nonscanner program must be run twice, once to process the numerical filter data base and again to process the shape factor data base. The first step in nonscanner processing is to open the temporary file and to read the two header records. The number of records on the file counter from the second header record is checked to make sure there is data on the file. If there is data, then the resolution key from the first header record is used to set resolution specific processing parameters to the correct values. The logical headers from both the linked list file and the housekeeping file are retrieved and validated using information from the first header record and the ERBE system utility IVLHED.

After file validation has been successfully completed, information from the housekeeping file is read into core. (See Table 6.1-9.) The days with data arrays are checked to make sure the overlap data has not already been stored. Then, the head pointers and scale factors are read into core. The scale factors are needed for nonscanner processing because the data records are stored on the temporary file in unpacked form and must be packed before being stored on the linked list. Finally, the empty and filled block pointers are read into core and are initialized exactly as they were in the nonscanner daily update program. (See Section 6.1.4.1.)

Data records are stored on the data base in exactly the same manner as described for the nonscanner daily update program in Section 6.1.4.5. Data base wrap-up processing proceeds as described in Section 6.1.4.6 except that the only report written is the data base cumulative total portion of the report shown in Figure 6.1-16 for the resolution being processed. The nonscanner program also has an ABEND module to identify the point of abnormal termination and to dump available data from variables and arrays.

Table 6.1-11 Nonscanner Overlap Data File Structure

Record Number	Record Type	Record Structure	Data Type
1	Header	Year, month, day: spacecraft ID, resolution key (50 = 5.0 degree resolution, 100 = 10.0 degree resolution)	Integer
2	Header	Number of data records on file	Integer
3	Data	Unpacked numerical filter data base record or shape factor record minus linked list pointer (See Tables 6.1-7 and 6.1-8)	33-element real array
•	•		
•	•		
•	•		
N	Data		

6.1.5 SCANNER POST-PROCESSOR

The scanner data base passes through one extra step before it can be passed on to MTSA. As mentioned previously, the daily update portion of the scanner processing is actually a “pre-sort” process in which data for the 10,368 scanner regions are sorted onto 36 latitudinal band files (each file contains regional data for two latitudinal bands). The regional data within these files, however, is still stored in random order. The final step in scanner DDB processing is to sort each of the 36 latitudinal band files so that regional data is stored sequentially within the files. The final sorting process is accomplished by module SDSSRT (6.1.4.1). The structure diagram for this program is shown in Figure 6.1-7. The processing flow for the scanner post-processor is illustrated in Figure 6.1-17.

The actual sorting of the latitudinal band files is performed by the CDC Sort/Merge utility routine. (See Reference 1.) The Sort/Merge utility routine requires separate storage areas for pre-sorted and sorted files; therefore, two removable disk packs are required by the SDSSRT program. Once the data base files have been successfully sorted, the pre-sorted removable disk pack can be recycled.

The data base files are stored on the removable disk packs as CDC direct access files. As such, the NOS commands DEFINE (create a file) and ATTACH (access an already existing file) are used to make the files local to the program. Normally, NOS commands are issued via the JCL procedures. However, due to the number of files (72 latitudinal band files and 2 housekeeping files) manipulated by SDSSRT, it is easier and more efficient to utilize the FORTRAN 5 Permanent File (PF) Interface to communicate with NOS through the FORTRAN program SDSSRT. (See Reference 4.) It should be noted that references to ATTACHing or DEFINEing data base files for the scanner post-processor imply calls to the PF Interface Utility.

SDSSRT is designed so that the operator has the option of sorting all 36 latitudinal band files at one time or any subset of consecutive files for two or more runs. For example, one execution of the program may sort files 1 - 12

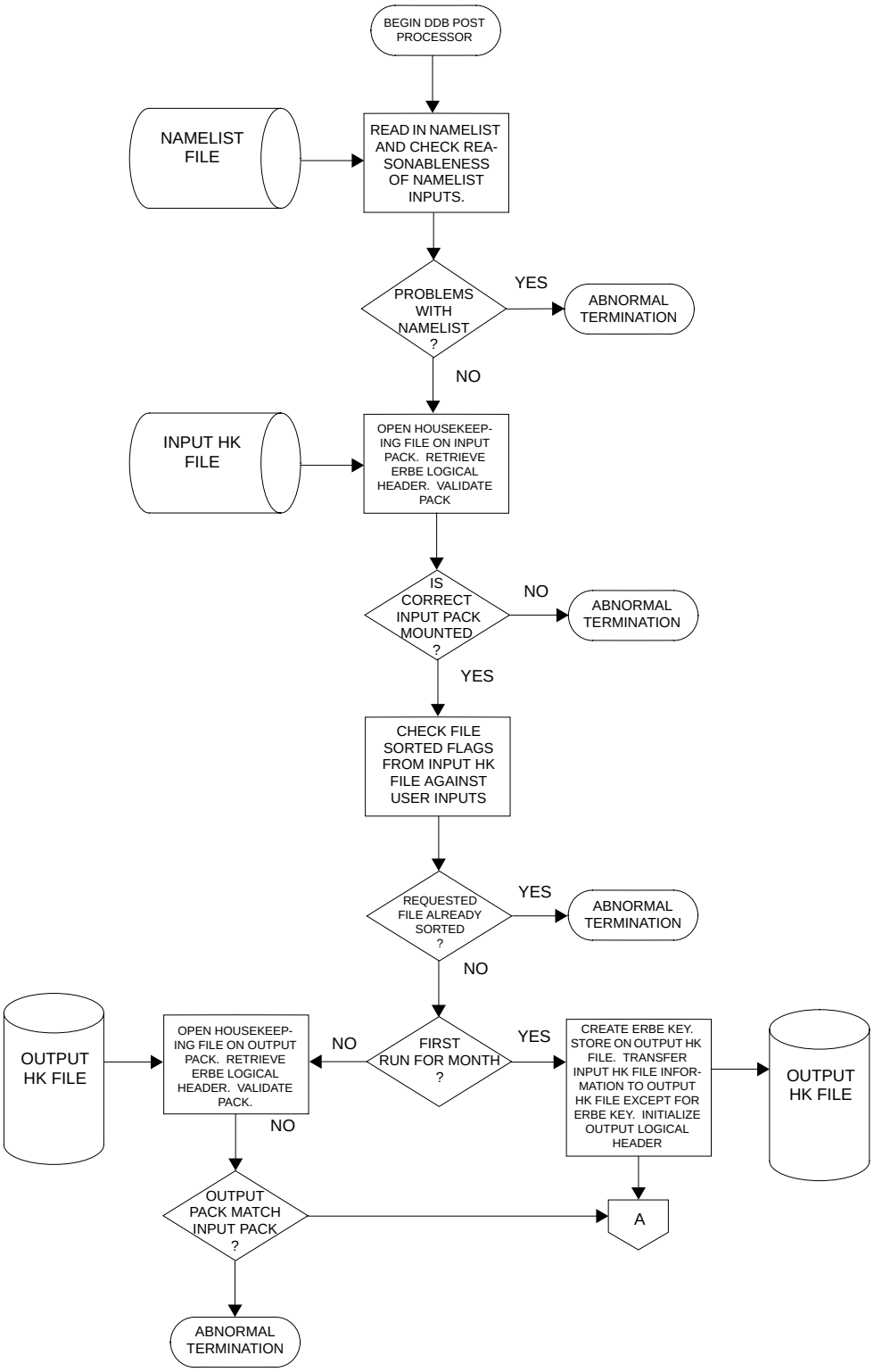


Figure 6.1-17. Scanner DDB Post-Processor Flowchart (1 of 2)

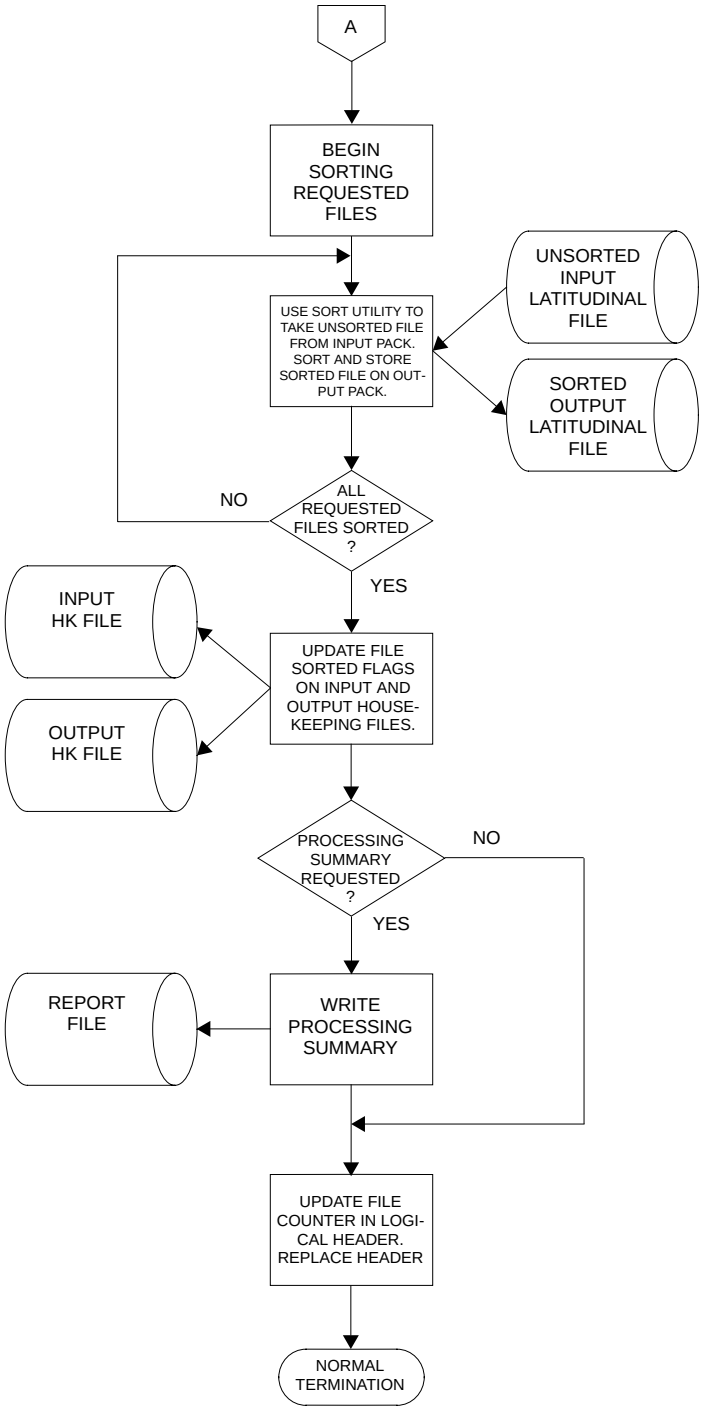


Figure 6.1-17. Scanner DDB Post-Processor Flowchart (2 of 2)

while the next execution sorts files 12 - 24. To accommodate the sort option, the numbers of the start and end files to be sorted are set up as NAMELIST inputs. The default setting is to sort all 36 files at one time.

In addition to control of which and how many files are to be sorted, the operator must also communicate to the program whether or not this is the first execution for the month. Because of the data base files being set up as CDC direct access files (which are DEFINEd if new, or ATTACHed if already exists) and because of the ERBE header file processing (which creates a key for a new file or fetches a key for an already existing file), the program must know whether to define and initialize new files, or attach and validate files which already exist. A switch is provided on the NAMELIST for this purpose. The default setting of the switch is to create a new file and an ERBE key. Further details of NAMELIST processing are discussed in Section 6.1.6.2.

6.1.5.1 Initializing Sorted Files. The first step in the scanner DDB post-processor is to read the NAMELIST file and do as much reasonableness checking as possible. The second step is to make sure that the pre-sorted pack contains the correct data base. This is accomplished by checking NAMELIST inputs against the ERBE logical header for the pre-sorted data base using the ERBE system utility IVLHED. The ERBE logical header is retrieved using the key stored on record 73 of the pre-sorted housekeeping file. (See Table 6.1-4.) The next step in the initialization process is to check the file sorted flags on record 76 of the pre-sorted housekeeping file to make sure that the files requested by the operator have not already been sorted.

The final part of the initialization is to determine whether the ERBE key for the output file already exists, or if it needs to be created. This decision is based on the NAMELIST switch described above. If this is the first sort for the month, the ERBE key for the sorted data base is created and stored on record 73 of the sorted housekeeping file. Records 1 - 72 and 74 - 76 from the pre-sorted housekeeping file are transferred to the sorted housekeeping file. This information is needed by MTSA to access the sorted data. (Note, however, that records 77 - 79 remain on the pre-sorted housekeeping file.) This information is required only by the record deletion process and not

needed to read data in MTSA. (See Section 6.1.6.1.) If this is not the first sort for the month, the already existing key on record 73 of the sorted housekeeping file is used to retrieve the ERBE logical header for the sorted data base. This header is checked to ensure that the sorted data base contains data corresponding to the same month, year, and satellite as the data on the pre-sorted data base.

6.1.5.2 Sorting Latitudinal Band Files. After the initialization and validation processes are successfully completed, the sorting process begins. Each of the requested input files are sorted separately and written to the sorted pack under a different file name. (See Table 6.1-6.) As previously mentioned, the sorting is performed by the Sort/Merge utility routine. The sort key to be used is the region number stored in bits 0 - 17 of the first word in the packed data record. (See Section 6.1.4.5.) The regional keys are sorted in ascending order.

6.1.5.3 Post-Processor Wrap-up. The final part of the program performs wrap-up procedures and writes a processing summary. To finalize processing for the pre-sorted and sorted housekeeping files, the file sorted flags on record 76 (see Table 6.1-4) are set for the files which have been sorted for this run. Both housekeeping files are updated in case more than one sort run is made for the month.

Two reports are written on the post-processor summary. The first report is a summary of the files sorted by the current run, files sorted by a prior execution, and files which remain unsorted. Also shown on the report are the number of records contained in each file. The numbers are obtained by adding all the number of records per region counters for each latitudinal band file. An asterisk beside a file in the unsorted files category indicates that there is no data for this file. This usually occurs for files which contain latitudinal bands close to the poles on the ERBS satellite. A sample of this report is shown in Figure 6.1-18. This report may be checked against the dayfile for the run where the Sort/Merge utility lists the number of records sorted for each file. The numbers in the dayfile from Sort/Merge and the numbers on the report from the housekeeping file must be the same. The second

record written is the cumulative totals for the scanner data base report as described in Section 6.1.4.6. (See Figure 6.1-19 for the scanner post-processor cumulative data base totals report.)

An ABEND module is included as part of the SDSSRT program to process controllable abnormal termination. Like the ABEND modules in the other DDB programs, this one identifies the cause of the abnormal termination, prints the processing summaries, if possible, and dumps available data from arrays and variables to aid in analysis of the problem.

Figure 6.1-18. Scanner Post-Processor Files Sorted Report

Figure 6.1-19. Scanner Post-Processor Cumulative Data Base Totals Report

6.1.6 MAINTENANCE ISSUES

6.1.6.1 Record Deletion. Provisions for deleting records from the scanner and the two nonscanner data bases have been made. It is not anticipated that record deletion will be used extensively. One reason for this is that record deletion is possible only if certain conditions have been met. These conditions are described later in this Section. Another reason is that an entire monthly data base can be created very quickly. It is possible to complete processing in one or two days if the resources are available. It is easier to re-create the data base if a large number of days must be deleted and/or replaced. At some point, however, it may be useful to use the record deletion capabilities to delete and replace one or two days. Because of the special analysis requirements of the record deletion process, this portion of the DDB Subsystem is considered an off-line process and is not included in the current version of the production software.

The record deletion process deletes one day of data at a time and incorporates the capability to delete overlap data if the first or last day of a month is being deleted. The record deletion process for the scanner data base is different than the record deletion process for the two nonscanner data bases because of the structural differences between the data bases. For these reasons, four separate programs are required to delete data from the monthly data bases. These four programs along with the module name prefixes and module number prefixes are shown in Table 6.1-1. The two scanner programs are module SDSDRC (6.1.5) for deleting scanner data records, and module SDSDER (6.1.6) for deleting scanner overlap records. The two nonscanner programs are module SDNDRC (6.1.11) for deleting nonscanner data base records, and module SDNDER (6.1.12) for deleting nonscanner overlap data records. The nonscanner programs are run separately for the numerical filter and shape factor data bases.

The structure diagrams for the scanner record deletion programs for the current and overlap data base records are shown in Figures 6.1-20 (SDSDRC) and 6.1-21 (SDSDER), respectively. A detailed processing flowchart for SDSDRC is provided in Figure 6.1-22. The processing flow for SDSDER is very similar.

The major difference is in the initialization and file validation process. The basic idea behind deleting records from the scanner data base is to transfer records from each latitudinal band file to a new file until the first record for the day to be deleted is encountered. Records for the day being deleted are read from the original file but not transferred to the revised file. Record transfer is resumed after the day to be deleted has been passed. The housekeeping file (see Table 6.1-4) is revised to subtract the number of records for the day deleted from each entry in the number of records per regions array. Other housekeeping items are revised as indicated on the flowchart. As can be seen, record deletion involves two removable disk packs with the revised data base being shifted from one pack to another as each day is deleted.

It can also be seen why the record deletion programs operate on the pre-sorted data base. Records for the day to be deleted are grouped together on the pre-sorted data base while they are scattered throughout the file on the sorted data base. It is therefore easier to delete data from the pre-sorted data base using the method outlined. Because of this, the file sorted flags on record 76 of the scanner housekeeping file are cleared so that the data base can be re-sorted after deleted data has been replaced or not, as desired.

Because record deletion involves modifications to the housekeeping file, the programs described above can only be used if the on-line system has run successfully. If the on-line system has aborted before the housekeeping data has been updated, the programs described above must be modified to take this into account.

Nonscanner record deletion also deletes data in blocks of one day at a time but there the similarity to the scanner record deletion process ends. Nonscanner record deletion operates by re-routing the pointers in the linked list to bypass the block of data to be deleted. These blocks then become available for future data storage. The empty and filled block pointers on the housekeeping file (see Table 6.1-9) are used to locate the blocks which contain data (filled blocks) and the blocks which are available for data (empty blocks). Because the nonscanner file structure allows records to

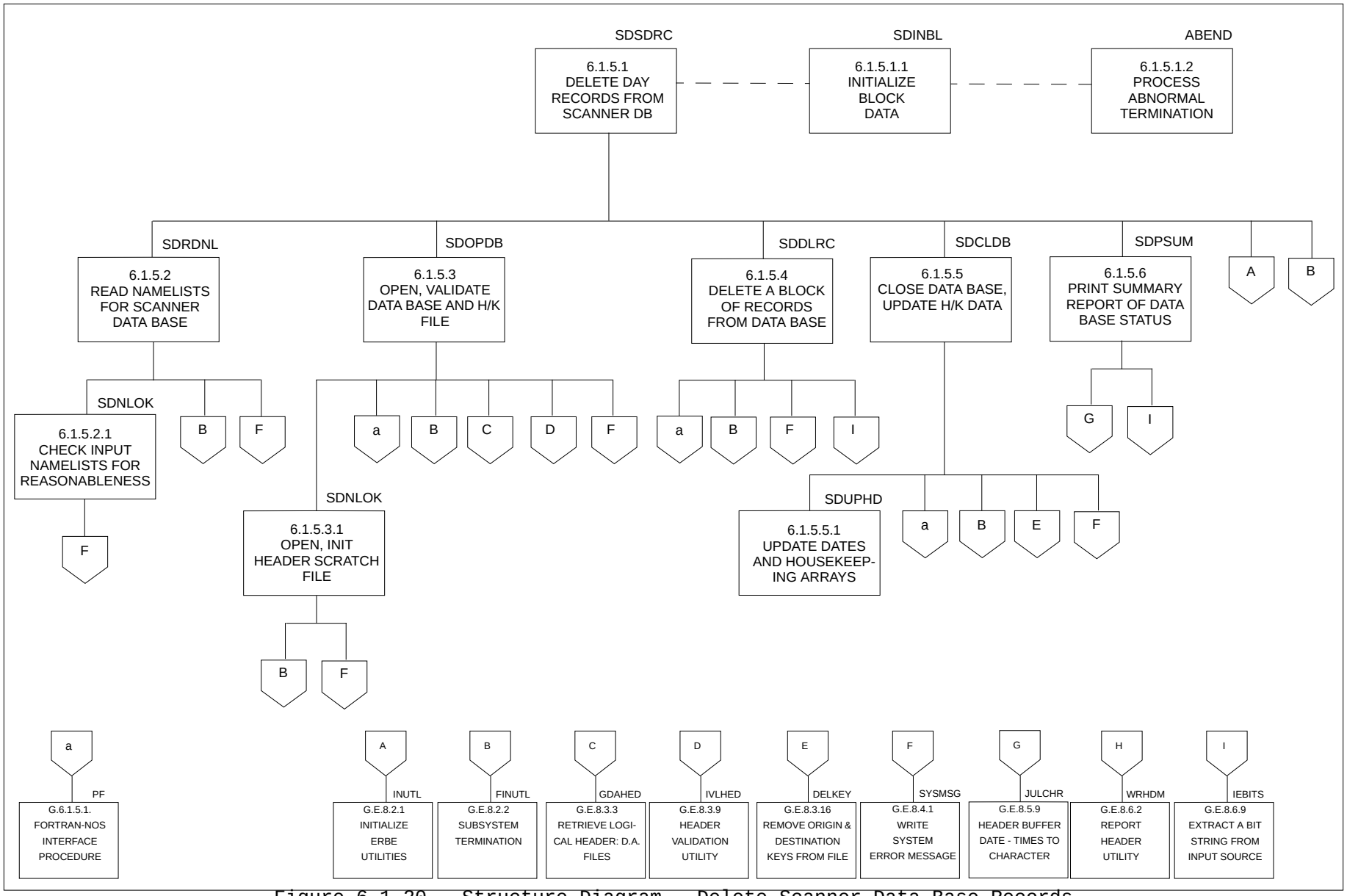


Figure 6.1-20. Structure Diagram - Delete Scanner Data Base Records

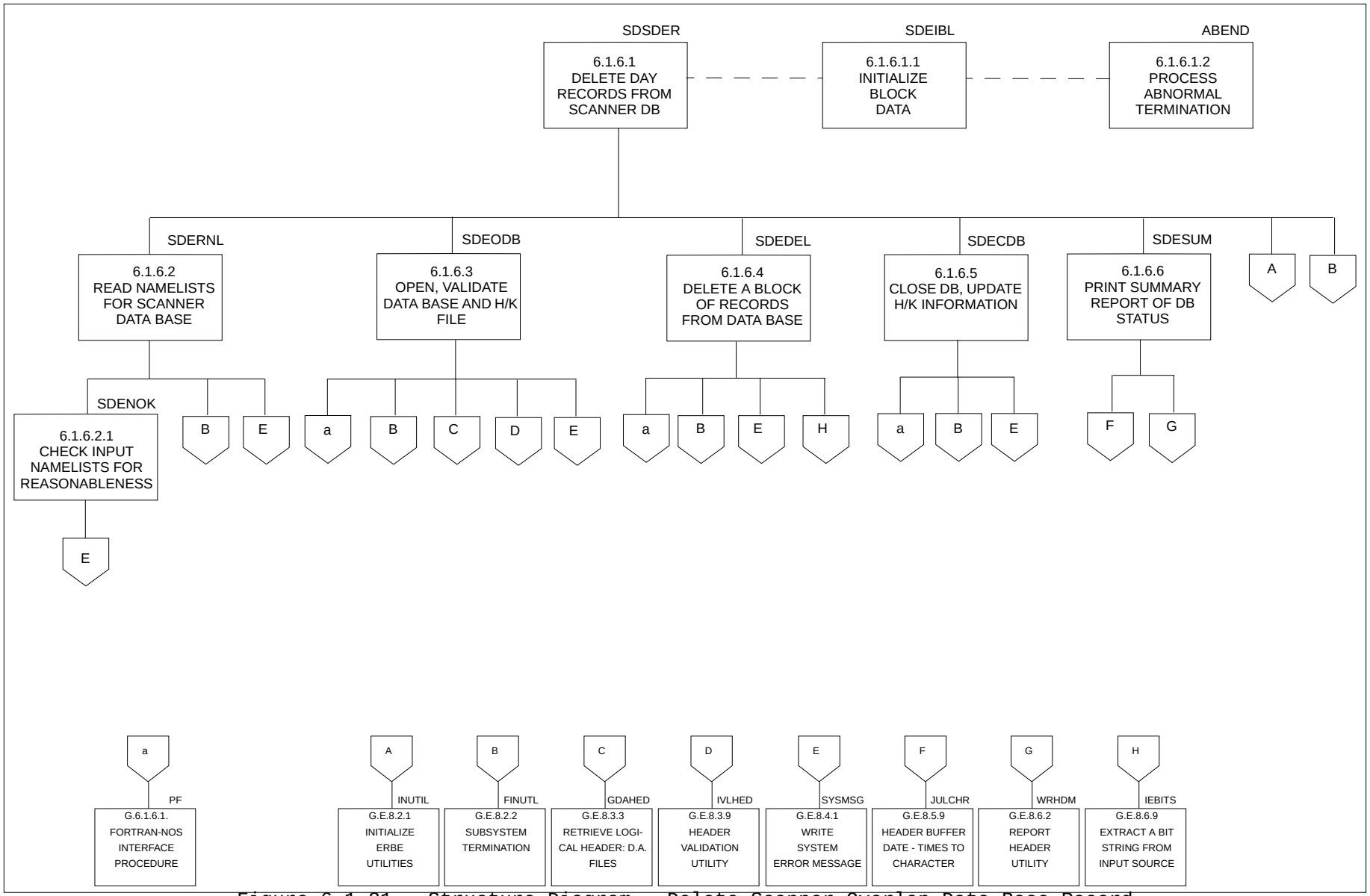


Figure 6.1-21. Structure Diagram - Delete Scanner Overlap Data Base Record

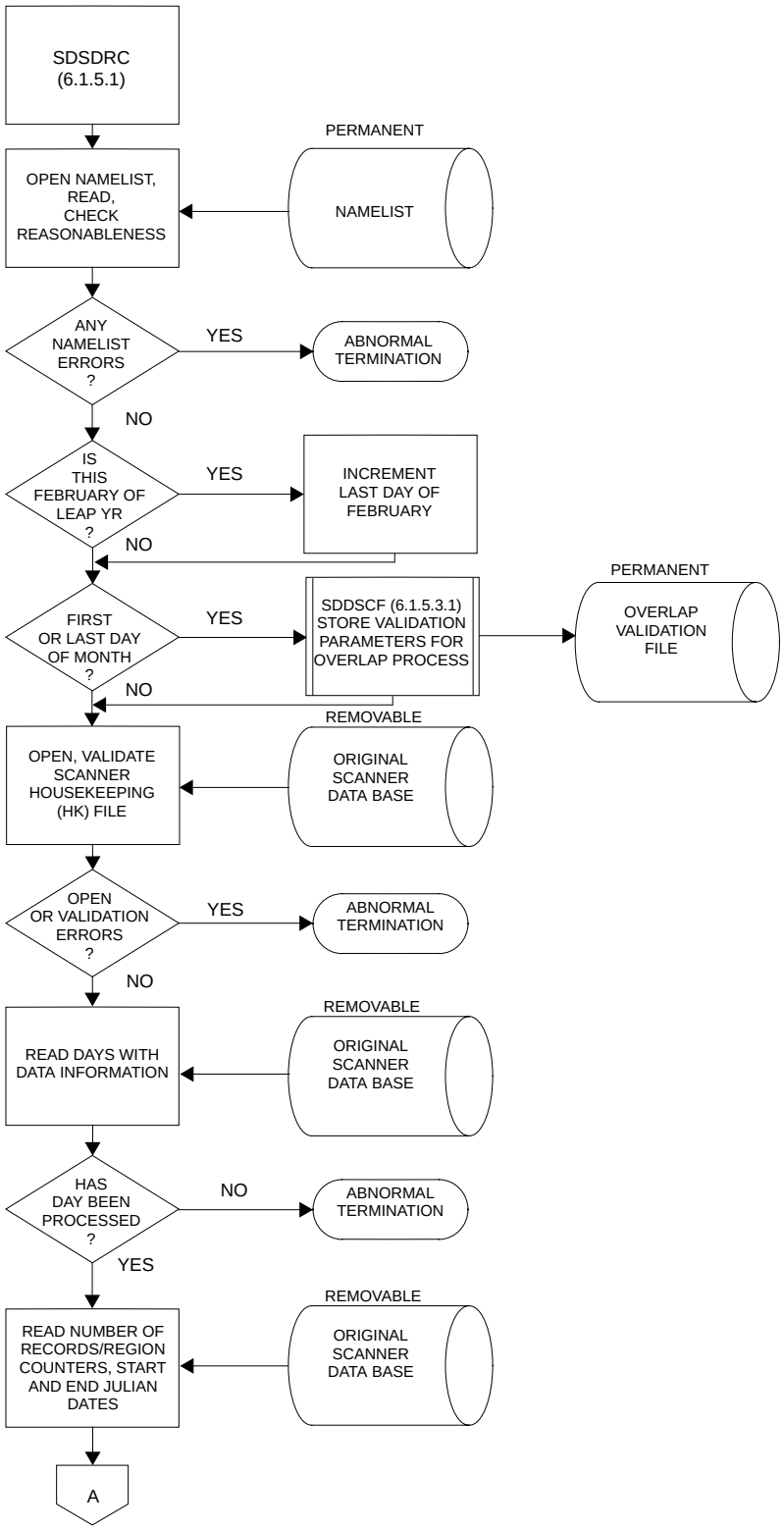


Figure 6.1-22. Processing Flow for Scanner Record Deletion (1 of 4)

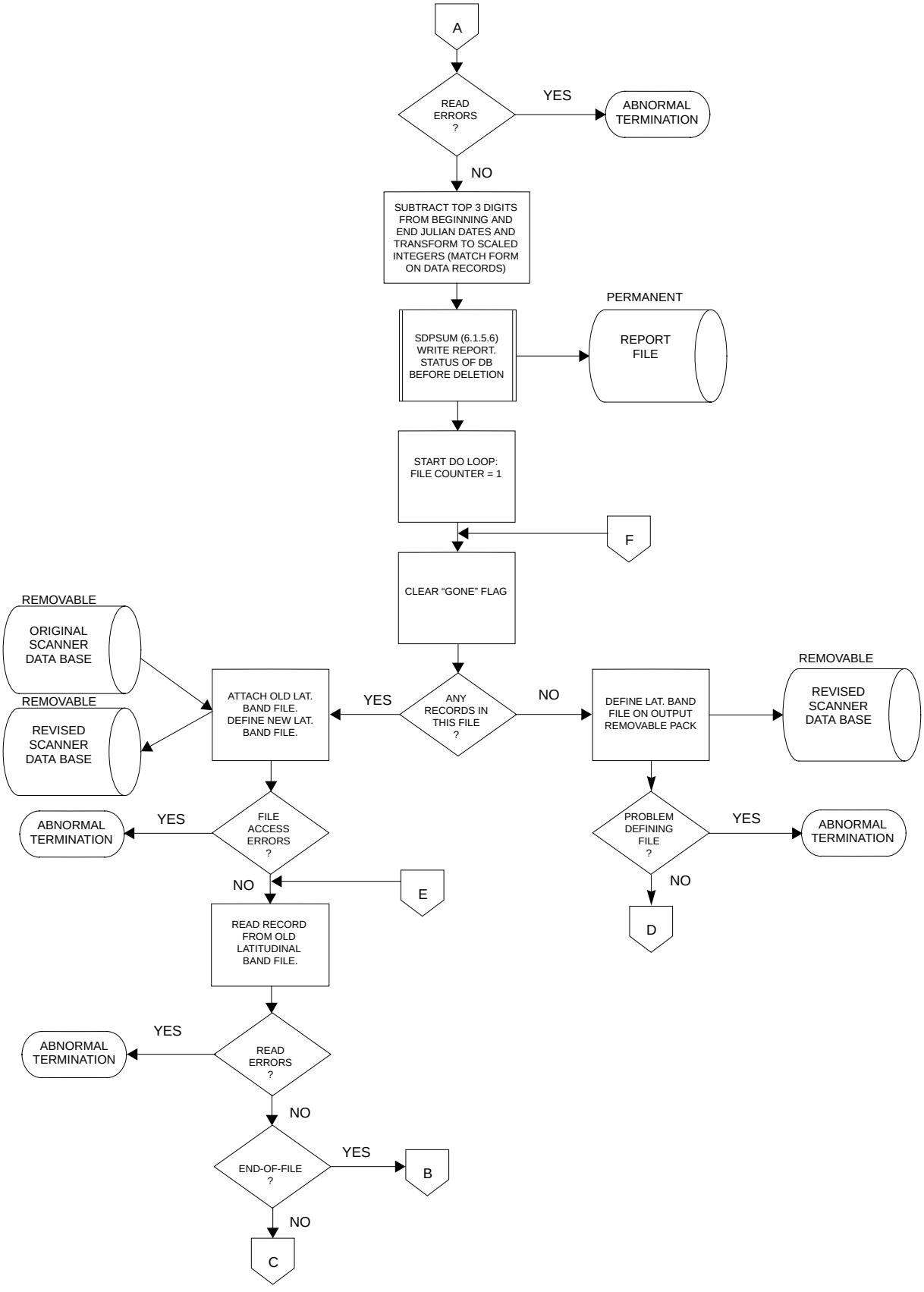


Figure 6.1-22. Processing Flow for Scanner Record Deletion (2 of 4)

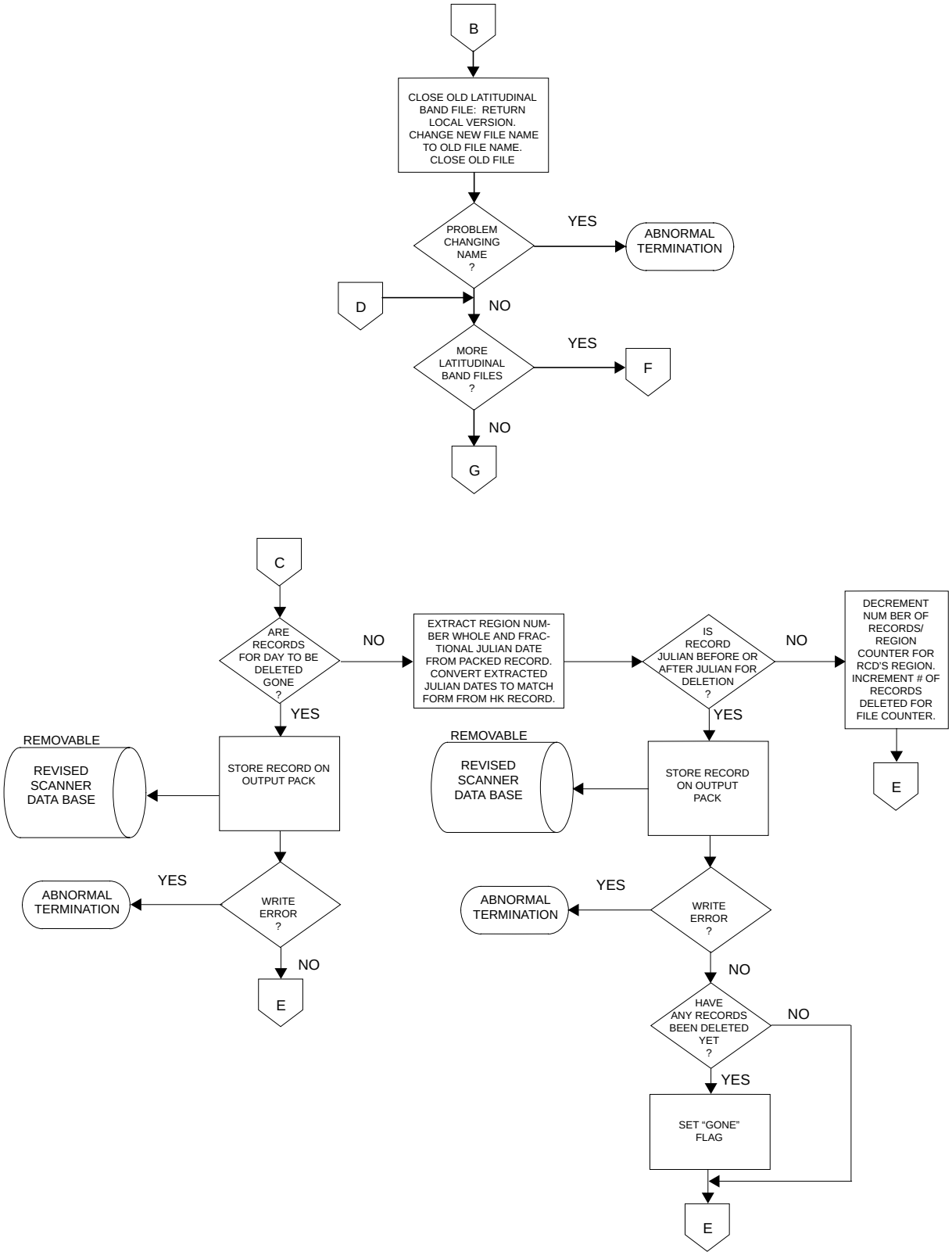


Figure 6.1-22. Processing Flow for Scanner Record Deletion (3 of 4)

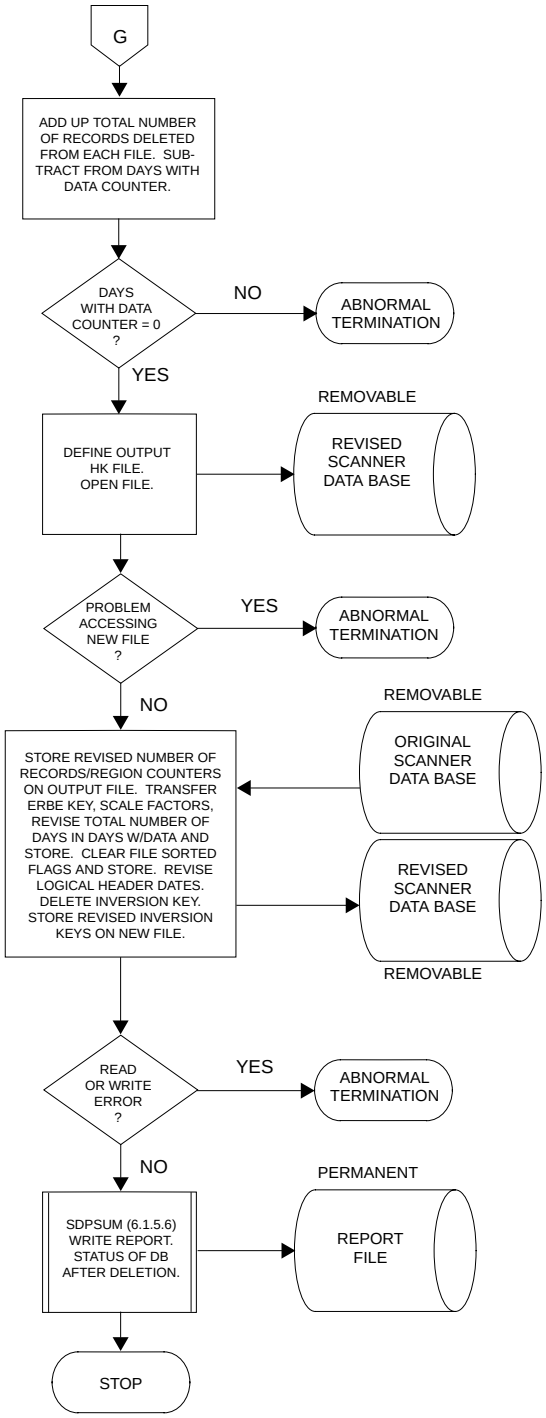


Figure 6.1-22. Processing Flow for Scanner Record Deletion (4 of 4)

overwrite records in “deleted” blocks of data, only one removable disk pack is required.

To see how data is deleted from the nonscanner data base, refer to Figure 6.1-23, which shows the condition of the linked list and pointers after the first three days of the Inversion data shown in Figure 6.1-9 have been stored. Suppose the data for the first day is to be deleted. It is known which block of records contains the data for day 1 because that information is stored in the filled block pointer array. To prevent these records from being accessed, the first record for each region which points into this block of data must be found and its linked list pointer changed to zero. The pointers to the block of records for day 1 must be removed from the filled block pointer array and transferred to the empty block pointer array so that the next time data is added to the linked list, the empty block of records between 2 and 8 will be filled before the block of records at the end of the file (28 - MAX) are filled.

Figure 6.1-24 shows the condition of the linked list and pointer arrays after day 1 is “deleted.” Although the records between 2 and 8 are shown as blank, the data is still there. These records cannot be accessed, however, and this space is available to be reused. The significant changes to the linked list file and pointers have been marked by asterisks.

Figure 6.1-25 shows the condition of the linked list and pointer arrays if the data for day 2 is “deleted.” In this case, the linked list pointer of the first record for each region which points into the block of data for day 2 is changed so that it now points to the last record for that region in the block of data for day 1. As before, the pointers to this block of records are removed from the filled block pointer array and transferred to the empty block pointer array so that this space can be reused.

Another case of deleting data, which is handled differently, occurs if the block most recently added must be removed. In this case, it is necessary to change the head pointers to bypass the block of records rather than changing the linked list pointers. As with the other cases, the filled block pointers

LINKED LIST

LINK RCD	INV. RCD	REGN	DAY	INV. DATA	LINK POINTER
1	--	ERBE KEY			
2	1	1	1	DATA	0
3	2	2	1	DATA	0
4	3	3	1	DATA	0
5	4	1	1	DATA	2
6	5	2	1	DATA	3
7	6	3	1	DATA	4
8	7	1	1	DATA	5
9	1	3	2	DATA	7
10	2	1	2	DATA	8
11	3	2	2	DATA	6
12	4	3	2	DATA	9
13	5	1	2	DATA	10
14	6	2	2	DATA	11
15	7	3	2	DATA	12
16	8	1	2	DATA	13
17	9	3	2	DATA	15
18	10	2	2	DATA	14
19	1	3	3	DATA	17
20	2	1	3	DATA	16
21	3	2	3	DATA	18
22	4	2	3	DATA	21
23	5	3	3	DATA	19
24	6	1	3	DATA	20
25	7	2	3	DATA	22
26	8	3	3	DATA	23
27	9	1	3	DATA	24
•	•	•	•	•	•
•	•	•	•	•	•
•	•	•	•	•	•
MAX					

EMPTY BLOCK POINTERS	
START	END
28	MAX
0	0
0	0
0	0
0	0
•	•
•	•
•	•
0	0

HEAD POINTERS		
REGN 1	REGN 2	REGN 3
27	25	26

FILLED BLOCK POINTERS		
DAY	START	END
1	2	8
2	9	18
3	19	27
0	0	0
0	0	0
0	0	0
0	0	0
•	•	•
•	•	•
•	•	•
0	0	0

Figure 6.1-23. Condition of Linked List and Pointers After Storing Three Days of Inversion Data

LINKED LIST

LINK RCD	INV. RCD	REGN	DAY	INV. DATA	LINK POINTER
1	--	ERBE KEY			
2					
3					
4					
5					
6					
7					
8					
9	1	3	2	DATA	0*
10	2	1	2	DATA	0*
11	3	2	2	DATA	0*
12	4	3	2	DATA	9
13	5	1	2	DATA	10
14	6	2	2	DATA	11
15	7	3	2	DATA	12
16	8	1	2	DATA	13
17	9	3	2	DATA	15
18	10	2	2	DATA	14
19	1	3	3	DATA	17
20	2	1	3	DATA	16
21	3	2	3	DATA	18
22	4	2	3	DATA	21
23	5	3	3	DATA	19
24	6	1	3	DATA	20
25	7	2	3	DATA	22
26	8	3	3	DATA	23
27	9	1	3	DATA	24
•	•	•	•	•	•
•	•	•	•	•	•
•	•	•	•	•	•
MAX					

EMPTY BLOCK POINTERS	
START	END
28	MAX
2*	8*
0	0
0	0
0	0
•	•
•	•
•	•
0	0

HEAD POINTERS		
REGN 1	REGN 2	REGN 3
27	25	26

FILLED BLOCK POINTERS		
DAY	START	END
2	9	18
3	19	27
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
•	•	•
•	•	•
•	•	•
0	0	0

Figure 6.1-24. Condition of Linked List and Pointers if Day 1 is Deleted

LINKED LIST

LINK RCD	INV. RCD	REGN	DAY	INV. DATA	LINK POINTER
1	--	ERBE KEY			
2	1	1	1	DATA	0
3	2	2	1	DATA	0
4	3	3	1	DATA	0
5	4	1	1	DATA	2
6	5	2	1	DATA	3
7	6	3	1	DATA	4
8	7	1	1	DATA	5
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19	1	3	3	DATA	7*
20	2	1	3	DATA	8*
21	3	2	3	DATA	6*
22	4	2	3	DATA	21
23	5	3	3	DATA	19
24	6	1	3	DATA	20
25	7	2	3	DATA	22
26	8	3	3	DATA	23
27	9	1	3	DATA	24
•	•	•	•	•	•
•	•	•	•	•	•
•	•	•	•	•	•
MAX					

EMPTY BLOCK POINTERS	
START	END
28	MAX
9*	18*
0	0
0	0
0	0
•	•
•	•
•	•
0	0

HEAD POINTERS		
REGN 1	REGN 2	REGN 3
27	25	26

FILLED BLOCK POINTERS		
DAY	START	END
1	2	8
3	19	27
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
•	•	•
•	•	•
•	•	•
0	0	0

Figure 6.1-25. Condition of Linked List and Pointers if Day 2 is Deleted

for the deleted data are transferred to the empty block pointer array so that the space can be reused. Figure 6.1-26 illustrates the condition of the linked list and pointer arrays if this case occurs.

To see the effect of adding new data and replacing deleted data, refer to Figure 6.1-25, which shows the condition of the linked list and pointer arrays after the data for day 2 is removed. The first step in the hypothetical example is to add a new day (Inversion tape 4 from Figure 6.1-9) to the linked list. Figure 6.1-27 shows the linked list and pointer arrays after day 4 is added.

As can be seen, the “empty” block of records between 9 and 18 is partially filled. Records 17 and 18 are still considered an empty “block” to be filled from the next Inversion tape. Records 9 through 16 are identified as a filled block which contains data for day 4. The linked list pointers are now scattered throughout the file, but records for any region are still accessed in a last-in, first-out fashion.

The final part of this example is to replace the data for day 2 which was deleted earlier. As far as the linked list and its pointers are concerned, this is a new Inversion tape. Figure 6.1-28 shows the condition of the linked list and pointer arrays after the data for day 2 has been replaced.

An examination of the filled block pointer array shows that the data for day 2 is actually stored in two separate blocks on the linked list file. This makes no difference to any attempts to access the data since the linked list pointers are still connecting all the data for day 2 in the proper order. The empty block pointer array now shows that there are no empty blocks in the middle of the file and also indicates the beginning of the available empty space at the end of the file.

The structure diagrams for the nonscanner record deletion programs for the current and overlap data base records are shown in Figures 6.1-29 (SDNDRC) and 6.1-30 (SDNDER), respectively. A detailed processing flowchart for SDNDRC

LINKED LIST

LINK RCD	INV. RCD	REGN	DAY	INV. DATA	LINK POINTER
1	--	ERBE KEY			
2	1	1	1	DATA	0
3	2	2	1	DATA	0
4	3	3	1	DATA	0
5	4	1	1	DATA	2
6	5	2	1	DATA	3
7	6	3	1	DATA	4
8	7	1	7	DATA	5
9	1	3	2	DATA	7
10	2	1	2	DATA	8
11	3	2	2	DATA	6
12	4	3	2	DATA	9
13	5	1	2	DATA	10
14	6	2	2	DATA	11
15	7	3	2	DATA	12
16	8	1	2	DATA	13
17	9	3	2	DATA	15
18	10	2	2	DATA	14
19					
20					
21					
22					
23					
24					
25					
26					
27					
•	•	•	•	•	•
•	•	•	•	•	•
•	•	•	•	•	•
MAX					

EMPTY BLOCK POINTERS	
START	END
28	MAX
19*	27*
0	0
0	0
0	0
•	•
•	•
•	•
0	0

HEAD POINTERS		
REGN 1	REGN 2	REGN 3
16*	18*	17*

FILLED BLOCK POINTERS		
DAY	START	END
1	2	8
2	9	18
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
•	•	•
•	•	•
•	•	•
0	0	0

Figure 6.1-26. Condition of Linked List and Pointers if Day 3 is Deleted

LINKED LIST

LINK RCD	INV. RCD	REGN	DAY	INV. DATA	LINK POINTER
1	--	ERBE KEY			
2	1	1	1	DATA	0
3	2	2	1	DATA	0
4	3	3	1	DATA	0
5	4	1	1	DATA	2
6	5	2	1	DATA	3
7	6	3	1	DATA	4
8	7	1	1	DATA	5
9	1	1	4	DATA	27
10	2	2	4	DATA	25
11	3	3	4	DATA	26
12	4	1	4	DATA	9
13	5	2	4	DATA	10
14	6	3	4	DATA	11
15	7	2	4	DATA	13
16	8	3	4	DATA	14
17					
18					
19	1	3	3	DATA	7
20	2	1	3	DATA	8
21	3	2	3	DATA	6
22	4	2	3	DATA	21
23	5	3	3	DATA	19
24	6	1	3	DATA	20
25	7	2	3	DATA	22
26	8	3	3	DATA	23
27	9	1	3	DATA	24
•	•	•	•	•	•
•	•	•	•	•	•
•	•	•	•	•	•
MAX					

EMPTY BLOCK POINTERS	
START	END
28	MAX
17	18
0	0
0	0
0	0
0	0
•	•
•	•
•	•
0	0

HEAD POINTERS		
REGN 1	REGN 2	REGN 3
12	15	16

FILLED BLOCK POINTERS		
DAY	START	END
1	2	8
3	19	27
4	9	16
0	0	0
0	0	0
0	0	0
0	0	0
•	•	•
•	•	•
•	•	•
0	0	0

Figure 6.1-27. Condition of Linked List and Pointers After Day 4 is Added

LINKED LIST

LINK RCD	INV. RCD	REGN	DAY	INV. DATA	LINK POINTER
1	--	ERBE KEY			
2	1	1	1	DATA	0
3	2	2	1	DATA	0
4	3	3	1	DATA	0
5	4	1	1	DATA	2
6	5	2	1	DATA	3
7	6	3	1	DATA	4
8	7	1	1	DATA	5
9	1	1	4	DATA	27
10	2	2	4	DATA	25
11	3	3	4	DATA	26
12	4	1	4	DATA	9
13	5	2	4	DATA	10
14	6	3	4	DATA	11
15	7	2	4	DATA	13
16	8	3	4	DATA	14
17	1	3	2	DATA	16
18	2	1	2	DATA	12
19	1	3	3	DATA	7
20	2	1	3	DATA	8
21	3	2	3	DATA	6
22	4	2	3	DATA	21
23	5	3	3	DATA	19
24	6	1	3	DATA	20
25	7	2	3	DATA	22
26	8	3	3	DATA	23
27	9	1	3	DATA	24
28	3	2	2	DATA	15
29	4	3	2	DATA	17
30	5	1	2	DATA	18
31	6	2	2	DATA	28
32	7	3	2	DATA	29
33	8	1	2	DATA	30
34	9	3	2	DATA	32
35	10	2	2	DATA	31
•	•	•	•	•	•
•	•	•	•	•	•
•	•	•	•	•	•
MAX					

EMPTY BLOCK POINTERS	
START	END
36	MAX
0	0
0	0
0	0
0	0
0	0
•	•
•	•
•	•
0	0

HEAD POINTERS		
REGN 1	REGN 2	REGN 3
33	35	34

FILLED BLOCK POINTERS		
DAY	START	END
1	2	8
3	19	27
4	9	16
2	17	18
2	28	35
0	0	0
0	0	0
0	0	0
0	0	0
•	•	•
•	•	•
•	•	•
0	0	0

Figure 6.1-28. Condition of Linked List and Pointers After Replacing Day 2

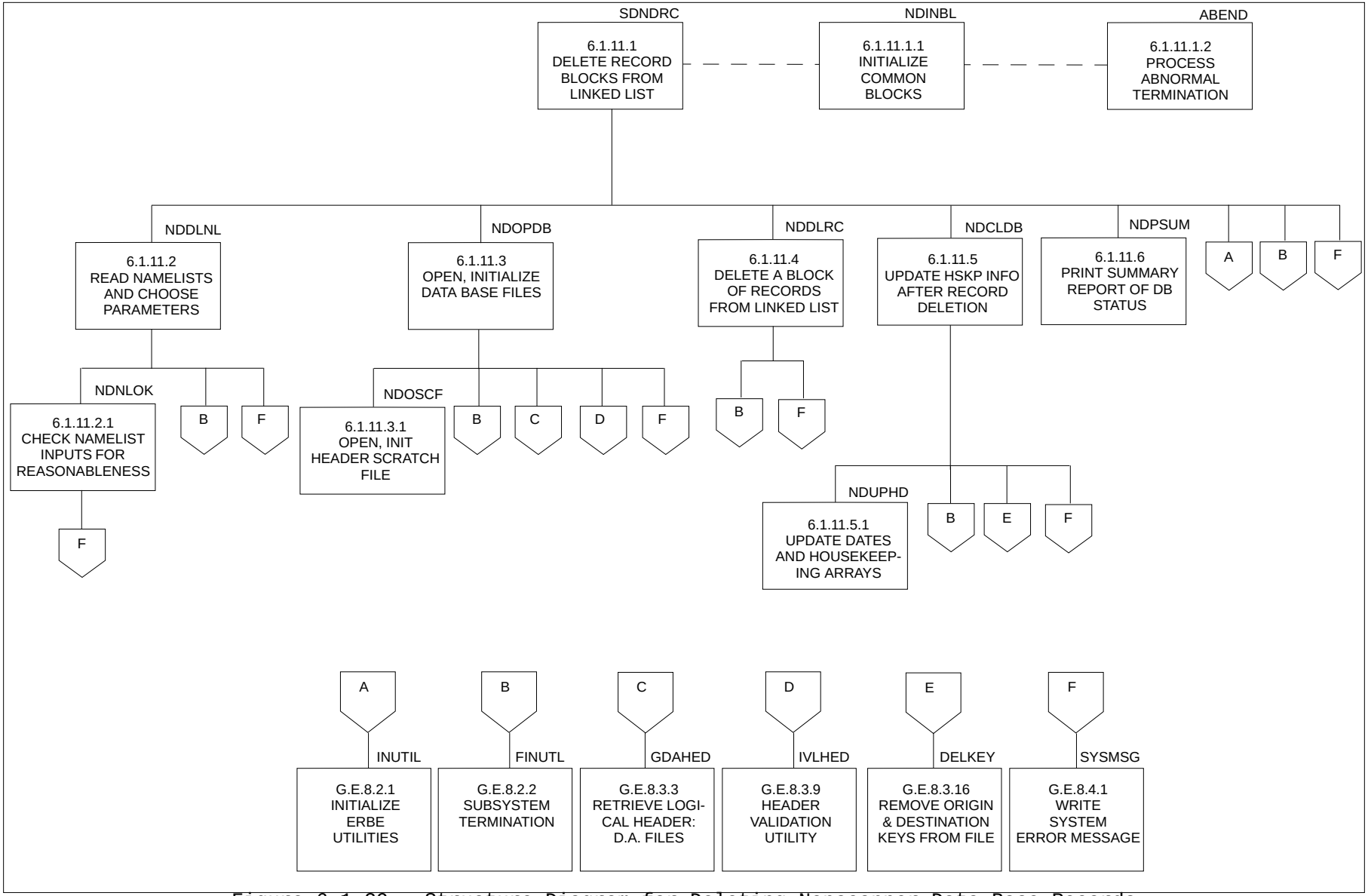


Figure 6.1-29. Structure Diagram for Deleting Nonscanner Data Base Records

is provided in Figure 6.1-31. The processing flow for SDNDER is very similar except for the initialization and file validation portions.

Like the scanner record deletion programs, the nonscanner programs assume that the daily update runs have completed successfully through updating the information on the housekeeping files. Unlike the scanner record deletion process, it is possible to store data if processing has been interrupted before the housekeeping information is updated simply by rerunning the update program. This is possible because the nonscanner data base uses a FORTRAN direct (random) access file structure so that data records can be overwritten by new data records. Since the nonscanner housekeeping files are updated at the end of processing, if execution is interrupted before this point, then the data base has no knowledge of any records which have been stored.

6.1.6.2 Running the DDB Subsystem. Reference 5 provides extensive directions on how to run the DDB Subsystem in the production account. The information provided in Reference 5 includes:

1. An overview of the processing from the standpoint of operations.
2. Directions on how to set up batch submittal files to run jobs including how to modify the files individually and how to use the automatic JCL generator (DDB on the procedure file DOYLE).
3. Detailed descriptions of the NAMELIST files.
4. Detailed descriptions of the ERBE error messages.
5. Scheduling considerations.

THe information provided in Reference 5 will not be repeated here. However, Reference 5 provides essential information to processing data through the DDB Subsystem and should be read before any changes to the subsystem are attempted.

The amount of data to be stored on the removable disk packs should not become an issue for the two nonscanner data bases. These data bases are relatively small and should easily fit on a removable disk pack. Size does become a factor for the scanner data base, however. A removable disk pack nominally holds approximately 360,000 physical record units (PRUs). This is ample storage space for the scanner data base. However, a problem could arise if

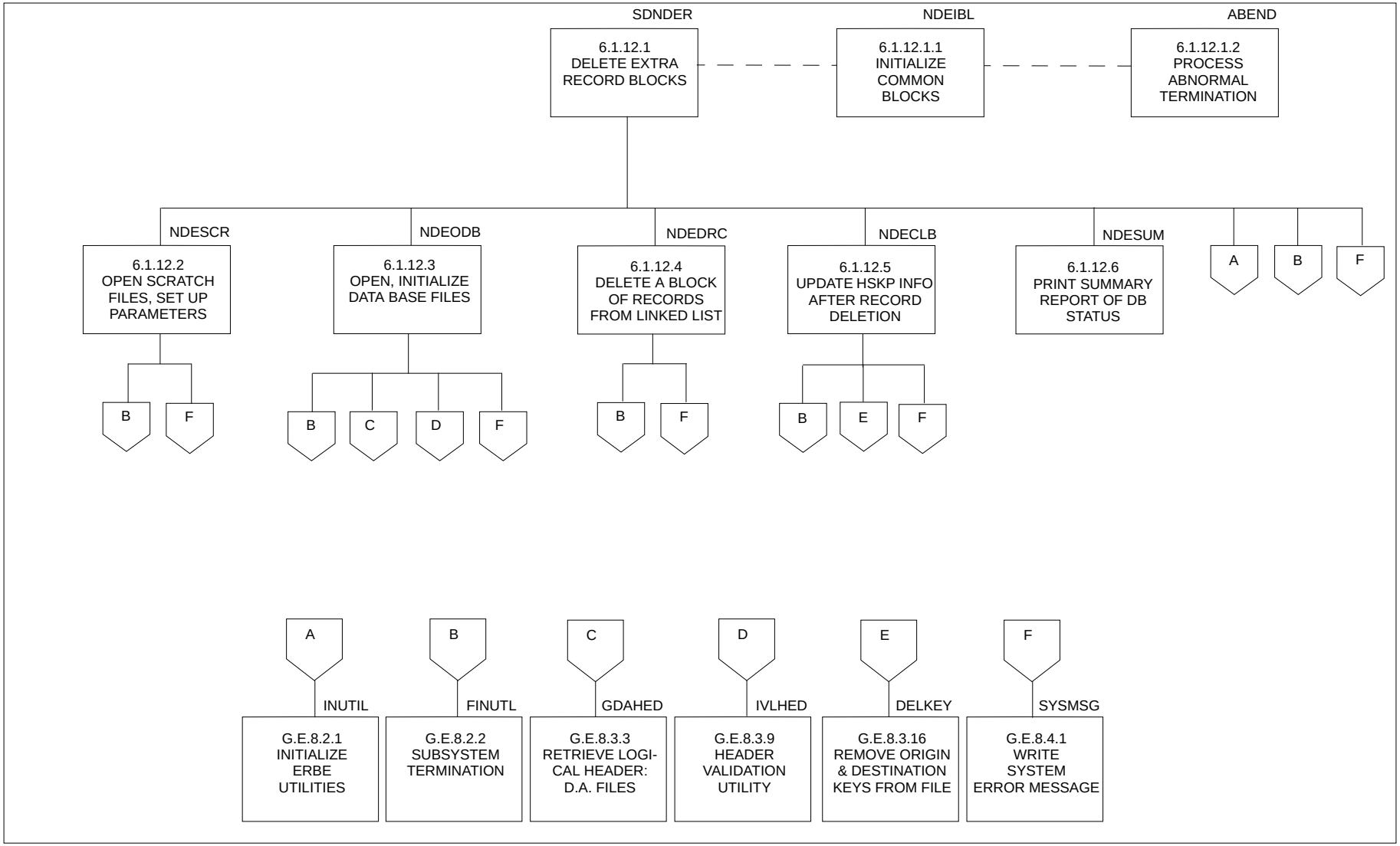


Figure 6.1-30. Structure Diagram for Deleting Nonscanner Overlap Data

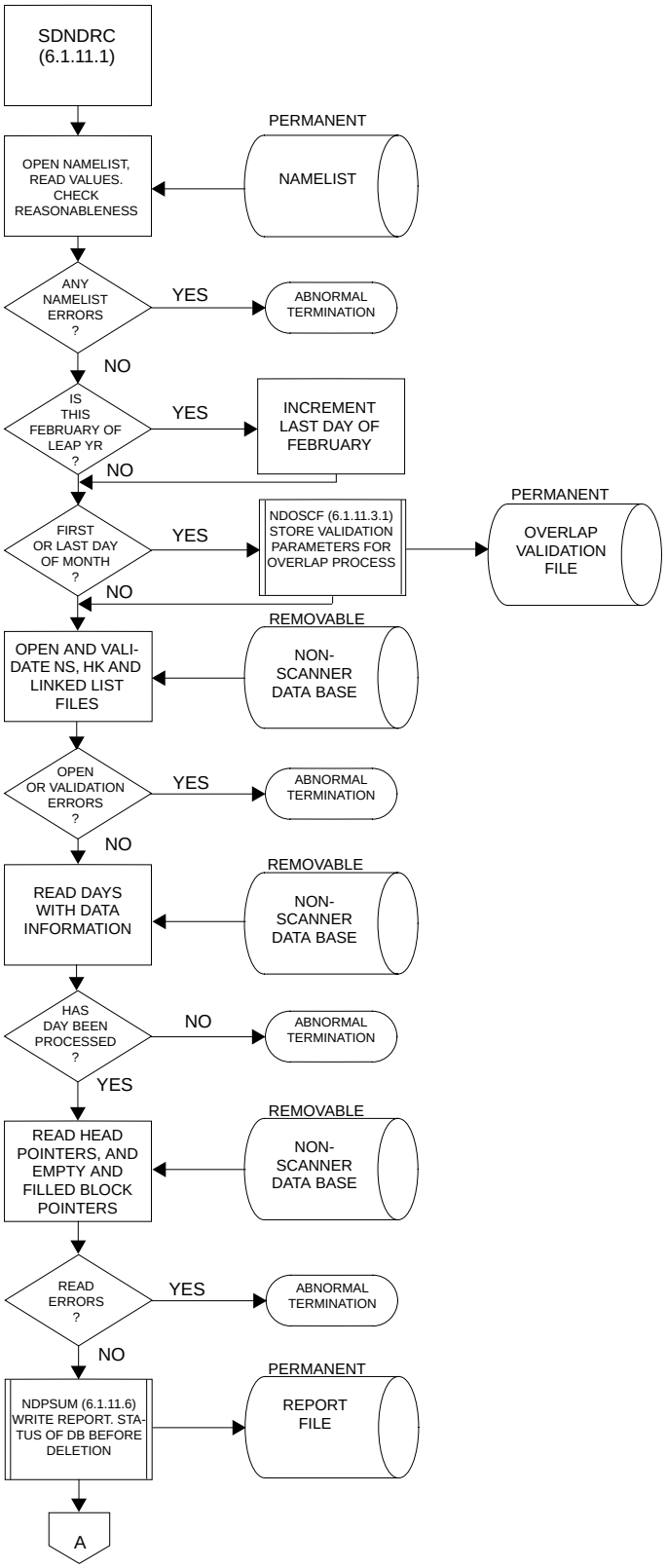


Figure 6.1-31. Processing Flow for Nonscanner Record Deletion (1 of 5)

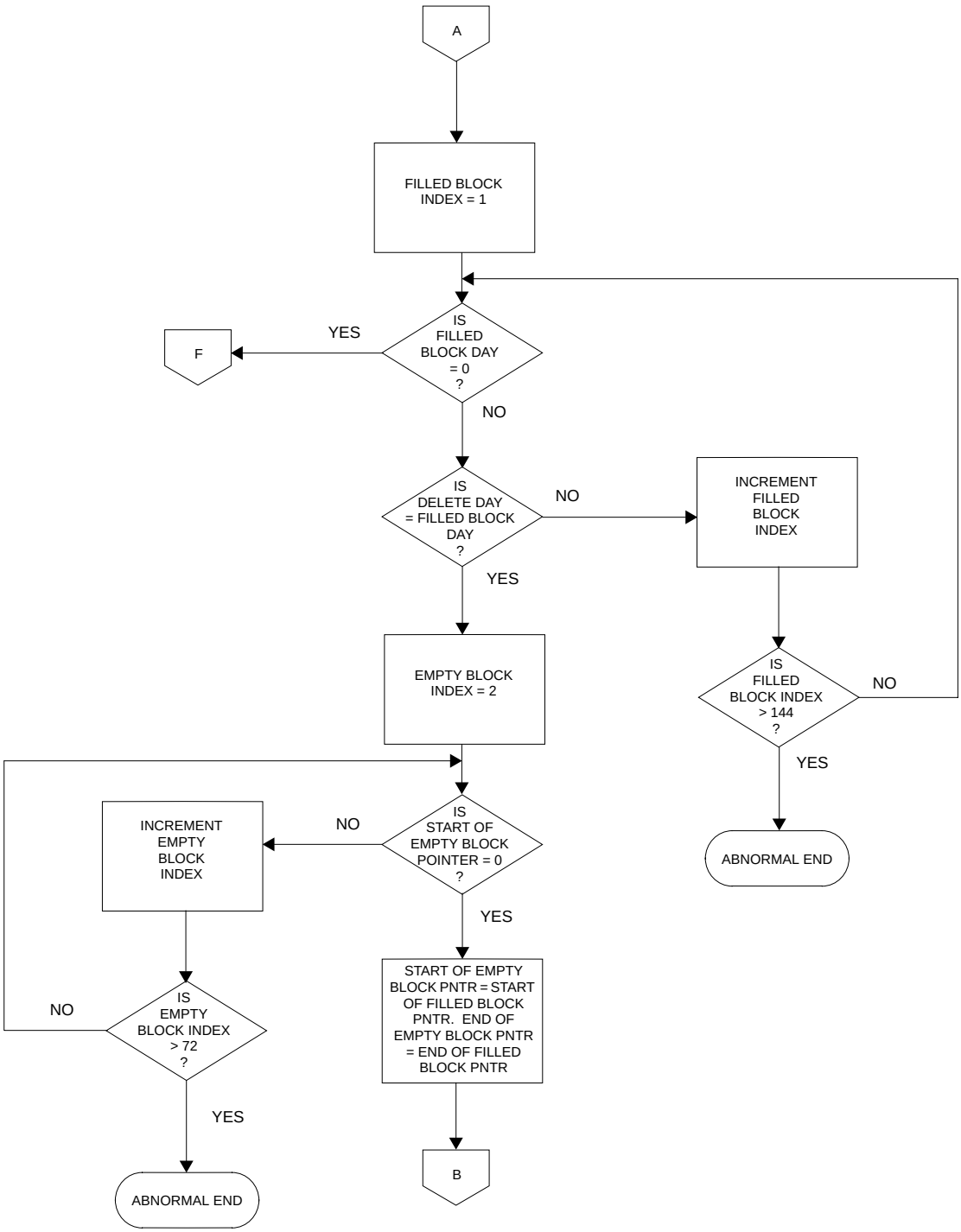


Figure 6.1-31. Processing Flow for Nonscanner Record Deletion (2 of 5)

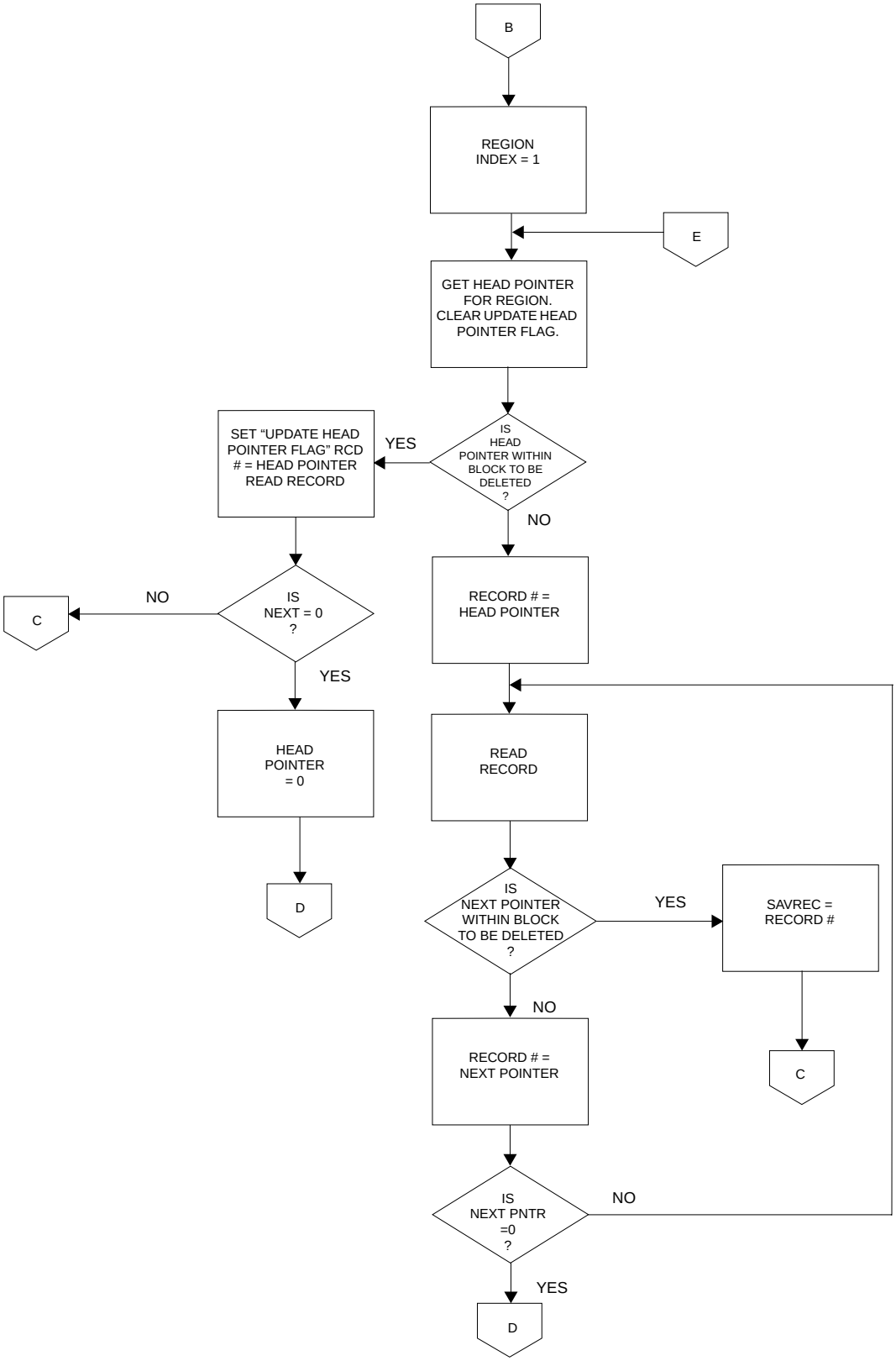


Figure 6.1-31. Processing Flow for Nonscanner Record Deletion (3 of 5)

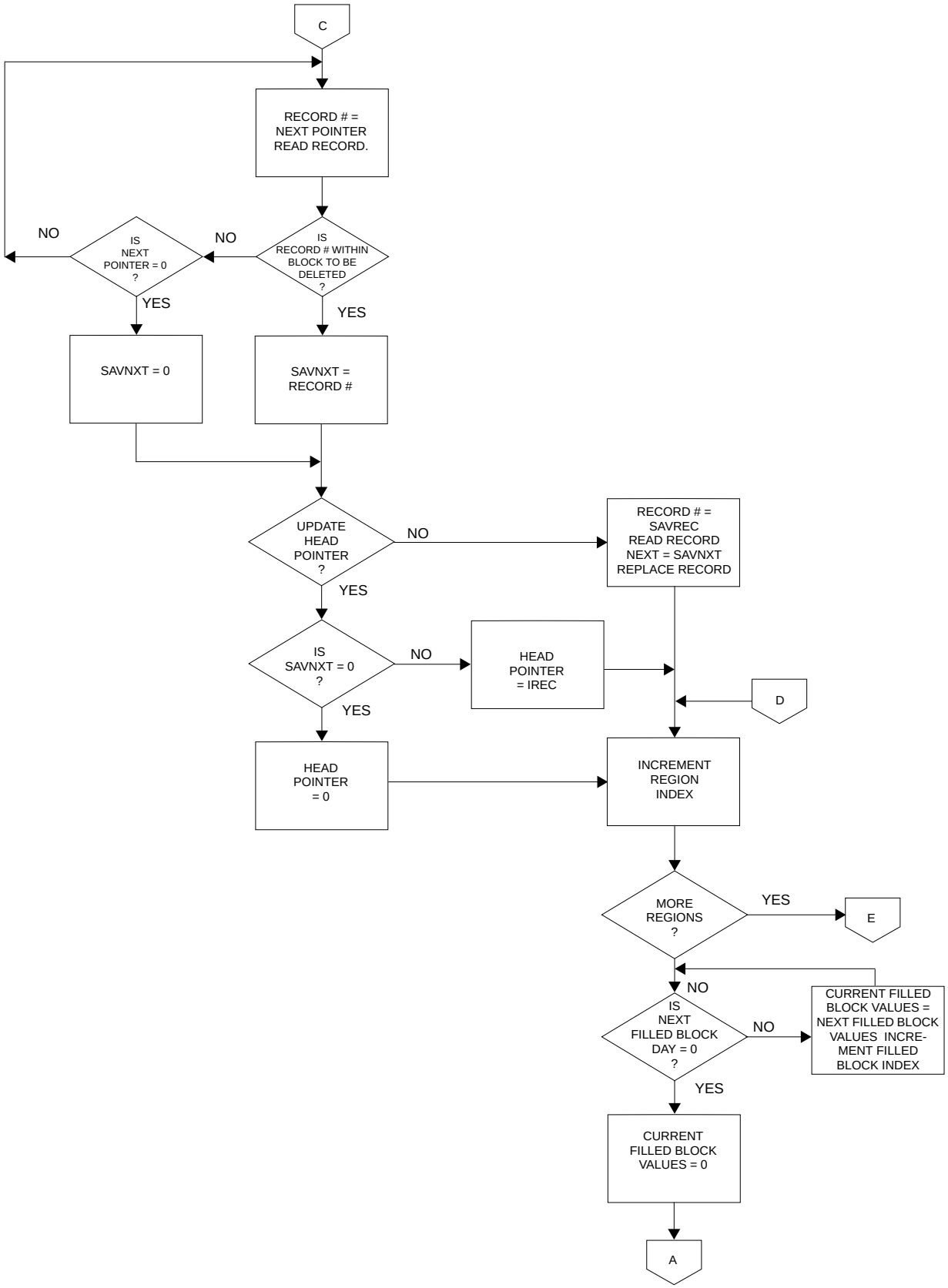


Figure 6.1-31. Processing Flow for Nonscanner Record Deletion (4 of 5)

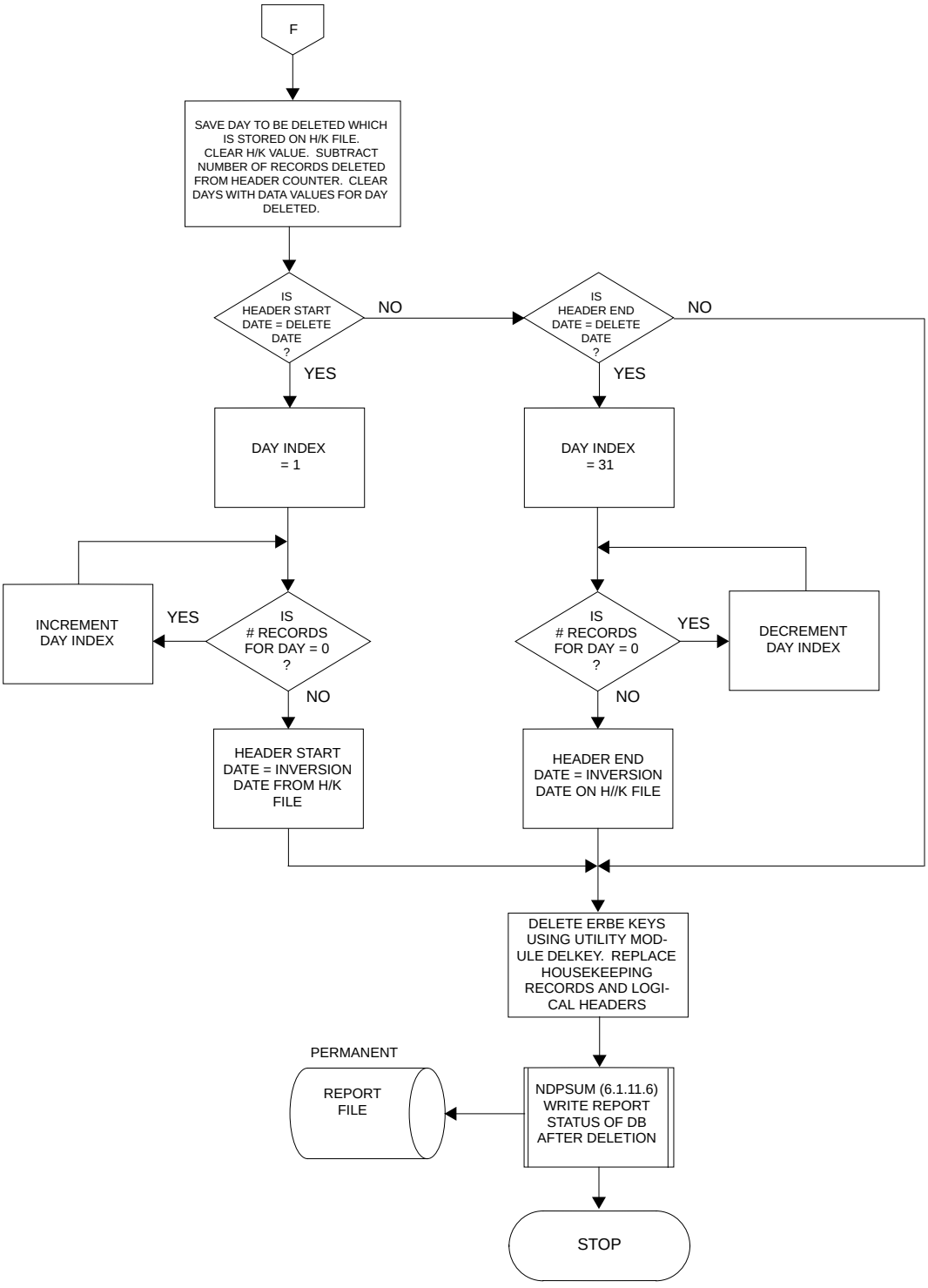


Figure 6.1-31. Processing Flow for Nonscanner Record Deletion (5 of 5)

for some reason other files are stored on the removable disk pack so that the entire space is not available. To ensure that the removable disk pack has adequate space for the scanner data base, a parameter is added to the DEFINE statement for the scanner housekeeping file. This parameter is:

S = 360,000

and the DEFINE aborts if there are less than 360,000 PRUs of storage available on the removable disk pack. Since the scanner data base is so large, no more data items should be added to the scanner monthly data base record without serious consideration of storage on the removable disk pack.

6.1.6.3 Validation Software. Some off-line software has been developed to use in validating the DDB Subsystem. Two programs are available to interactively examine the contents of the housekeeping files. The scanner program is called SDSHDS. A structure diagram for SDSHDS is shown in Figure 6.1-32. A procedure file is available to run this program and is called PDSHSK. The program is capable of reading either the pre-sorted or sorted housekeeping file. Output is displayed interactively and an option is available to save it on a file for hard copy. The nonscanner program is called SDNHDS. The structure diagram for this program is shown in Figure 6.1-33. PDSHSK can also be used for this program with some minor modifications.

Two programs have been developed which provide data in the form of a sequential, unpacked data file and/or a report for a range of regions from any of the three data bases. The program for the scanner is called SDRSDB. The two nonscanner data bases use a program called SDRNDB. Two procedure files are needed to run the programs: PDRSDB for the scanner program and PDRNDB for the nonscanner program. An interactive procedure file, PDRDDB, is available which prompts the user for the information necessary to set up a batch submittal and NAMELIST file for each run. Help information is provided on PDRDDB.

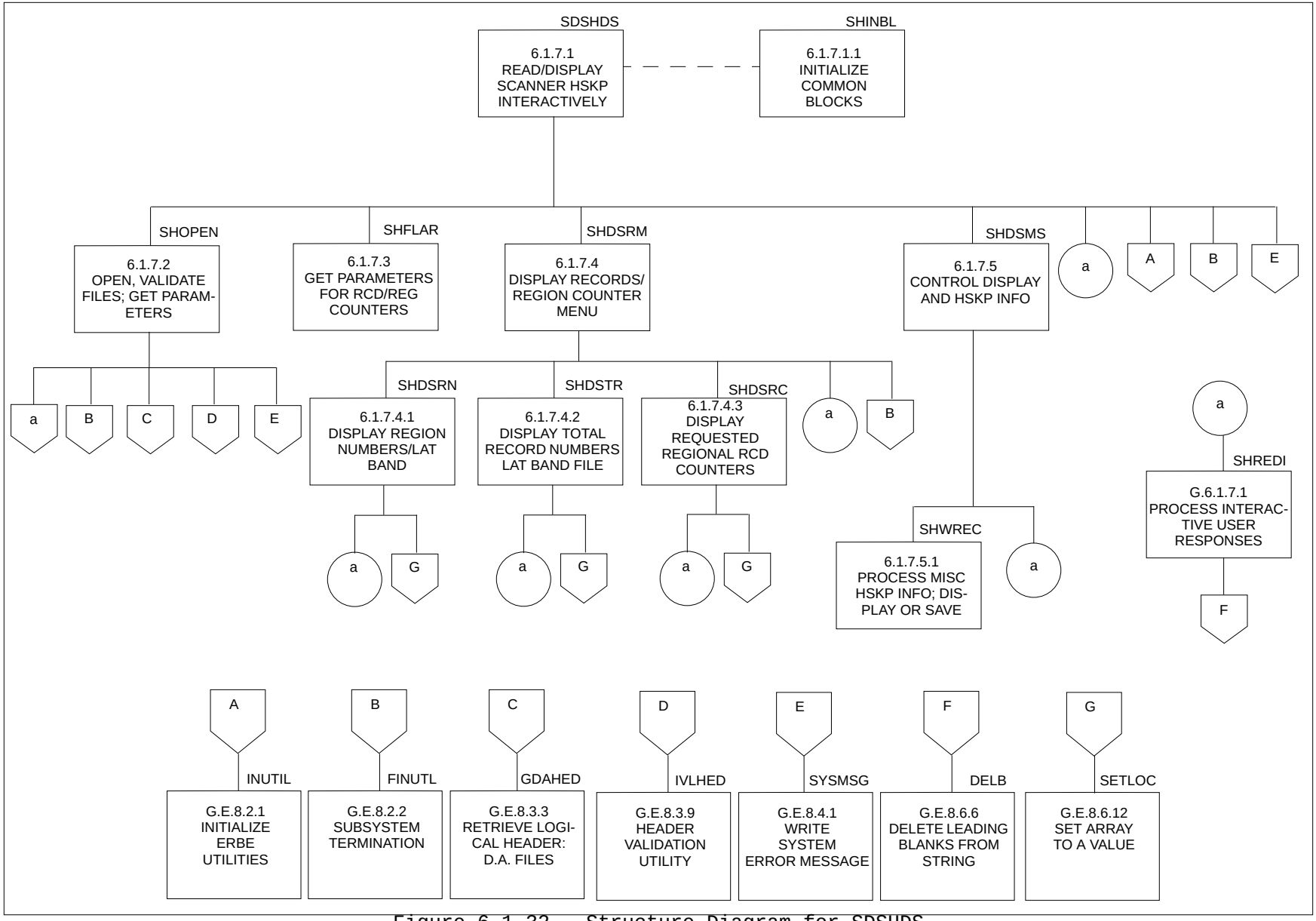


Figure 6.1-32. Structure Diagram for SDSHDS

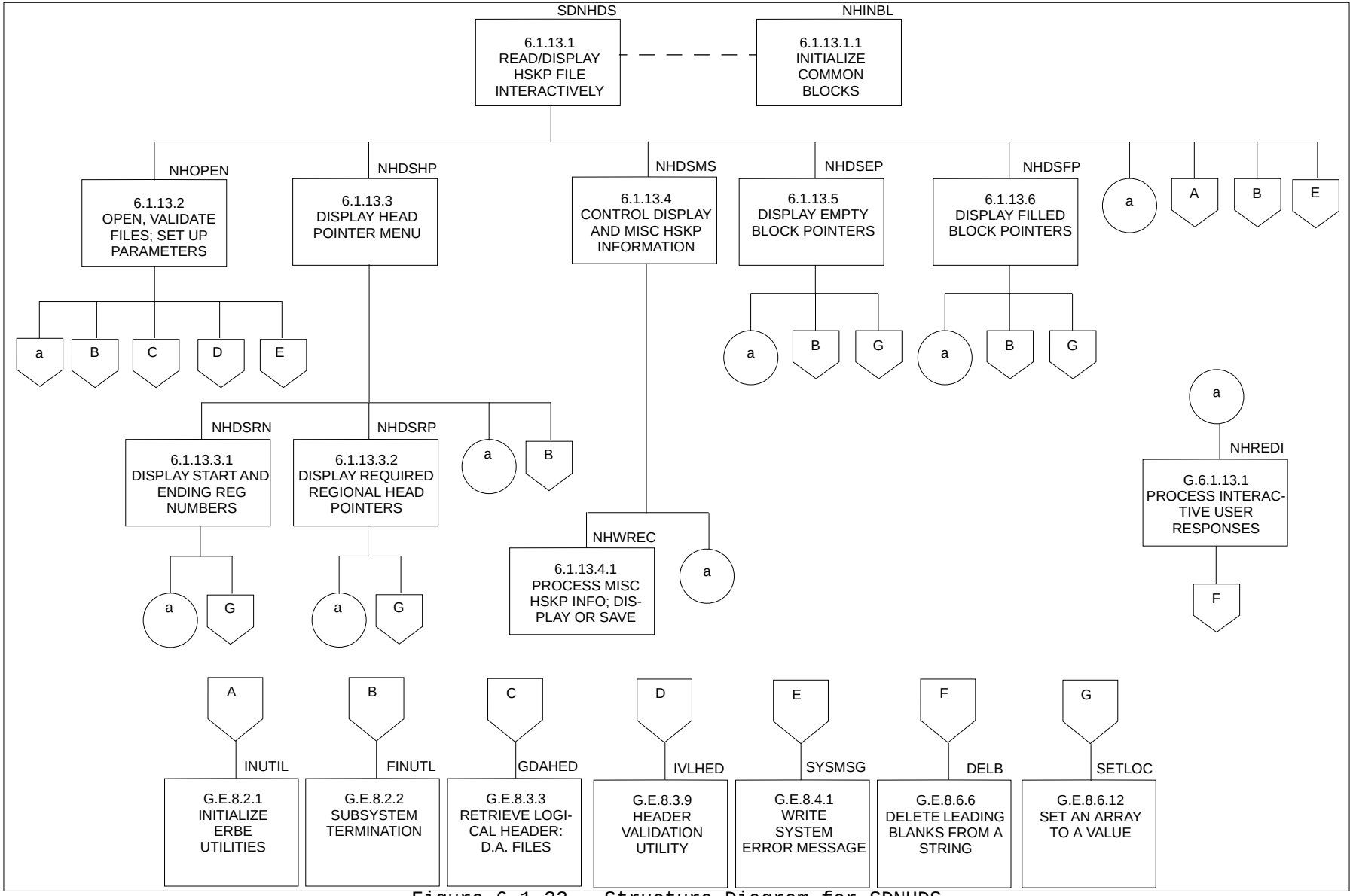


Figure 6.1-33. Structure Diagram for SDNHDS

A final program to use with the DDB Subsystem is available for reading data from the input Inversion tape. This program is called SDRINV and a batch submittal file called CDRIXX is available to run the program. The program can read and display records from either a scanner or nonscanner Inversion tape.

6.1.6.4 Cross-Reference Tables. This section contains two tables which may be useful for maintaining the DDB Subsystem. The first (Table 6.1-12) is a table which lists all module names and numbers (ordered by module number) for all the programs which are part of the on-line and off-line DDB Subsystem. (See Table 6.1-1 for a list of the scanner and nonscanner program names.) Included on this table is a brief description of the function of each module.

The second table (Table 6.1-13) is a COMMON Block matrix for each program listed on Table 6.1-1. The COMMON Block matrix consists of all DDB Subsystem modules listed alphabetically (representing the rows of the matrix) and all the program COMMON Block names also listed alphabetically (representing the columns of the matrix). A check in the box formed by the intersection of a module name with a COMMON Block name indicates that the COMMON Block is used in that module.

Table 6.1-12 Daily Data Base Module Reference Table (1 of 10)

PROGRAM NAME	MODULE NAME	MODULE NUMBER	DESCRIPTION
SDSINT	SDSINT	6.1.1.1	Initialize the Monthly Time/Space Averaging data base for scanner processing.
	SINBLK	6.1.1.1.1	Initialize values in COMMON Blocks by use of data statements.
	ABEND	6.1.1.1.2	Print module name and number in which an abnormal termination occurred.
	SIRDNL	6.1.1.2	Read in NAMELISTs for Daily Data Base preprocessor.
	SINLOK	6.1.1.2.1	Check NAMELISTs inputs for reasonableness.
	SINHSK	6.1.1.3	Initialize records on the scanner MTSA data base housekeeping file.
SDSUPD	SDSUPD	6.1.2.1	Add one set of 24-hour scanner Inversion data to the pre-sorted Monthly Time/Space Averaging data base.
	SUINBL	6.1.2.1.1	Initialize values in COMMON Blocks by use of data statements.
	ABEND	6.1.2.1.2	In case of abnormal termination, write out useful information.
	SURDNL	6.1.2.2	Read in NAMELISTs for scanner Daily Data Base main processor.
	SUNLOK	6.1.2.2.1	Check NAMELIST inputs for reasonableness.
	SUOPIN	6.1.2.4	Open Inversion file, retrieve logical header, make sure correct tape is mounted, and convert the header data/time to character format for reports.
	SUOPDB	6.1.2.5	Open and validate scanner data base (latitudinal band and housekeeping files). Read housekeeping items into core.
	SUSCAN	6.1.2.6	Control processing of one 24-hour Inversion tape for the scanner Monthly Time/Space Averaging data base.

Table 6.1-12 Daily Data Base Module Reference Table (2 of 10)

PROGRAM NAME	MODULE NAME	MODULE NUMBER	DESCRIPTION
SDSUPD	SUMNHR	6.1.2.6.1	Calculate the monthly/hour index.
	SUPKRC	6.1.2.6.2	Pack a scanner monthly record.
	ISUHCL	6.1.2.6.3	Determine which column of the radiant exitant histogram matrix to update.
	SUWREP	6.1.2.7	Control writing of quality control reports.
	SUWSM2	6.1.2.7.1	Write a quality control report summarizing the UT hours filled and number of records processed for the scanner data base.
	SUWSM3	6.1.2.7.2	Write the scanner radiant exitant histogram as a quality control report.
	SUCLDB	6.1.2.8	Close scanner data base files and replace updated housekeeping information and logical header array.
	SUUPHD	G.6.1.2.1	Update the start and end times for the scanner monthly logical header
SDSUER	SDSUER	6.1.3.1	Read the overlap data file containing previous or next month’s local day data and add the records to the latitudinal band files.
	SUEINB	6.1.3.1.1	Initialize values in COMMON Blocks by use of data statements.
	ABEND	6.1.3.1.2	In case of abnormal termination, write out useful information.
	SUEOPN	6.1.3.2	Open and validate data base and scratch files. Read housekeeping items into core.
	SUECLS	6.1.3.3	Close scanner data base files and replace updated housekeeping information and logical header array.
	SUESUM	6.1.3.4	Write a quality control report summarizing the current status of the scanner data base after records from the previous or next month have been added.

Table 6.1-12 Daily Data Base Module Reference Table (3 of 10)

PROGRAM NAME	MODULE NAME	MODULE NUMBER	DESCRIPTION
SDSSRT	SDSSRT	6.1.4.1	Sort by region the 36 files output from Daily Data Base Subsystem.
	SSINBL	6.1.4.1.1	Initialize values in COMMON Blocks by use of data statements.
	ABEND	6.1.4.1.2	In case of abnormal termination, write out useful information.
	SSRDNL	6.1.4.2	Read NAMELIST file and check validity.
	SSVLHK	6.1.4.3	Validate input housekeeping file.
	SSVLOT	6.1.4.4	Create an output housekeeping file if this is the first run for the month, or validate the existing output housekeeping file against user inputs.
	SSORTF	6.1.4.5	Open input files to be sorted, perform sort, write sorted files to output, and close all files.
	SSERMS	G.6.1.4.1	Write error messages to the messages report and begin termination through ERBE system utility FINUTL.
	SSUMRP	G.6.1.4.2	Write a quality control report showing information about sorted files.
SDSDRC	SDSDRC	6.1.5.1	Delete a block of records from the scanner data base and update the housekeeping file.
	SDINBL	6.1.5.1.1	Initialize values in COMMON Blocks by use of data statements.
	ABEND	6.1.5.1.2	In case of abnormal termination, write out useful information.
	SDRDNL	6.1.5.2	Read NAMELIST files.
	SDNLOK	6.1.5.2.1	Check reasonableness of NAMELIST values.
	SDOPDB	6.1.5.3	Open and validate housekeeping file, read housekeeping items into core.
	SDOSCF	6.1.5.3.1	Store overlap data header information.

Table 6.1-12 Daily Data Base Module Reference Table (4 of 10)

PROGRAM NAME	MODULE NAME	MODULE NUMBER	DESCRIPTION
	SDDLRC	6.1.5.4	Delete a day from the scanner data base.
	SDCLDB	6.1.5.5	Update housekeeping information after records have been deleted.
	SDUPHD	6.1.5.5.1	Update initial or final Julian Dates in logical header array and update information in housekeeping arrays.
	SDPSUM	6.1.5.6	Write a summary report of the status of the data base.
SDSDER	SDSDER	6.1.6.1	To delete overlap data from the scanner data base.
	SDEIBL	6.1.6.1.1	Initialize values in COMMON Blocks by use of data statements.
	ABEND	6.1.6.1.2	In case of abnormal termination, write out useful information.
	SDERNL	6.1.6.2	To read in NAMELIST and special overlap header file.
	SDENOK	6.1.6.2.1	To check header inputs for reasonableness.
	SDEODB	6.1.6.3	Open and validate housekeeping file, read housekeeping items into core.
	SDEDEL	6.1.6.4	Delete overlap data from old data base.
	SDECDB	6.1.6.5	Update housekeeping information after records have been deleted.
	SDESUM	6.1.6.6	Write a summary report of the status of the data base.
SDSHDS	SDSHDS	6.1.7.1	Read and display the contents of the scanner housekeeping file interactively to aid in tracing errors. Can be used for both of the pre-sorted and scanner housekeeping files.
	SHINBL	6.1.7.1.1	Initialize values in COMMON Blocks by use of data statements.

Table 6.1-12 Daily Data Base Module Reference Table (5 of 10)

PROGRAM NAME	MODULE NAME	MODULE NUMBER	DESCRIPTION
SDSHDS	SHOPEN	6.1.7.2	Open I/O and housekeeping files. Validate housekeeping files, and set up processing parameters based on sorted or pre-sorted file.
	SHFLAR	6.1.7.3	Set up processing parameters related to the number of records per region counters.
	SHDSRM	6.1.7.4	Display the records/region counters menu and decide what action to take.
	SHDSRN	6.1.7.4.1	Display the starting and ending region numbers for each latitudinal band, and show which latitudinal band file they are in.
	SHDSTR	6.1.7.4.2	Display the total number of records in each latitudinal band file.
	SHDSRC	6.1.7.4.3	Display regional record counters requested by the user.
	SHDSMS	6.1.7.5	Control the display and saving of miscellaneous housekeeping information based on the user’s request.
	SHWREC	6.1.7.5.1	Determine what miscellaneous housekeeping information to display or save on the screen output or message file.
	SHREDI	G.6.1.7.1	Utility to process interactive user responses.
SDNINT	SDNINT	6.1.8.1	Initialize the MTSA data base for the nonscanner. Creates the numerical filter and shape factor monthly data base.
	NINBLK	6.1.8.1.1	Initialize values in COMMON Blocks by use of data statements.
	ABEND	6.1.8.1.2	Print module name and number in which an abnormal termination occurred.
	NIRDNL	6.1.8.2	Read in NAMELISTs for Daily Data Base pre-processor.

Table 6.1-12 Daily Data Base Module Reference Table (6 of 10)

PROGRAM NAME	MODULE NAME	MODULE NUMBER	DESCRIPTION
SDNINT			
	NINLOK	6.1.8.2.1	Check NAMELIST inputs for reasonableness.
	NIOPFL	6.1.8.3	Open the data base files to be initialized. Create and store the product keys for those files.
	NINHSK	6.1.8.4	Initialize records on the MTSA data base housekeeping file.
	NISTHD	6.1.8.5	Store linked list and housekeeping logical file headers.
SDNUPD	SDNUPD	6.1.9.1	Add one set of 24-hour Inversion data (nonscanner only) to the Monthly Time/Space Averaging data base. Update housekeeping files and produce quality control reports.
	NUINBL	6.1.9.1.1	Initialize values in COMMON Blocks by use of data statements.
	ABEND	6.1.9.1.2	Write out useful information in case of abnormal termination. Set a flag in the JCL to update the logical header file if the numerical filter update has been successfully completed.
	NURDNL	6.1.9.2	Read in NAMELISTs for Daily Data Base main processor.
	NUCKIN	6.1.9.2.1	Make sure Inversion file assignments are consistent with NAMELIST inputs.
	NUCHKF	6.1.9.2.2	Make sure file assignments are consistent with NAMELIST inputs.
	NUNLOK	6.1.9.2.3	Check NAMELIST inputs for reasonableness.
	NUNSCN	6.1.9.4	Control the processing of one 24-hour non-scanner Inversion tape for the numerical filter and/or shape factor data bases.

Table 6.1-12 Daily Data Base Module Reference Table (7 of 10)

PROGRAM NAME	MODULE NAME	MODULE NUMBER	DESCRIPTION
SDNUPD	NUWSM2	6.1.9.5	Write a quality control report summarizing the UT hours filled for the nonscanner Inversion tapes and number of records processed.
	NUWSM3	6.1.9.6	Write the radiant exitant histogram as a quality control report.
	NUOPIN	G.6.1.9.1	Open the Inversion file, retrieve logical header, make sure correct tape is mounted, and convert the header date/time to character format for the quality control reports.
	NUOPDB	G.6.1.9.2	Open and validate data base files (linked list and housekeeping). Read housekeeping items into core and initialize pointers.
	NUOPSF	G.6.1.9.2.1	Open and initialize overlap data files to store previous/next month’s local day records.
	NUPHED	G.6.1.9.3	Update start and end times for the linked list and housekeeping logical headers.
	NUPREC	G.6.1.9.4	Process, pack, and write a linked list record to the data base. Update pointers and quality control report information.
	XNUMHR	G.6.1.9.4.1	Calculate the monthly/hour index.
	NUPHIS	G.6.1.9.4.2	Update the radiant exitant histogram.
	NUHSCL	G.6.1.9.4.2.1	Determine which column of the radiant exitant histogram matrix to update.
	NUCLDB	G.6.1.9.5	Write regional summary quality control report. Replace updated housekeeping information and logical header arrays. Close the data base files.
SDNUER	SDNUER	6.1.10.1	Read records from overlap data file containing previous or next month’s data and add the data to the appropriate data base.

Table 6.1-12 Daily Data Base Module Reference Table (8 of 10)

PROGRAM NAME	MODULE NAME	MODULE NUMBER	DESCRIPTION
SDNUER	NEUDLB	6.1.10.1.1	Initialize values in COMMON Blocks by use of data statements.
	ABEND	6.1.10.1.2	In case of abnormal termination, write out useful information.
	NUEDBO	6.1.10.2	Open and validate data base files and scratch files. Read housekeeping items into core and initialize pointers.
	NUEGRC	6.1.10.3	Process, pack, and write a linked list record to the data base using data from the previous or next month’s overlap data.
	NUEDRC	6.1.10.4	Replace updated housekeeping information and linked list logical header arrays. Close the data base and overlap data files.
	NUESUM	6.1.10.5	Write a quality control report summarizing the current status of the numerical filter or shape factor data base after records from the previous or next month has been added.
SDNDRC	SDNDRC	6.1.11.1	Delete a block of records from the linked list and update the housekeeping file.
	NDINBL	6.1.11.1.1	Initialize values in COMMON Blocks by use of data statements.
	ABEND	6.1.11.1.2	In case of abnormal termination, write out useful information.
	NDDLNL	6.1.11.2	Read in records to be deleted and choose appropriate processing parameters.
	NDDLOK	6.1.11.2.1	Check NAMELIST inputs for reasonableness.
	NDOPDB	6.1.11.3	Open and initialize data base files (linked list and housekeeping). Read housekeeping items into core.
	NDOSCF	6.1.11.3.1	Open and initialize overlap data file to store previous/next month’s information.

Table 6.1-12 Daily Data Base Module Reference Table (9 of 10)

PROGRAM NAME	MODULE NAME	MODULE NUMBER	DESCRIPTION
	NDDLRC	6.1.11.4	Delete a block of records from the linked list.
	NDCLDR	6.1.11.5	Update housekeeping information after records have been deleted.
	NDUPHD	6.1.11.5.1	Update initial or final Julian dates on linked list and housekeeping logical headers, and update arrays for housekeeping file.
	NDPSUM	6.1.11.6	Write a summary report of the current status of the data base.
SDNDER	SDNDER	6.1.12.1	Delete a block of records from the linked list and update the housekeeping file.
	NDEIBL	6.1.12.1.1	Initialize values in COMMON Blocks by use of data statements.
	ABEND	6.1.12.1.2	In case of abnormal termination, write out useful information.
	NDESCR	6.1.12.2	Open overlap data file that contains information needed to delete records which came from the previous or next month. Set up parameters for the record deletion process.
	NDEODB	6.1.12.3	Open and initialize data base files (linked list and housekeeping). Read housekeeping items into core.
	NDEDRC	6.1.12.4	Delete a block of records from the linked list.
	NDECDB	6.1.12.5	Update housekeeping information after records have been deleted.
	NDESUM	6.1.12.6	Write a summary report of the current status of the data base.
SDNHDS	SDNHDS	6.1.13.1	Read and display the contents of a non-scanner housekeeping file interactively.

Table 6.1-12 Daily Data Base Module Reference Table (10 of 10)

PROGRAM NAME	MODULE NAME	MODULE NUMBER	DESCRIPTION
SDNHDS	NHINBL	6.1.13.1.1	Initialize values in COMMON Blocks by use of data statements.
	NHOPEN	6.1.13.2	Open I/O files and housekeeping file. Validate the housekeeping file and set up parameters based on resolution.
	NDHSHP	6.1.13.3	Display the head pointer menu and decide what action to take.
	NHDSRN	6.1.13.3.1	Display the starting and ending region numbers for each latitudinal band.
	NHDSRP	6.1.13.3.2	Display regional head pointers requested by the user.
	NHDSMS	6.1.13.4	Control the display and saving of miscellaneous housekeeping information based on user’s request.
	NHWREC	6.1.13.4.1	Determine what miscellaneous housekeeping information to display or save on the screen output or message file.
	NHDSEP	6.1.13.5	Display the empty block pointers.
	NHDSFP	6.1.13.6	Display the filled block pointers.
	NHREDI	G.6.1.13.1	Utility to process interactive user responses.

Table 6.1-13 COMMON Block Matrix (1 of 15)

		COMMON BLOCK NAMES for SDSINT															
		CHARCM	ERRLAB	FILNAM	GLOBAL	LENGTH	LOCNAM	MINMAX	OUTPTS	SFCTRS	UNITS						
SUBROUTINE NAMES	ABEND				✔												
	SDSINT	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔						
	SINBLK		✔	✔	✔	✔	✔	✔	✔	✔	✔						
	SINHSK	✔			✔												
	SINLOK	✔			✔												
	SIRDNL	✔	✔		✔		✔	✔		✔	✔						

Table 6.1-13 COMMON Block Matrix (2 of 15)

SUBROUTINE NAMES	COMMON BLOCK NAMES for SDSUPD														
	ABINFO	CHARCM	DATES	ERRLAB	FILNAM	FLGCNT	GLOBAL	LENGTH	LOCNAM	LOGHED	MINMAX	NUMDAY	OUTPTS	RCHRCM	
ABEND	✔	✔	✔			✔	✔	✔		✔			✔	✔	
ISUHCL															
SDSUPD	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	
SUCLDB		✔	✔		✔	✔	✔	✔		✔			✔		
SUINBL	✔	✔	✔	✔	✔	✔	✔	✔	✔		✔	✔		✔	
SUMNHR			✔				✔					✔			
SUNLOK		✔					✔								
SUOPDB		✔			✔	✔	✔	✔	✔	✔		✔	✔		
SUOPIN		✔			✔		✔		✔	✔			✔	✔	
SUPKRC							✔	✔							
SURDNL		✔	✔	✔			✔		✔		✔	✔	✔		
SUSCAN	✔	✔	✔		✔	✔	✔	✔							
SUUPHD										✔					
SUWREP		✔					✔	✔	✔				✔	✔	
SUWSM2						✔							✔		
SUWSM3		✔													

Table 6.1-13 COMMON Block Matrix (3 of 15)

		COMMON BLOCK NAMES for SDSUPD															
		REPTS	UNITS	WRKARR													
SUBROUTINE NAMES	ABEND	✔	✔	✔													
	ISUHCL			✔													
	SDSUPD	✔	✔	✔													
	SUCLDB		✔														
	SUINBL	✔	✔	✔													
	SUMNHR			✔													
	SUNLOK																
	SUOPDB		✔	✔													
	SUOPIN		✔														
	SUPKRC			✔													
	SURDNL	✔	✔														
	SUSCAN	✔	✔	✔													
	SUUPHD																
	SUWREP	✔	✔														
	SUWSM2	✔	✔														
	SUWSM3	✔	✔														

Table 6.1-13 COMMON Block Matrix (4 of 15)

		COMMON BLOCK NAMES for SDSUER														
		ABINFO	CHARCM	FILNAM	FLGCNT	GLOBAL	LENGTH	LOCNAM	LOGHED	UNITS						
SUBROUTINE NAMES	ABEND	✔			✔	✔			✔							
	SDSUER	✔	✔	✔	✔	✔	✔	✔	✔	✔						
	SUECLS	✔	✔	✔	✔	✔	✔	✔		✔						
	SUEINB	✔	✔		✔	✔	✔	✔		✔						
	SUEOPN	✔	✔	✔	✔	✔	✔	✔	✔	✔						
	SUESUM	✔	✔		✔		✔	✔	✔	✔						

Table 6.1-13 COMMON Block Matrix (5 of 15)

		COMMON BLOCK NAMES for SDSSRT															
		CHARAC	CHARCM	GLOBAL	HKPARM	INPVAL											
SUBROUTINE NAMES	ABEND					✔											
	SDSSRT	✔	✔	✔	✔	✔											
	SSERMS		✔	✔													
	SSINBL	✔	✔	✔	✔	✔											
	SSORTF	✔	✔	✔	✔	✔											
	SSRDNL	✔	✔	✔		✔											
	SSUMRP	✔	✔	✔	✔	✔											
	SSVLHK	✔	✔	✔	✔	✔											
	SSVLOT	✔	✔	✔	✔	✔											

Table 6.1-13 COMMON Block Matrix (6 of 15)

		COMMON BLOCK NAMES for SDSDRC														
		ABINFO	CHARCM	ERRLAB	FILNAM	FLGCNT	GLOBAL	GLOBL	LENGTH	LOCNAM	LOGHED	MINMAX	NUMDAY	OUTPTS	UNITS	WRKARR
SUBROUTINE NAMES	ABEND	✔				✔	✔									
	SDCDB		✔			✔	✔			✔	✔	✔		✔	✔	
	SDDLRC	✔	✔			✔	✔			✔				✔	✔	✔
	SDINBL		✔	✔	✔	✔	✔		✔	✔		✔	✔		✔	
	SDNLOK		✔				✔									
	SDOPDB		✔		✔	✔	✔		✔	✔	✔			✔	✔	
	SDOSCF		✔				✔			✔			✔	✔	✔	
	SDPSUM		✔			✔	✔			✔	✔			✔	✔	
	SDRDNL		✔	✔			✔	✔		✔		✔	✔	✔	✔	
	SDSDRC	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
	SDUPHD										✔			✔		

Table 6.1-13 COMMON Block Matrix (7 of 15)

		COMMON BLOCK NAMES for SDSDER														
		ABINFO	CHARCM	ERRLAB	FILNAM	FLGCNT	GLOBAL	GLOBL	LENGTH	LOCNAM	LOGHED	MINMAX	NUMDAY	OUTPTS	UNITS	WRKARR
SUBROUTINE NAMES	ABEND	✔				✔	✔									
	SDECDB		✔			✔	✔		✔	✔	✔			✔	✔	
	SDEDEL	✔	✔			✔	✔			✔				✔	✔	✔
	SDEIBL		✔	✔	✔	✔	✔		✔	✔		✔	✔		✔	
	SDENOK		✔				✔									
	SDEODB		✔		✔	✔	✔		✔	✔	✔			✔	✔	
	SDERNL		✔	✔			✔	✔		✔		✔	✔	✔	✔	
	SDESUM		✔			✔	✔			✔	✔			✔	✔	
	SDSDER	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔

Table 6.1-13 COMMON Block Matrix (8 of 15)

		COMMON BLOCK NAMES for SDSHDS															
		CHARCM	FILNAM	GLOBAL	POINTS	UNITS	WPARM	WRKARR									
SUBROUTINE NAMES	SDSHDS	✔	✔	✔	✔	✔	✔	✔									
	SHDSMS			✔													
	SHDSRC			✔	✔		✔										
	SHDSRM																
	SHDSRN			✔	✔		✔										
	SHDSTR			✔	✔		✔										
	SHFLAR				✔		✔										
	SHINBL	✔	✔	✔	✔	✔	✔										
	SHOPEN	✔	✔	✔		✔	✔	✔									
	SHREDI																
	SHWREC							✔									

Table 6.1-13 COMMON Block Matrix (9 of 15)

SUBROUTINE NAMES	COMMON BLOCK NAMES for SDNINT														
	CHARCM	ERLAB	FILNAM	GLOBAL	HEDCOD	LENGTH	LOCNAM	MINMAX	MXREC	OUTPTS	PSWTCH	SFCTRS	UNITS		
ABEND				✔											
NINBLK		✔		✔		✔	✔	✔	✔	✔		✔	✔		
NINHSK	✔			✔											
NINLOK	✔			✔											
NIOPFL	✔		✔	✔	✔	✔	✔			✔	✔		✔		
NIRDNL	✔	✔	✔	✔			✔	✔		✔	✔				
NISTHD															
SDNINT	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔		

Table 6.1-13 COMMON Block Matrix (10 of 15)

SUBROUTINE NAMES	COMMON BLOCK NAMES for SDNUPD														
	ABINFO	CHARCM	CHRSCR	DATES	ERRLAB	FILNAM	GLOBAL	LENGTH	LOCNAM	LOGHED	MINMAX	NUMDAY	NUMSCR	OUTPTS	
ABEND	✔						✔	✔						✔	
NUCHKF		✔													
NUCKIN		✔				✔			✔						
NUCLDB	✔	✔		✔		✔	✔	✔					✔	✔	
NUHSCL															
NUINBL		✔	✔		✔		✔	✔	✔		✔	✔	✔	✔	
NUNLOK		✔					✔								
NUNSCN	✔	✔		✔		✔	✔	✔	✔	✔			✔	✔	
NUOPDB	✔	✔					✔	✔				✔		✔	
NUOPIN	✔	✔					✔			✔				✔	
NUOPSF	✔	✔	✔				✔	✔				✔	✔	✔	
NUPHED															
NUPHIS								✔							
NUPREC	✔	✔	✔			✔	✔	✔					✔	✔	
NURDNL	✔	✔	✔		✔	✔	✔		✔		✔	✔	✔	✔	
NUWSM2		✔					✔						✔	✔	
NUWSM3		✔					✔							✔	
SDNUPD	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	
XNUMHR							✔					✔			

Table 6.1-13 COMMON Block Matrix (11 of 15)

		COMMON BLOCK NAMES for SDNUPD															
		PNTCUR	POINTS	PSWTCH	RCHRCM	REPTS	UNITS	UNVITM	WRKARR								
SUBROUTINE NAMES	ABEND	✔	✔	✔	✔				✔								
	NUCHKF																
	NUCKIN			✔													
	NUCLDB				✔		✔										
	NUHSCL								✔								
	NUINBL	✔			✔	✔	✔	✔	✔								
	NUNLOK																
	NUNSCN	✔	✔	✔	✔	✔	✔	✔	✔								
	NUOPDB								✔								
	NUOPIN																
	NUOPSF																
	NUPHED																
	NUPHIS					✔			✔								
	NUPREC						✔	✔	✔								
	NURDNL			✔		✔	✔	✔									
	NUWSM2	✔	✔			✔											
	NUWSM3					✔											
	SDNUPD	✔	✔	✔	✔	✔	✔	✔	✔								
	XNUMHR							✔	✔								

Table 6.1-13 COMMON Block Matrix (12 of 15)

		COMMON BLOCK NAMES for SDNUER														
		CHARCM	GLOBAL	LENGTH	LOCNAM	LOGHED	PNTCUR	POINTS	SCRHED	UNITS	WRKARR					
SUBROUTINE NAMES	ABEND		✔			✔	✔	✔	✔		✔					
	NUEBLD	✔	✔	✔	✔		✔			✔	✔					
	NUEDBC	✔	✔	✔	✔	✔	✔	✔	✔	✔						
	NUEDBO	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔					
	NUEGRC	✔	✔	✔	✔		✔	✔	✔	✔	✔					
	NUESUM	✔	✔	✔	✔	✔		✔	✔	✔						
	SDNUER	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔					

Table 6.1-13 COMMON Block Matrix (13 of 15)

		COMMON BLOCK NAMES for SDNDRC														
		ABINFO	CHARCM	ERRLAB	FILNAM	GLOBAL	LENGTH	LOCNAM	LOGHED	MINMAX	NUMDAY	OUTPTS	POINTS	PUNITS	UNITS	
SUBROUTINE NAMES	ABEND	✔				✔	✔						✔			
	NDCLDB		✔		✔	✔			✔			✔	✔	✔		
	NDDLNL	✔	✔	✔	✔	✔	✔			✔		✔		✔	✔	
	NDDLRC	✔	✔		✔	✔								✔		
	NDINBL	✔	✔	✔		✔	✔	✔		✔			✔		✔	
	NDDLOK		✔			✔										
	NDOPDB		✔		✔	✔		✔	✔			✔	✔	✔		
	NDOSCF	✔	✔			✔	✔	✔			✔	✔			✔	
	NDPSUM	✔	✔			✔	✔	✔	✔			✔	✔		✔	
	NDUPHD								✔			✔				
	SDNDRC	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	

Table 6.1-13 COMMON Block Matrix (14 of 15)

SUBROUTINE NAMES	COMMON BLOCK NAMES for SDNDER														
	ABINFO	CHARCM	FILNAM	GLOBAL	LENGTH	LOCNAM	LOGHED	OUTPTS	POINTS	PUNITS	UNITS				
ABEND	✔			✔	✔				✔						
NDECDB		✔	✔	✔			✔	✔	✔	✔					
NDEDRC	✔	✔	✔	✔						✔					
NDEIBL	✔	✔		✔	✔	✔			✔		✔				
NDEODB		✔	✔	✔		✔	✔	✔	✔	✔					
NDESCR	✔	✔		✔	✔	✔		✔	✔		✔				
NDESUM	✔	✔		✔	✔	✔	✔	✔	✔		✔				
SDNDER	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔				

Table 6.1-13 COMMON Block Matrix (15 of 15)

SUBROUTINE NAMES	COMMON BLOCK NAMES for SDNHDS															
	CHARCM	FILNAM	GLOBAL	LENGTH	POINTS	UNITS	WPARM	WRKARR								
NHDSEP			✔	✔	✔											
NHDSFP			✔	✔	✔											
NHDSHP																
NHDSMS			✔													
NHDSRN			✔				✔									
NHDSRP			✔		✔		✔									
NHINBL	✔	✔	✔	✔		✔										
NHOPEN	✔	✔	✔	✔		✔	✔	✔								
NHREDI																
NHWREC								✔								
SDNHDS	✔	✔	✔	✔	✔	✔	✔	✔								

References

1. Sort/Merge Version 5 Reference Manual, CDC Document 60484800, February 1984.

2. Earth Radiation Budget Experiment (ERBE) Data Management System Reference Manual, Volume VIII, Utilities User's Guide, October 1986.

3. Brooks, David R.: Grid Systems for Earth Radiation Budget Experiment Applications. NASA TM-83233, December 1981.

4. FORTRAN Version 5 Reference Manual, CDC Document 60481300, Section 8, January 1985.

5. ERBE Data Management System, Daily Data Base Operator's Guide, August 1986.

6. ERBE Data Management System Reference Manual, Volume V, Inversion Subsystem, 1986.

6.2 MONTHLY TIME/SPACE AVERAGING

6.2.1 GENERAL

The function of Monthly Time/Space Averaging (MTSA) is to produce daily, monthly hourly, and monthly averages of shortwave and longwave radiant exitance (SWRE and LWRE) at the top of the atmosphere. This processing is done at three different resolution levels of 2.5°, 5°, and 10° for each satellite processed as well as for a multiple satellite product which contains data for all available satellites. To accomplish this goal, primary output data files from the Inversion Subsystem are rearranged from a time referenced order to regionally accessible files at each resolution level by the Daily Data Base Subsystem. These files are used to produce single satellite tape files which can be used as input to the multiple satellite processing or for analysis purposes by ERBE Science Team members. Regardless of where the input files are generated, their contents are processed by the MTSA algorithms to produce daily averages, monthly hourly averages (each hour averaged for all data during the month), and two grand monthly averages (averages of the daily and monthly hourly averages). These averages are written to tape and disc files and become the basis for preparation of several of the output products of the ERBE Data Management System.

To accomplish its goal, MTSA is split into two main processors, one for scanner data and one for nonscanner data. Each processor is split further into a base program, a single satellite library and a multiple satellite library. In addition, multiple satellite processing requires a preprocessor to combine the individual data points for all available satellites.

Figure 6.2-1 depicts the functional structure of the scanner single satellite processor. Note that those routines whose module numbers are prefaced by an S. reside on the single satellite library. Figure 6.2-2 depicts the functional structure of the nonscanner single satellite processor. An overview of the processing and data flow is provided in Figure 6.2-3. Processing details for the Subsystem are found in Section 6.2.5. Some of the

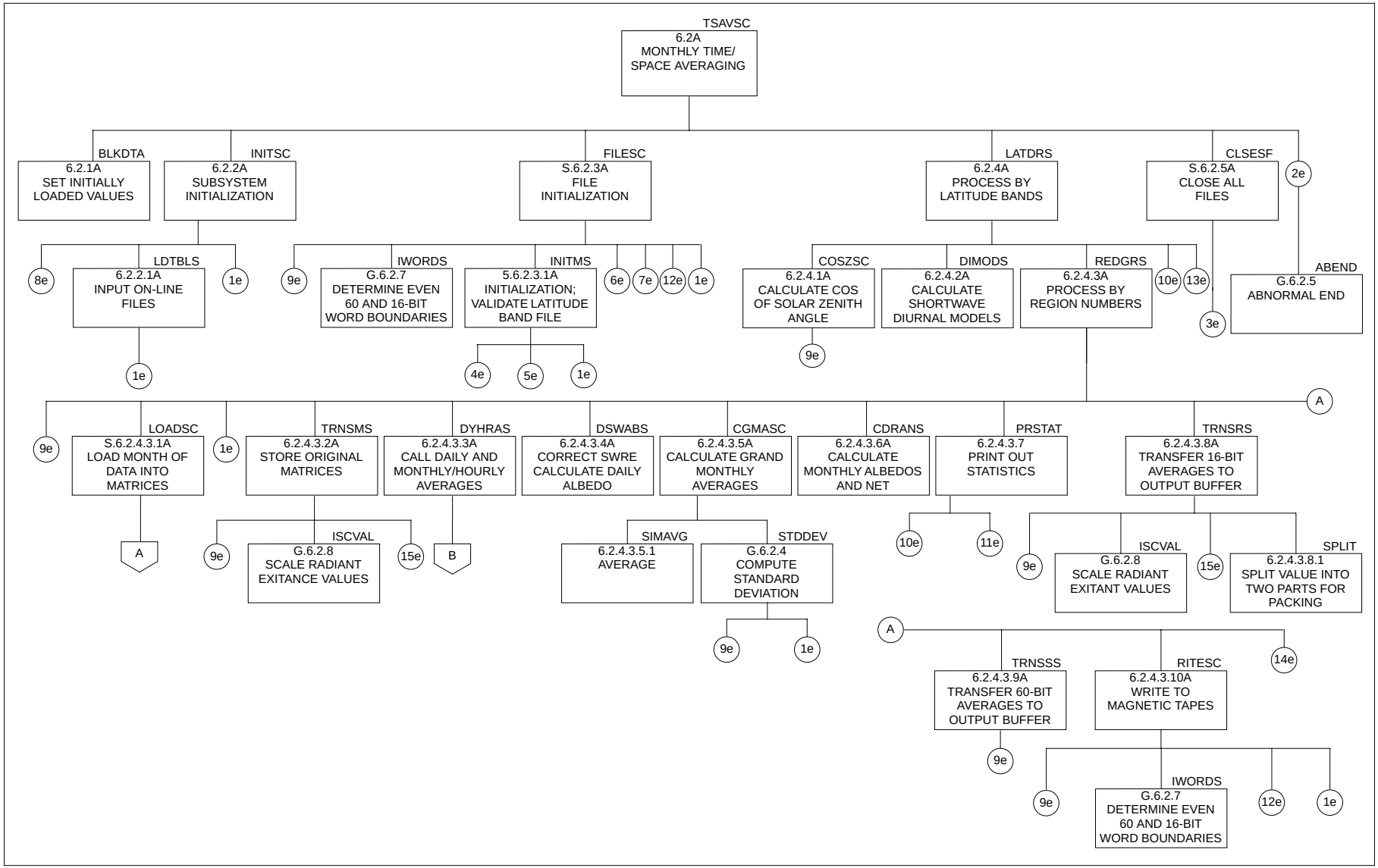


Figure 6.2-1. Scanner Processing Structure Chart (1 of 4)

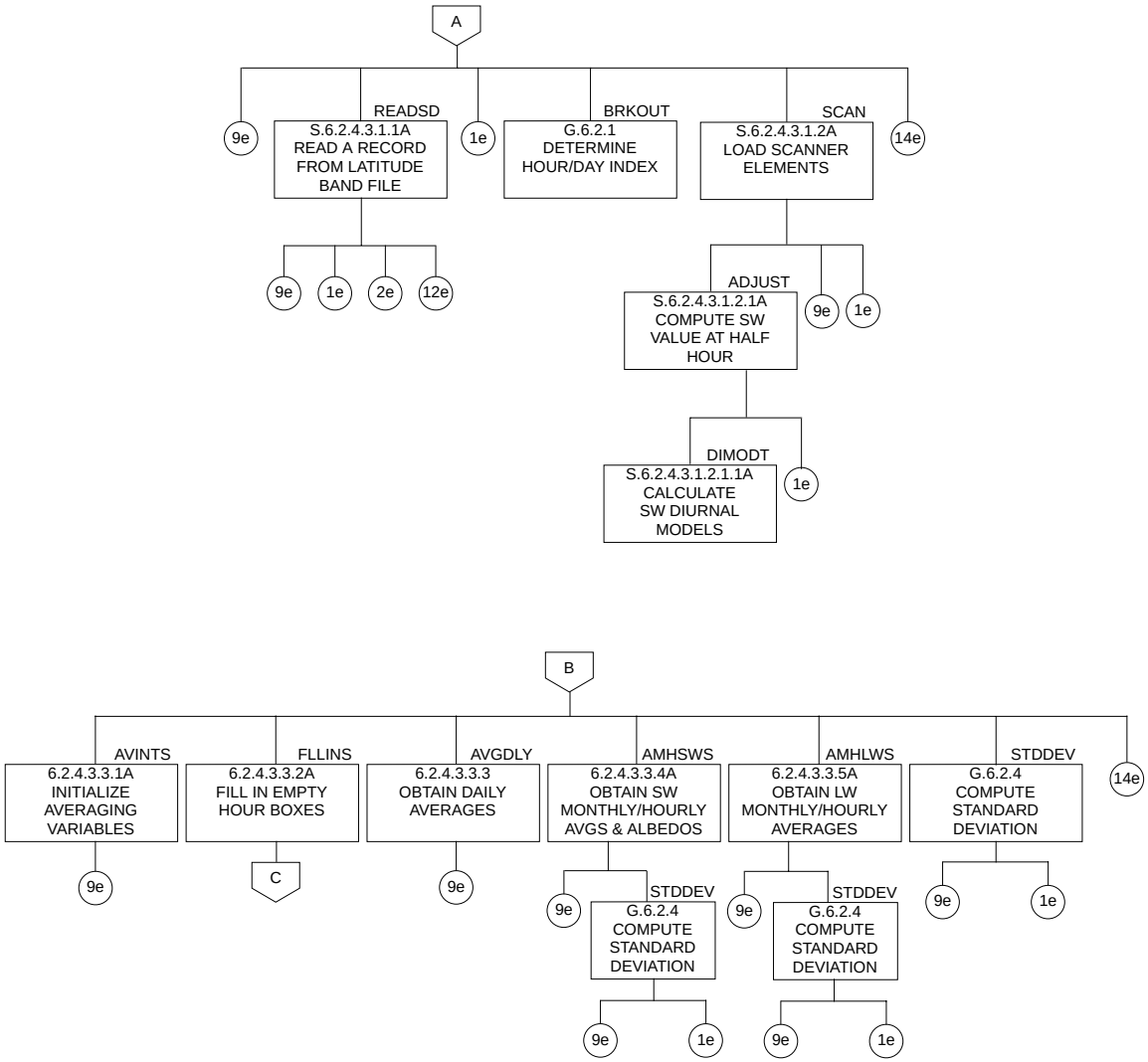


Figure 6.2-1. Scanner Processing Structure Chart (2 of 4)

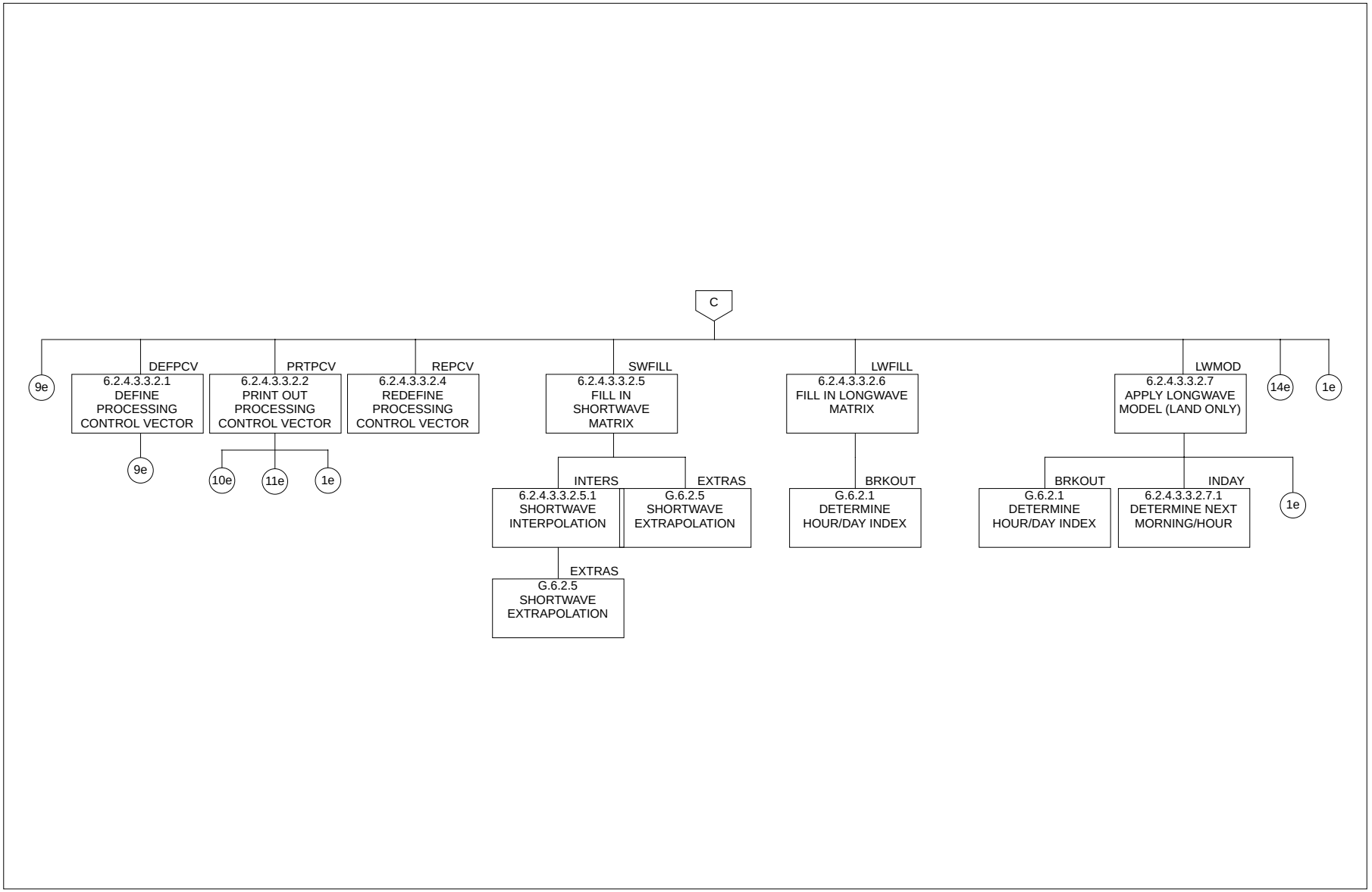


Figure 6.2-1. Scanner Processing Structure Chart (3 of 4)

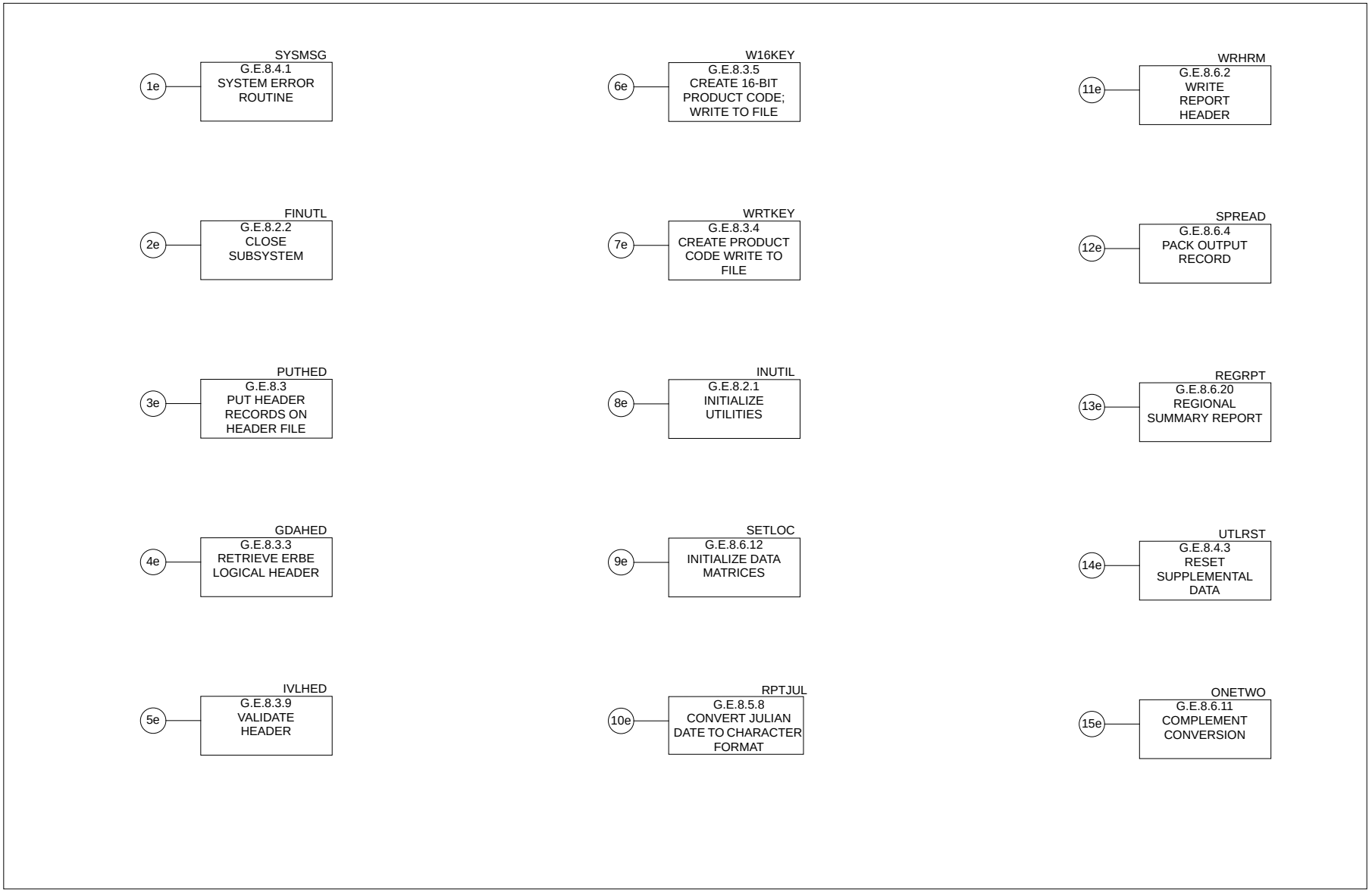


Figure 6.2-1. Scanner Processing Structure Chart (4 of 4)

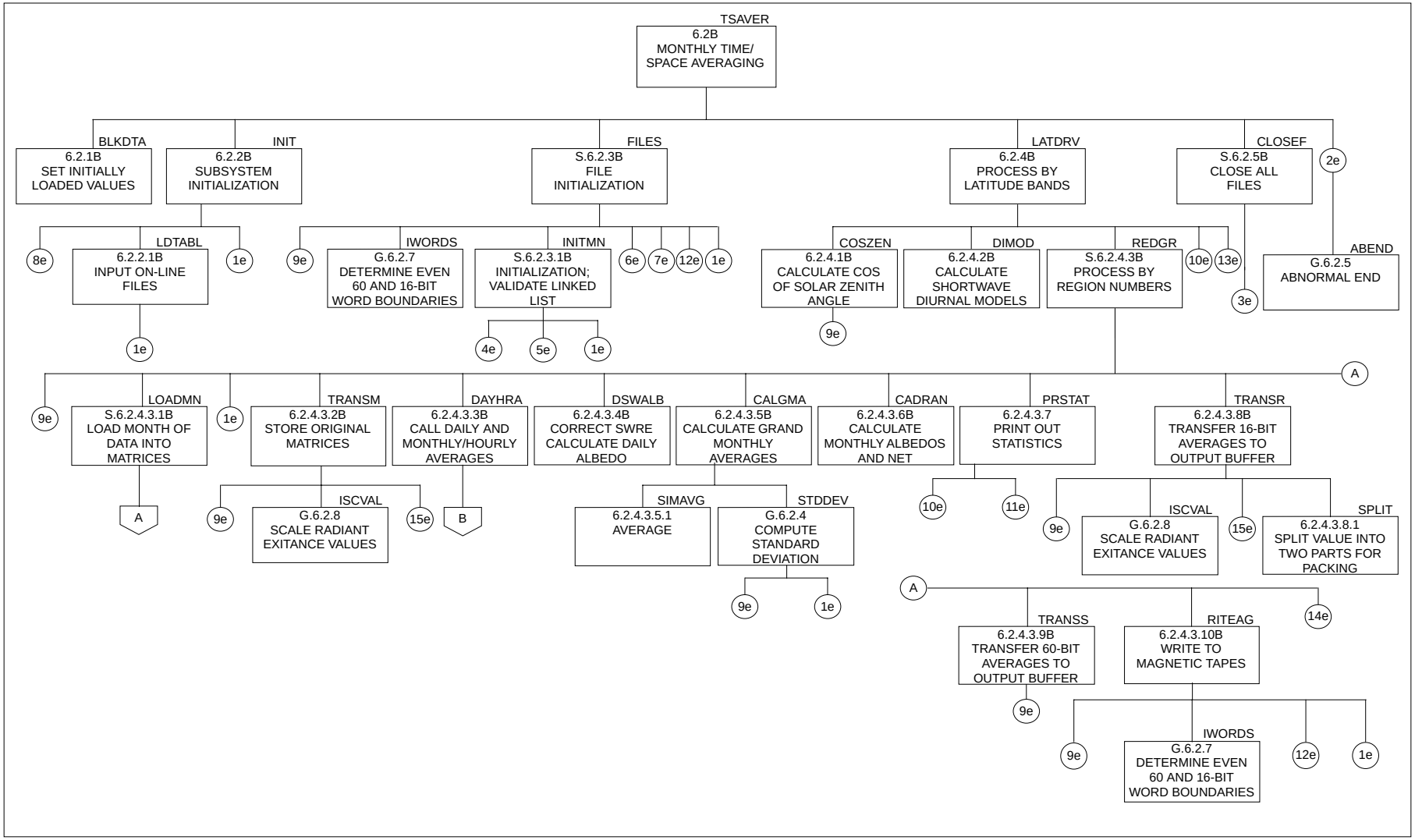


Figure 6.2-2. Nonscanner Processing Structure Chart (1 of 4)

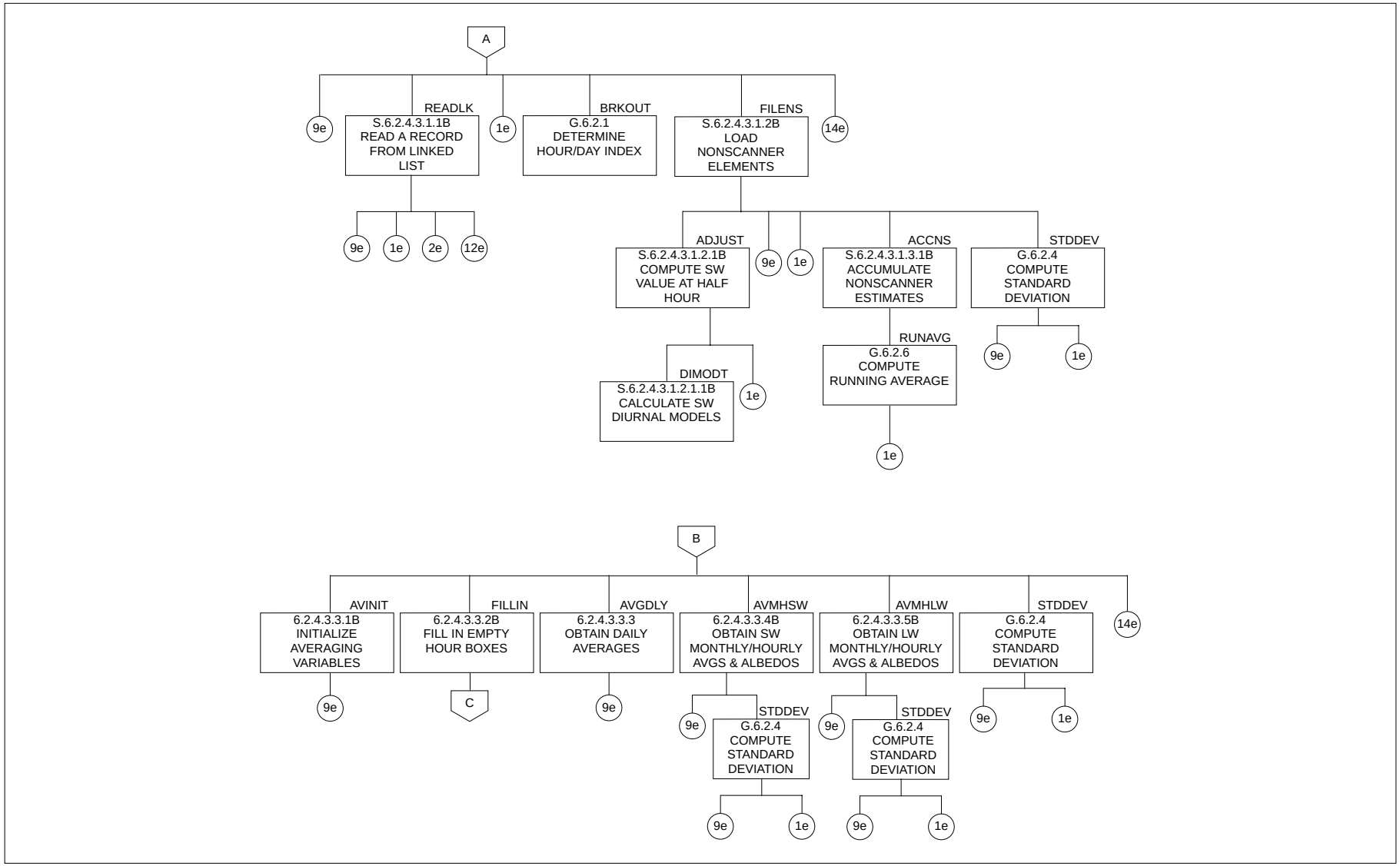


Figure 6.2-2. Nonscanner Processing Structure Chart (2 of 4)

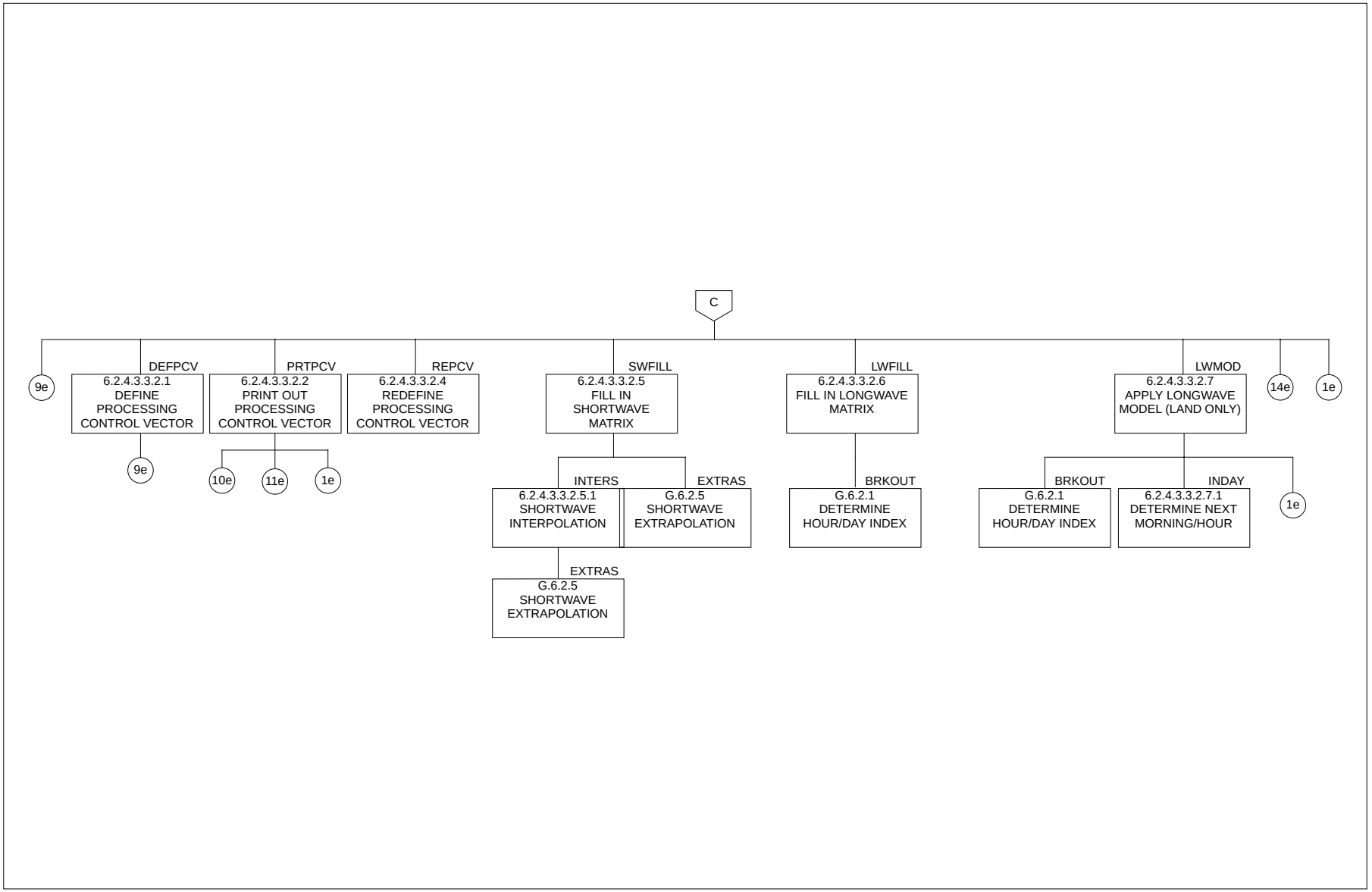


Figure 6.2-2. Nonscanner Processing Structure Chart (3 of 4)

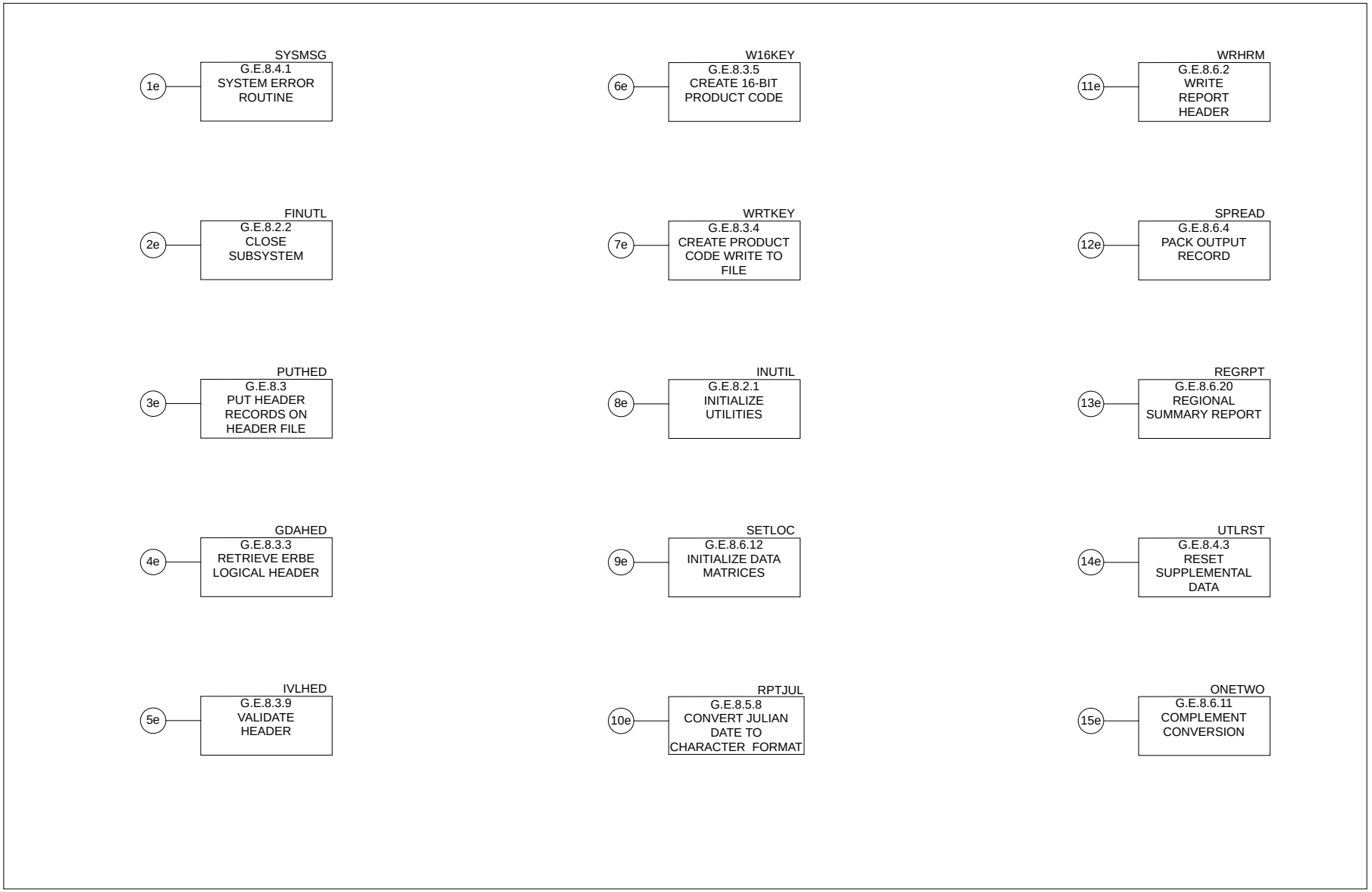


Figure 6.2-2. Nonscanner Processing Structure Chart (4 of 4)

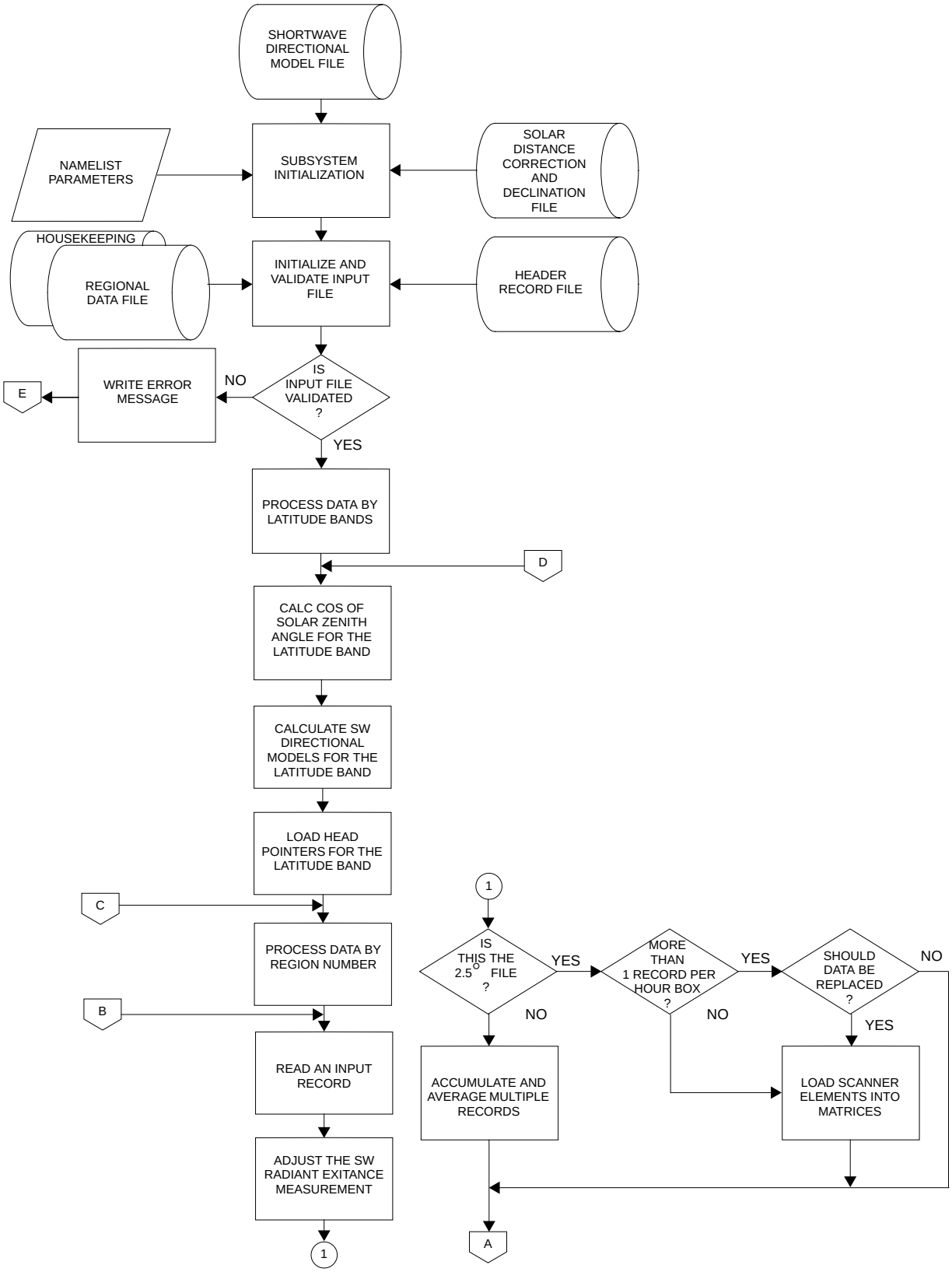


Figure 6.2-3. Overview of Data Processing (1 of 3)

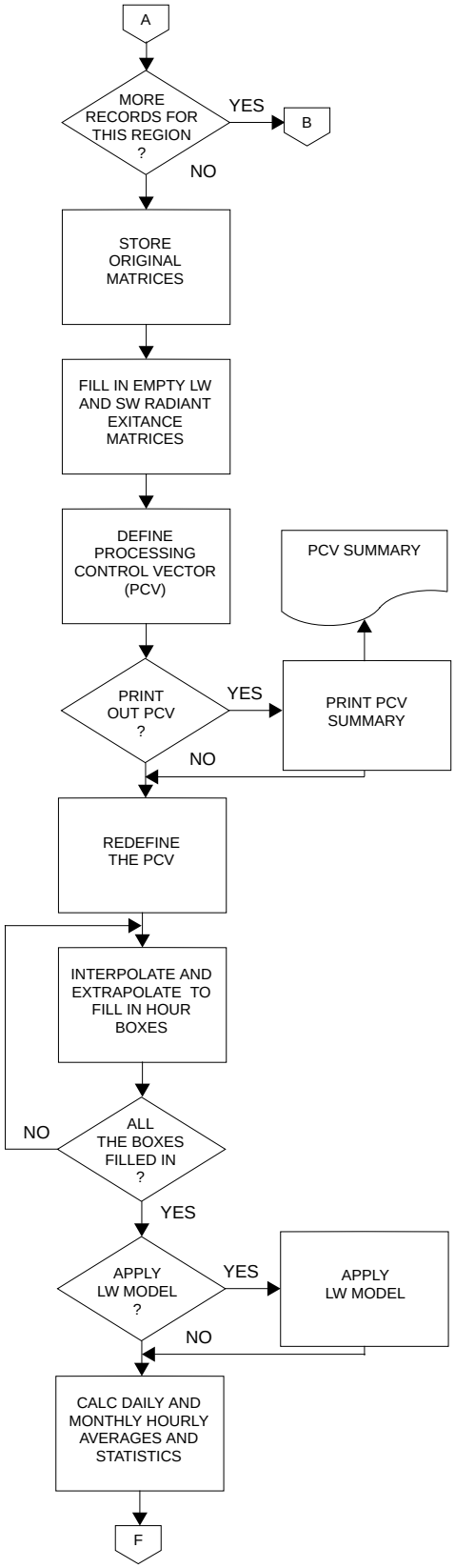


Figure 6.2-3. Overview of Data Processing (2 of 3)

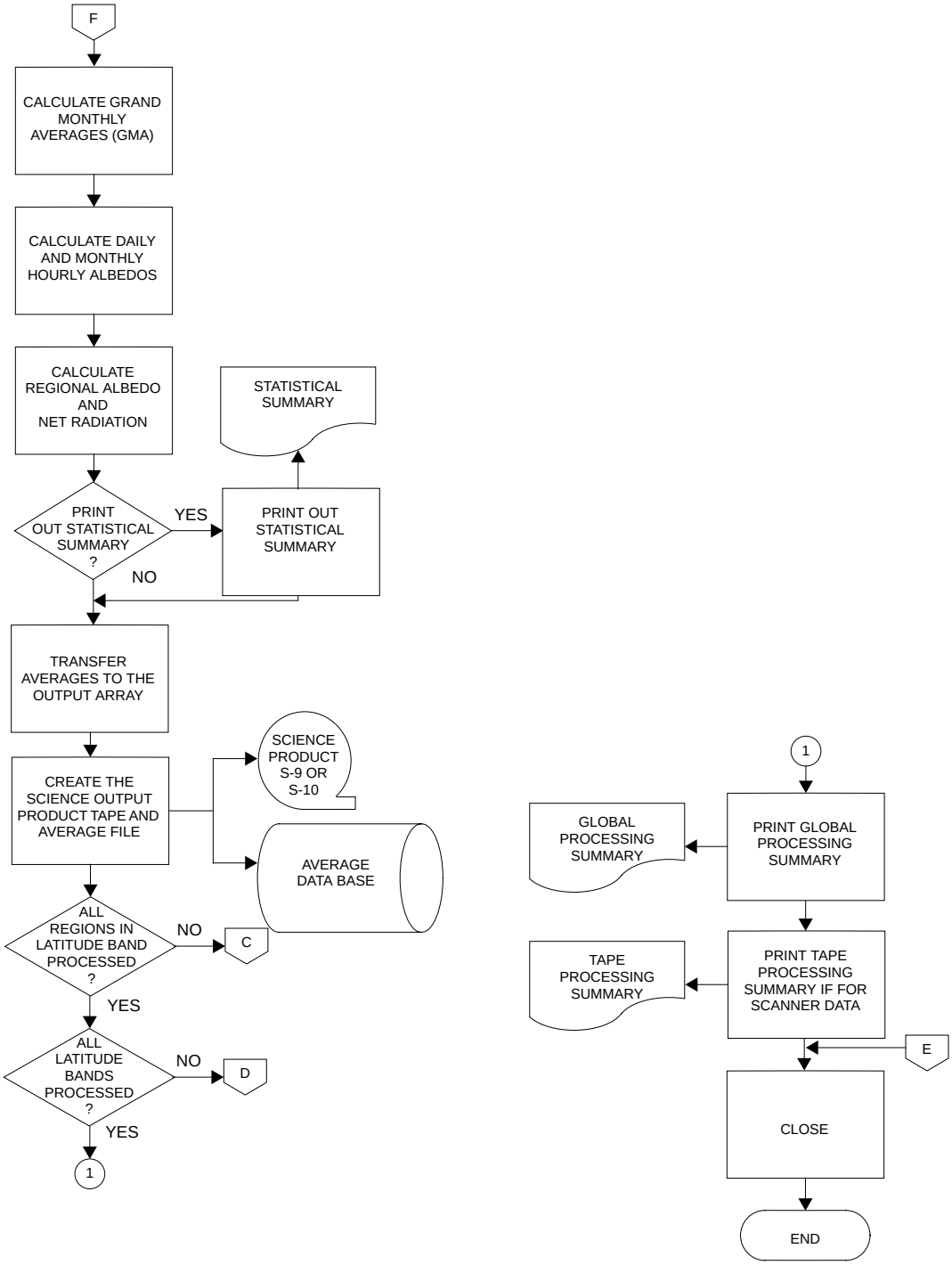


Figure 6.2-3. Overview of Data Processing (3 of 3)

files produced within MTSA are available to members of the ERBE Science Team as external science data products. The other files are used for intermediate transfer to other subsystems. A guide to the files produced by the entire Subsystem may be found in Table 6.2-1.

6.2.2 INPUT FILES

Each file of regionally accessible data contains one month's worth of Inversion output at a specific grid resolution. The scanner data base (2.5 degree resolution) is stored in a series of 36 sequential files. Each file stores the equivalent of two latitudinal bands of data ordered by region. The Daily Data Base Section provides a discussion of how data is stored on the scanner data base. Section 6.2.5.5.1 discusses data retrieval.

The nonscanner data base structure is completely different from the scanner structure. The nonscanner data base contains two separate data bases: the numerical filter (5.0 degree resolution) and the shape factor (10.0 degree resolution). Each data base is processed separately but the structure of each is identical.

The nonscanner data bases are each stored on a single FORTRAN direct (random) access type file which is set up logically as a linked list with multiple head pointers. Data is physically stored in time-sequenced order. Data for each region is retrieved in space-sequenced order by following a chain of pointers through the file. The Daily Data Base Section provides a discussion of how data is stored on the two nonscanner data bases. Section 6.2.5.5.1 discusses data retrieval.

Data retrieved from the input file is stored in memory as a 31x24 matrix representing the days and hours of the month. An additional column is used for daily averages, an additional row for monthly hourly averages, and one additional corner box which contains the grand monthly averages. This matrix is shown schematically in Figure 6.2-4. Each X in the 31x24 matrix indicates that one or more measurements were made at that particular day and hour. This is not a single piece of information, but an entire vector of data

Table 6.2-1 A Guide to T/S Averaging Subsystem Files

Description	I/O	Document Reference	Designator	Format*	Use**
Global system constants and parameters	I	***	GLOBL	D	I
Scanner Housekeeping File	O/I	Tbl 6.1-4	ID-15.1	DP	I
Numerical Filter (5°) Housekeeping File	O/I	Fig 6.1-9	ID-16.1	DP	I
Shape Factor (10°) Housekeeping File	OI	Fig 6.1-9	ID-17.1	DP	I
Inversion data: scanner	I	Tbl 6.1-2	ID-6	T	I
nonscanner	I	Tbl 6.1-3	ID-7	T	I
Scanner monthly data base record	O/I	Tbl 6.1-5	ID-15	DP	I
Numerical filter (5°) linked list record	O/I	Tbl 6.1-7	ID-16	DP	I
Shape Factor (10°) linked list record	O/I	Tbl 6.1-8	ID-17	DP	I
DDB regions filled:					
Scanner	O	Fig 6.1-13	QC-10.1	P	E
Numerical Filter (5°)	O		QC-10.2	P	E
Shape Factor (10°)	O		QC-10.3	P	E
Hours filled summary	O	Fig 6.1-11	QC-11	P	E
Radiant exitance histograms	O	Fig 6.1-13	QC-12	P	E
Current Status of Data Base:					
Scanner	O	Fig 6.1-15	QC-11.1	P	E
Nonscanner		Fig 6.1-16	QC-11		
Monthly T/S housekeeping parameters	I	Tbl 6.2-2		N	I
SW directional model data	I	Tbl A-1		D	I
Solar declination and solar constant data	I	Tbl D-2		D	I
Science output product: scanner	O	Tbl 6.2-8	S-9	T	E
5° MFOV	O	Tbl 6.2-9	S-10.1	T	E
5° WFOV	O	"	S-10.2	T	E
10° MFOV	O	"	S-10.3	T	E
10° WFOV	O	"	S-10.4	T	E
Regional monthly average data base	O	Tbl 6.2-11	ID-9	D	I
Global regions processed summary, single (0 or 1)	O	Tbl 6.2-8	QC-25	P	E
PCV summaries: 20 selected regions	O	Fig 6.2-11	QC-9	P	E 1
Statistics processing summary 20 selected regions	O	Fig 6.2-12	QC-34	P	E 2
Global regions processed summary, multiple (0, 1, 2, or 3)	O	Fig 6.2-15	QC-26	P	E 3
Output Tape Summary (scanner)	O	Fig 6.2-10	QC-41	P	E 0

* D=disc; DP=disc pack; T=magnetic tape; P=printed; N=FORTRAN NAMELIST

** I=internal use (formatted only for LaRC computer system); E=external use (printed or tapes formatted for external computer systems)

*** See Reference 1 for these values

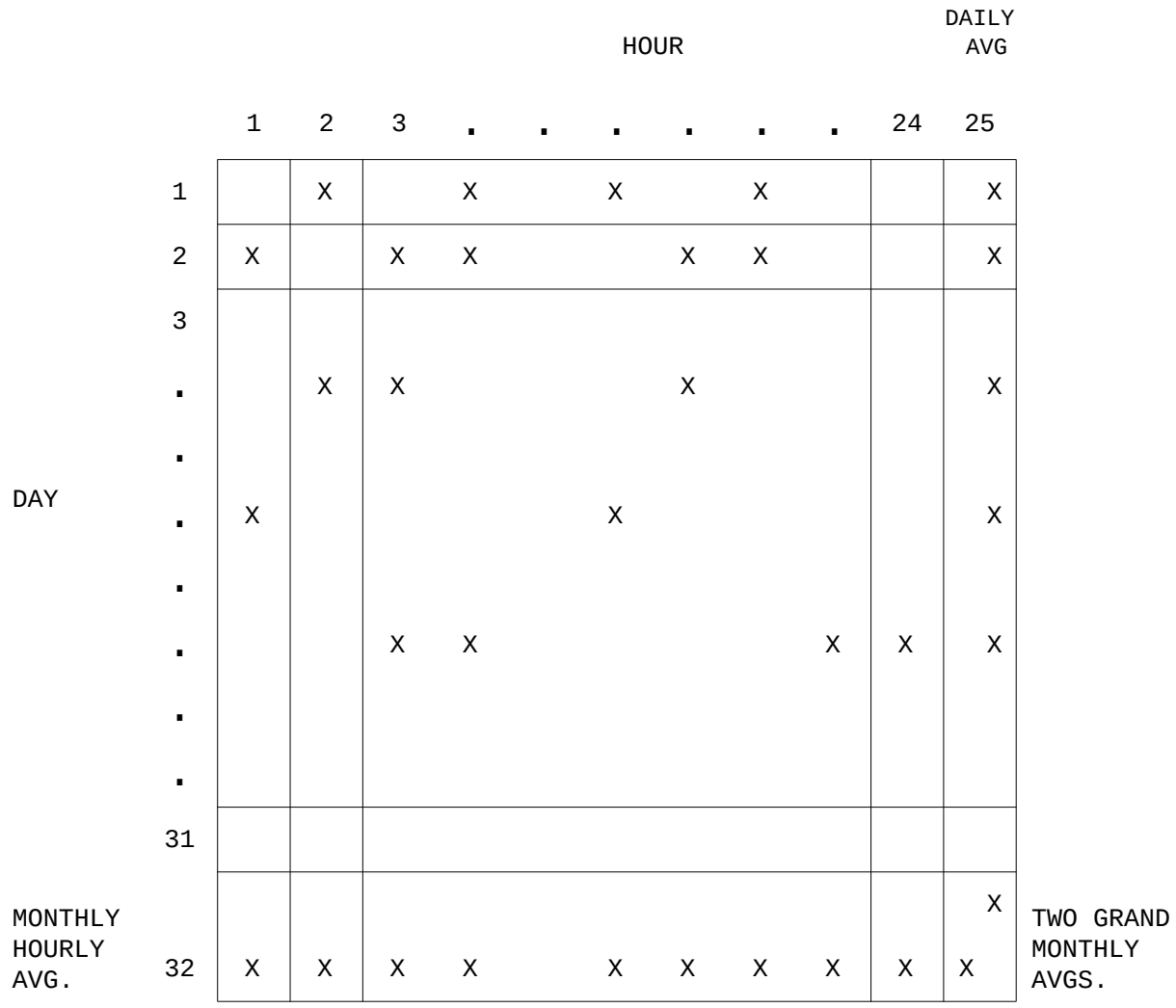


Figure 6.2-4. Region Data Matrix

concerning the radiometric information available at that particular time. The hour divisions correspond to the local solar half hour. This is an arbitrary but convenient choice which takes advantage of the symmetry of shortwave irradiance about local solar noon for all regions and times of the year.

6.2.3 PROCESSING DATA - THEORY

6.2.3.1 Initializing the T/S Data Matrix. The regional ordering of the input file makes it possible to process data by latitude band. In this way, certain solar information can be applied to every region in each band to save repetitive calculations. The solar declination is used to calculate the cosine of the solar zenith angle corresponding to each local solar time half hour, at the mid colatitude of the band. Symmetry about local solar noon minimizes the number of such calculations, which are done on line as each new colatitude band is processed. The solar declination is updated once each day from a pre-calculated table, at $0^h0^m0^s$ UT, and used throughout the day. The distance correction for the solar constant is another value which may be calculated a priori for each day based on an assumed value at an Earth-Sun distance of 1 AU and a table of values of $(l/r \text{ Earth-Sun})^2$ at $0^h0^m0^s$ UT. These astronomical quantities are calculated from an analytic ephemeris in the off-line program SSDEC (see Appendix D).

6.2.3.2 Loading Spacecraft Data into the T/S Data Matrix. All radiant exitance measurements are referenced to the local solar half hour in the T/S data matrix. This choice gives symmetry about local solar noon which facilitates calculation and interpretation of monthly hourly quantities, in particular, and gives a globally constant reference point for interpreting individual measurements in MTSA output. Note that by a “measurement” we refer to the output from Inversion which is assumed to be the best estimate of the variables in question.

Diurnal variation of longwave radiant exitance (LWRE) is assumed to be small enough that the measured value is the same as the value at the local solar half hour. (Later on in the processing, longwave diurnal models are introduced which imply that this may not be a good assumption in all

circumstances. However, even when these models are used, this assumption is retained for dealing with data from the file). Diurnal variation of shortwave radiant exitance (SWRE) is another matter; it is an essential first order feature of the radiation budget. So, for SWRE, it is not a good assumption to assign a measurement taken at some arbitrary time to the nearest local solar half hour. Instead, the known scene types being viewed at the time, with their albedos, and predetermined models for the change of albedo with solar zenith angle, must be used to predict albedo (and SWRE) at one time based on measured values at some other time. Our approach to this problem is developed in Appendix A. Equation (A-6) is used to convert input SWRE measurements from their values at some observation time t_{obs} to new values at t = local solar half hour.

Clock times are not really required for this conversion. Once the measurement has been assigned to the proper local solar hour box (a value included in the input file), the calculations are based directly on the cosine of the solar zenith angle at the time of measurement and at the local solar half hour. In this case, the constant meteorology assumption required to generate albedo at one time based on an albedo measured at another time is acceptable because the time span between the measurement and the local solar half hour is never more than about ±30 minutes.

A special case may arise in which SWRE measurements may have been assigned to the hour box before sunrise or after sunset. This is a result of the non-linear relationship between local time and solar zenith angle. A software test traps such cases and moves the measurement to the first or last daytime box, as appropriate. Even in this case, the adjustment to the local solar half hour still spans no more than about one half hour.

Finally, we note those cases for which multiple measurements may occur in a given regional hour box. This situation occurs routinely when medium field-of-view and wide field-of-view instrument outputs are being processed. The data for these hour boxes is combined using a continuously updated average. This method is discussed in Section 6.2.5.5.2.

Multiple measurements in an hour box also occur for single satellite scanner measurements between the end of one Inversion Subsystem processing day and the start of the next. In this case, data from the end of one day can fall into the same regional hour box as data from the beginning of the next day. The scanner processing software does not contain averaging algorithms that will allow combining these two measurements. Consequently, the data set with the larger number of inverted points is retained and the other is discarded.

When multiple satellite information is processed, multiple measurements within a given regional hour box are expected for scanner data as well as for nonscanner data. This is due to the fact that more than one satellite may view the same region at the same time. The algorithms used to combine multiple satellite data are discussed in Section 6.2.3.6.

6.2.3.3 Modeling LWRE. The longwave data will not typically exhibit significant diurnal behavior over most of the globe. Hence, the ERBE processing first considers the longwave (LW) modeling on a monthly basis. The goal is to fill in LWRE for all the hour boxes from the existing data. From this, monthly averages may be computed, and the vector (of length 24x31 = 744) can be broken up to provide both daily and monthly hourly averages. To achieve this goal, the concept of a processing control vector (PCV) is developed. This vector is an array which consists of 744 values, one for each hour box in the month. It is defined in three steps. First, the vector is initialized to 0's. Then the 0's representing those hour boxes which contain actual data are replaced with 1's (in Module DEFPCV). For example, if a 24-hour period contains data for hours 7, 12, and 20, the PCV would be

0 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0 1 0 0 0 0

Finally, the 0's are redefined as 6-digit integers (in Module REPCV) with two possible interpretations. If the lower order three digits are zeros, an extrapolation is required to get the LWRE value for that hour and the high order three digits tell from which hour the value, as a constant, is to be extrapolated. For example, a value of 007000 means that the value for an hour box is to be the same as the value for hour box seven. This would apply to

those hour boxes before the first measurement for the month and after the last. When the lower order 3 digits are not zero, they and the high order three digits indicate two hour boxes which are to be used as end points in a linear interpolation to provide a LWRE value for the hour box in question. For example, a value of 007012 might be found in the PCV for hour boxes 8-11. It means to interpolate using the values in hour boxes 7 and 12 as end points. This is the most common case, applied between measurements throughout the month.

In some land regions like deserts and arid mountains, LWRE exhibits a pronounced diurnal variation. The software incorporates a LW diurnal model to be applied to such regions. The model, and the criteria for its application, are explained in Appendix B and the implementation is found in Module LWMOD. In most cases, the liner interpolations for LWRE are left unchanged. Extensive testing of the model indicates that its appropriate application lowers the bias associated with retrieving monthly LWRE averages from simulated satellite samples. Processing of single early morning or late afternoon sun-synchronous satellite data pose the primary circumstance in which the model might produce questionable results. Hence, the model in these cases may be switched off through an input flag.

6.2.3.4 Modeling SWRE. The SWRE varies substantially during the day, and is zero by definition at night. Because of the way in which hour boxes have been defined relative to local time, each set of 24 hour boxes, goes through a night-day-night cycle. A PCV of length 24 is defined for each, as above. However, “extrapolation” and “interpolation” have much more complicated definitions. “Extrapolation” means that a particular hour is to be filled in from the measurements at the nearest hour, using equation (A-6) with its implied assumption of constant meteorology. This situation occurs for all empty daylight hours even if only one daylight measurement is available, and before the first measurement or after the last measurement when more than one measurement is available. In between pairs of daylight measurements, we assume that the meteorology will change linearly between the observed values. Hence, we use a time-weighted interpolation of two predicted values. In general, the values predicted for a particular hour box will not be the same

as those based on measurements at two other times, because the meteorology is different. For example, if we seek a mid day value for SWRE based on measurements in the early morning and late afternoon, the value based on an extrapolation from early morning cloud conditions will be different from the one based on afternoon cloud conditions. The algorithm for defining the SWRE at hour t_h based on measurements at two surrounding daytime hours is:

$$M(t_h) = \frac{1}{t_{H2} - t_{H1}} \left[(t_{H2} - t_h) M_{H1} + (t_h - t_{H1}) M_{H2} \right] \quad (1)$$

where H1 and H2 are hours with measurements, extracted from the upper and lower three digits of the SW PCV, respectively, and M_{H1} and M_{H2} are the values of SWRE at hour t_h based on albedo extrapolations of measurements at hours H1 and H2, respectively, to hour h. The algorithms for generating M_{H1} and M_{H2} are those of Appendix A.

6.2.3.5 Comparison of Scanner and Nonscanner Processing. The ERBE scanner measurements passed to MTSA are actually the 2.5° regional average of several scanner sweeps. Hence, some information is retained in the output files about the minimum, maximum, and number of such individual measurements associated with a particular regional day-hour box. All scanner measurements are associated with 2.5° regions, and as a rule no multiple measurements are expected from a single satellite at a given day-hour box (see Section 6.2.3.2 for exception). Nonscanner measurements are essentially “snapshots” made at 32-second intervals. The energy these detectors receive is centered at nadir, but not restricted to it. The problem is how to decide what grid resolution is appropriate for processing these data, and how to assign data to regions on the grid. One difficulty in uniform treatment of nonscanner (as well as scanner) measurements is that the ERBE grid system is not a constant area system (see Appendix C). Another difficulty associated with existing procedures is found in the Inversion algorithms which do their internal processing not on the ERBE grid, but on a grid which is symmetrical about the spacecraft groundtrack. The approach chosen for the ERBE software is a simple one in which all nonscanner shape factor (SF) inversions are processed by T/S

Averaging on a 10° ERBE grid and all nonscanner numerical filter (NF) inversions are processed at 5°, no matter what the surface area of the region, or the presumed surface coverage of the instrument. Both MFOV and WFOV spacecraft measurements are processed with SF and NF inversions, so the grid allocation becomes not a function of the instrument, but of the Inversion procedures. Each measurement is assigned a region on the appropriate grid by the Inversion Subsystem based on the nadir coordinates at the time of measurement.

What about those regions that are within the field-of-view, and maybe “just miss” being included, when the measurement could easily be said to be as representative of them as it is of the assigned region? One argument against more sophisticated and costly algorithms in Inversion or T/S Averaging is that these “missing” regions will eventually be “assigned” values when zonal averages are calculated. That “model” effectively fills in missing hour regions with values equal to the zonal average of regions with data. In the absence of firm, convincing, and feasible alternatives, this de facto assignment seems acceptable.

There are differences in the interpretation of scanner and nonscanner data which need to be discussed. With scanner data, the scene fraction and albedo vectors are dimensioned at four - for clear, partly cloudy, mostly cloudy, and overcast. A separate quantity (the geotype) identifies the geographic scene type as land, desert, snow, ocean, or land/ocean mix (see Appendix A). The albedos have the physical significance indicated by equation (A-1); that is, the SWRE given in the measurement is consistent with the scene fractions and albedos. For extrapolating SWRE to other times, the information given is enough to allow selection of the proper directional model, for example, “partly cloudy overland”. For partly cloudy scenes, the models for land, desert, snow, and land/snow are considered identical. This is also true for the mostly cloudy scenes. This approach has been used to save space on the scanner file, which already crowds existing disc capacity because of the large number of 2.5° degree regions which must be processed.

The situation is different on the nonscanner files. Here, there are two values for SWRE and, to save space, one set of scene fractions and albedos. The scene fraction vector is generated from 4 or 16 2.5° scenes, so it may contain multiple clear scene (geographic) types. Hence, fractions and albedos for all nine scene types must be specified by Inversion.

The albedo vector $a_i^{(t)}$ is now defined as a normalized vector such that the elements give only the relative distribution of SWRE array of the scenes. Note that the physical albedo is defined as:

$$a(t) = \frac{M_{SW}(t)}{E(d)\mu(t)} = \sum_{i=1}^{N} f_i(t)\, a_i(t) \tag{2}$$

where M_{SW} is the SWRE measured at time t; N is the number of scene types; E(d) is the distance corrected solar constant for the day of the measurement at $0^h0^m0^s$ UT; $\mu(t)$ is defined in terms of the solar zenith angle θ' as:

$$\mu(t) = \begin{cases} \cos\theta'_o & 0 \le \theta'_o \le 90^\circ \\ 0 & \theta'_o > 90^\circ \end{cases} \tag{3}$$

Define the normalized albedos $a'_i(t)$ from (2):

$$1 = \sum_{i=1}^{N} f_i(t) \qquad \frac{a_i(t)}{a(t)} = \sum_{i=1}^{N} f_i(t)\, a'_i(t) \tag{4}$$

To use equation (A-6), the albedos $a_i(t)$ for both nonscanner measurements must be given the same physical significance as they had from scanner data. From (2) and (4):

$$a_i(t) = a'_i(t)\, \frac{M_{SW}(t)}{E(d)\mu(t)} \tag{5}$$

(We might note here that for the scanner, the SWRE value itself is never used in the processing, as the extrapolation of individual measurements to the standard processing time proceeds directly from the linear combination of individual scenes.)

For n nonscanner measurements in the same hour box (a possibility that is excluded for the scanner), average values are computed as follows: First, define the $a_i(t)$'s from equation (5) for each of the n measurements. Then adjust M_{SW_j} for each measurement to the local solar half hour. The average $M_{SW}(d,h)$ associated with the hour box is the unweighted average of the adjusted measurements:

$$\bar{M}_{SW}(d,h) = \frac{\sum_{j=1}^{n} M_{SW_j}(d,h)}{n} \tag{6}$$

Similarly, the scene fractions to be associated with the hour box are given by:

$$\bar{f}_i(d,h) = \frac{\sum_{j=1}^{n} f_{i,j}(t)}{n} \tag{7}$$

Finally, the average albedos are computed by nothing that, analogously to equation (6):

$$\bar{M}_{SW_i}(d,h) = \frac{\sum_{j=1}^{n} M_{SW_{i,j}}(d,h)}{n} \tag{8}$$

then:

$$\bar{a}_i = \frac{\bar{M}_{SW_i}(d,h)}{\mu(d,h)\,E(d)\,\bar{f}_i(d,h)} \qquad (9)$$

The nonscanner records may contain measurements for some quantities and not for others, for a variety of reasons. To handle this, a flag value is inserted for quantities that are not measured. A zero value for SW is not valid, and should not be passed to T/S Averaging from the Inversion Subsystem.

6.2.3.6 Multiple Satellite Processing. One of the output products from T/S Averaging contains all the regional data for a month, standardized at the local solar half hour. (See the S-9 and S-10 Output Product descriptions, below.) These products are "recycled" as input records. Two or three such products are combined to do monthly processing for multiple satellites. The T/S Averaging procedures are identical, resulting in additional S-9 and S-10 products containing the unweighted averages of calculated quantities based on the combination of data being processed.

The averaging of data from more than one satellite is based on the unweighted averaging of each satellite. Specifically, radiant exitance is combined as follows:

$$M_{new} = \frac{M_1 + M_2 + \ldots}{NSAT} \qquad (10)$$

Standard deviation is, by the parallel axis theorem:

$$\sigma_{SW_{NEW}} = \sqrt{\frac{\sum_{j=1}^{NSAT} \left[\sigma_{SW_j}^{\ 2} + \left(M_{SW_j} - M_{SW_{NEW}} \right)^2 \right]}{NSAT}} \tag{11a}$$

$$\sigma_{LW_{NEW}} = \sqrt{\frac{\sum_{j=1}^{NSAT} \left[\sigma_{LW_j}^{\ 2} + \left(M_{LW_j} - M_{LW_{NEW}} \right)^2 \right]}{NSAT}} \tag{11b}$$

The new scene albedos are formed from a new set of scene fractions and radiant exitances for each scene type:

$$f_{i,new} = \frac{f_{i,1} + f_{i,2} + \cdots}{NSAT} \tag{12}$$

$$M_{i,new} = \frac{M_{i,1} + M_{i,2} + \cdots}{NSAT} \tag{13}$$

where:

$$M_{i,1} = a_{i,1} \mu(d,h) E(d) f_{i,1} \tag{14}$$

so that

$$a_{i,new} = \frac{M_{i,new}}{\mu(d,h)E(d)f_{i,new}} \tag{15}$$

This definition guarantees that:

$$\sum_{i=1}^{\#scenes} f_{i,new}a_{i,new} = \frac{M_{new}}{\mu(d,h)E(d)} \tag{16}$$

so that scene fractions, albedos, and SWRE for multiple satellites have the same relationship as they do for a single satellite.

Finally, the absolute maximum difference between multiple satellite radiant exitance estimates for both SW and LW for each hour box are stored on the S-9 and S-10 output products. The hour box indicator (an integer from 1 to 744) on these products is increased by 2000 or 3000 to allow determination of how many satellites have contributed to the hourly value.

6.2.3.7 Daily, Monthly Hourly, and Monthly Averages. Now we are in a position to calculate daily, monthly hourly, and monthly averages. Daily averages are formed by summing the values in all hour boxes for a given day and dividing by 24. Note that this is done even for SWRE, yielding a 24-hour average rather than an average over daylight hours.

For SWRE and incoming solar radiation, the sum over daylight hours is a potentially crude numerical approximation to an analytic integral of M_{SW}. We have chosen to improve this value by taking advantage of the fact that a plot of SWRE as a function of time will be similar to a plot of incoming solar radiation as a function of time -- changing meteorology is the source of

differences. The integral of the latter curve is easily done analytically with the assumption of constant solar declination and solar constant for one day, and may be compared to the numerical approximation of incoming solar radiation based on the solar constant and the tabulated values of cosine of solar zenith angle stored for each hour box. The analytic calculation for incoming solar radiation is as follows, assuming that the sun's position is constant for one UT day:

$$S(d) = \frac{2E(d)}{\rho}\int_0^{\beta_1} (\sin\Delta(d)\sin L_c + \cos\Delta(d)\cos L_c\cos\beta)\,d\beta$$

$$= \frac{2E(d)}{\rho}\,[\beta_1\sin\Delta(d)\sin L_c + \sin\beta_1\cos\Delta(d)\cos L_c] \qquad (17)$$

where

β = hour angle of the Sun, radians

$$\beta_1 = \begin{cases} \pi\ , & \Delta > 0^\circ, \quad L_c = 90^\circ \\ 0\ , & \Delta < 0^\circ, \\ \pi\ , & \Delta < 0^\circ, \quad L_c = -90^\circ \\ 0\ , & \Delta > 0^\circ, \\ \pi\ , & CS \le -1, \quad L_c \neq \pm 90^\circ \\ 0\ , & CS \ge +1 \\ \cos^{-1}(CS), & -1 < CS < +1 \end{cases}$$

CS = $-\sin\Delta(d)\sin L_c/(\cos\Delta(d)\cos L_c)$

$\Delta(d)$ = solar declination at day d

L_c = center latitude (not colatitude) of region

$E(d)$ = distance corrected solar constant at day d, $0^h0^m0^s$

ρ = rotational rate of Earth, 360 deg/day = 0.26179938 rad/hour, (a rate which gives the correct daily integrated value under the assumption that the Sun's position is fixed for the entire day).

The numerical approximation for the daily incoming solar radiation is:

$$S'(d) = E(d) \sum_{j=1}^{24} \mu(j) \tag{18}$$

where $\mu(j)$ is as defined in equation (3) for the local solar half hour in hour box j. A SW daily average is then given by:

$$SWRE(d) = \frac{S(d)}{S'd} \sum_{j=1}^{24} M_{SW}(j)/24 \tag{19}$$

The SW daily average is done every day having at least one SW measurement. Days for which the cosine of the solar zenith angle is never greater than zero are interpreted as being in regions of polar darkness, and are given a daily average of zero. As noted before, the LW daily average is available for each day of the month even if there is only one measurement available during the entire month.

Monthly hourly longwave averages are calculated using data from each day of the month. This average includes data from completely interpolated days. Monthly hourly shortwave averages are done somewhat differently. It is anticipated that there will be missing days where there are no SW measurements. This may occur where there are spacecraft data dropouts or processing difficulties. In this case, the monthly hourly averages for SWRE are taken over only the number of days with data (those hours which still contain the initialization value (current default is 32767) are ignored). While no attempt is made to “model” the missing days, this decision is, in fact, a model which effectively assigns hours on missing days a value equal to the average of those days with data at that hour. As a result, interpretation of monthly hourly averages is a variable matter. If there are a few random missing days, we might call it a “good” monthly value. If half the month is missing at the equator, then the defacto model will produce a result known to be in error due at least to differences in solar orientation during the

missing part of the month. If several consecutive days are missing near the beginning or end of polar darkness, we might attempt to include the known zeros associated with darkness in the average. However, the ERBE processing does not allow this variety of interpretation.

To aid the interpretation of monthly hourly and other monthly averages, a vector is maintained for each region which contains for each day the number of hours per day for which SWRE measurements exist. Missing days are represented by zeros. Post processors of these data may manipulate the monthly averages as they wish, weighting them with solar and perhaps meteorological information, as available. We seek further to aid interpretation of monthly averages by maintaining some monthly hourly data from just those days which contain measurements (as opposed to interpolated values) at a given hour. These values are the sum, sum squared, and number of actual measurements. In this way, some statistical tests may be performed which would otherwise be inaccessible in the more concise output products. All the monthly hourly results may be thought of as filling in the bottom row of Figure 6.2-4.

The lower right hand corner box in Figure 6.2-4 represents monthly average quantities. The "bottom line" value of interest is the monthly net hourly radiant exitance, which may be written:

$$M_{net} = \left[(1-a) \sum_{d=1}^{N} S(d) - L_{LW} \right] / (24 N_{SW}) \qquad (20)$$

where N is the number of days in the month.

This formulation poses several problems in terms of missing data, as the LW and SW data may generally be available over different days in the month. First of all, we can specify the definition of monthly net albedo as:

$$\bar{a} = \sum_{\text{Days with SW data}} SWRE(d) \times 24 / \sum_{\text{Days with SW data}} S(d) \qquad (21)$$

where SWRE(d) are the nonzero daily SW averages stored in the right hand

column of Figure 6.2-4. Albedo is not defined for situations of total polar darkness. For situations where there is daylight for only part of the month, S(d) is defined as zero for dark days. We note again that LW daily averages are available for every day of the month, if we are to define net radiant exitance at all, and we define L_{LW} as the sum over all days of the month.

$$L_{LW} = \sum_{J=1}^{24} \sum_{d=1}^{N} M_{LW}(d,j) \qquad (22)$$

An alternate definition of monthly net radiant exitance is based on defining monthly average albedos as:

$$\bar{a}' = \sum_{J=1}^{24} \sum_{\substack{\text{Days with} \\ \text{SW data}}} M_{SW}(d,j) \Big/ \sum_{J=1}^{24} \sum_{\substack{\text{Days with} \\ \text{LW data}}} S'(d,j) \qquad (23)$$

and using the LW measurements only on days that had LW data:

$$M'_{net} = \frac{(1-\bar{a}') \sum_{J=1}^{24} \sum_{\substack{\text{Days with} \\ \text{SW data}}} S'(d,j)}{\begin{array}{c}24 * \text{days} \\ \text{with SW} \\ \text{data}\end{array}} - \frac{\sum_{J=1}^{24} \sum_{\substack{\text{Days with} \\ \text{LW data}}} M_{LW}(d,h)}{\begin{array}{c}24 * \text{days} \\ \text{with LW} \\ \text{data}\end{array}} \qquad (24$$

Note that in general, M'_{net} is not equal to M_{net}.

6.2.3.8 User Options. As a user option within the standard ERBE processing, daily, monthly hourly, and monthly averages and statistics can be printed out for up to 20 regions. An additional available option is a listing of the processing control vector in the 0 or 1 state for up to 20 regions. The default region numbers used by either of these options are the default validation regions seen in Table 6.2-2.

Table 6.2-2 Default Validation Regions

STANDARD REGION NUMBER	2.5° GRID REGION NUMBER	5.0° GRID REGION NUMBER	10.0° GRID REGION NUMBER
1	1583	432	108
2	9003	2270	559
3	3547	910	239
4	2729	717	179
5	6445	1639	424
6	7867	1990	491
7	4987	1270	311
8	5031	1292	322
9	2985	773	207
10	5593	1429	355
11	3899	942	219
12	1759	448	116
13	993	281	69
14	9901	2503	640
15	4053	1019	258
16	3857	993	245
17	2693	669	170
18	2993	777	209
19	3749	939	218
20	6743	1716	426

6.2.3.9 Processing Clear Sky Scanner Data. A large part of the computation time within the Inversion Subsystem is devoted to scene identification. Because of the importance of clear sky radiation data, and the difficulty of obtaining this information from ERBE in a post processing mode, it is worthwhile to separate the ERBE clear scenes as a subset of the total inverted data set. Toward this end, the clear sky LWRE, the standard deviation of clear sky LWRE and albedo, and the number of clear LW scanner scenes (pixels) are saved separately on the scanner data file. These additional values are used in conjunction with the clear scene albedo and fraction. These clear sky LW and SW values are used to perform the same regional operations as the total data set, producing as a final result a clear sky monthly regional net radiant exitance. The standard deviations can be used in later scientific studies to assess the quality of the original data; large values could indicate that the scene identification algorithms were improperly identifying cloudy scenes as clear. It should be noted that the “clear” classification includes up to five percent cloud cover, thereby expanding the “clear” data base at the expense of cloud contamination.

Much of the computation and products of Monthly T/S Averaging is duplicated with the subset of clear sky data. The duplicated quantities are flagged in the description of T/S Averaging output, below. We would naturally expect much more “missing” data for the clear sky subset -- there will be many days with no cloud free measurements -- so the interpretation of monthly averages is less certain. Clear sky measurements at night are made on the basis of a LW scene identification

6.2.4 OUTPUT FROM T/S AVERAGING - OVERVIEW

The end result of monthly regional processing is the calculation of daily, monthly hourly, and monthly averages. Major output products (S-9 and S-10) from T/S Averaging contain all the measurements, plus these averages. The contents of these files are detailed in Section 6.2.6.1.1. They are summarized here.

1.	Day-hour box data (elements of the 31x24 day-hour matrix containing measurements)	Julian Date and local solar time hour box index Scene fractions (includes geotype for scanner) Albedos For SWRE and LWRE: best estimate (adjusted to the local solar half hour), minimum, maximum, standard deviation, number of measurements Cosine of solar zenith angle at local solar half hour Incoming solar radiation at local solar half hour Spacecraft viewing angles Clear sky data: LWRE, standard deviation and n for LWRE and standard deviation of the albedo (only appears on the scanner S-9 product)

"Number of measurements" for scanner data refers to the number of individual scanner measurements, while for nonscanner, it is the number of inversions done in the region. Multiple satellite measurements may increase n, but will not change its interpretation. NOTE: For SWRE the best estimate has been adjusted to the local solar half hour whereas the rest of the statistics apply to the best estimate originally passed to the MTSA Subsystem. Therefore, if the original estimates from the Inversion Subsystem were relatively far from the half hour and the range of the estimates was small, it is possible the adjusted SWRE will be outside of the range indicated by the maximum and minimum values from the Inversion Subsystem.

2.	Daily averages (the right hand column of the T/S Data Matrix)	For SWRE and LWRE: mean, minimum, maximum, standard deviation, number of hours with data (measurement from Inversion) Mean albedo, distance-corrected solar constant at $0^h0^m0^s$ UT
3.	Monthly hourly averages (the bottom row of the T/S Data Matrix)	For SWRE and LWRE: mean, minimum, maximum, standard deviation, number of days with data Mean albedo $\sum_{i=1}^{n} M_i$ and $\sum_{i=1}^{n} M_i^2$ for actual SWRE and LWRE measurements
4.	Monthly averages (the lower right-hand box in the T/S Data Matrix)	For SWRE and LWRE, and from both daily and monthly hourly averages: mean, minimum, maximum, standard deviation, number of days (or hours) with measurements Best estimate of net monthly radiant exitance per hour

Net monthly albedo from daily SWRE and integrated solar incoming radiation
Net monthly albedo from monthly hourly average SWRE and solar incoming radiation as tabulated at local solar half hour
Histogram of scene fraction counts

Data items given in numbers 2, 3, and 4 above are also given for the scanner clear sky data.

6.2.5 THE MONTHLY T/S AVERAGING SUBSYSTEM CODE

The two MTSA main processors (scanner and nonscanner) are similar. Differences exist due to processing of clear sky data for the scanner processor and processing numerical filter and shape factor data for the nonscanner processor. Modules which perform basically the same function but are customized due to the type of data being processed are referenced by similar module names in the processors. In the following discussion these modules will be referenced by both names separated by a / with the scanner module name appearing first (i.e., TSVSC/TSVNS).

6.2.5.1 The Subsystem Driver. The purpose of the T/S Averaging Subsystem driver (TSAVSC/TSAVER) is to oversee all processing which is done during any execution of the subsystem. The flow through the driver is shown in Figure 6.2-5. The first step is to initialize the subsystem and all input and output files. If the initialization completes without error, the input data is processed. After the data is processed, all files are closed and information about the files created is written to the ERBE Header File (see Utilities Reference Manual, Reference 1, for details of this file). Regardless of whether or not the data was processed correctly the subsystem terminates by printing out a processing summary which contains informative, as well as error messages created during the processing. This flow is the same regardless of the type of data being processed, however the nonscanner module TSAVER performs one additional task. It is possible when processing nonscanner data

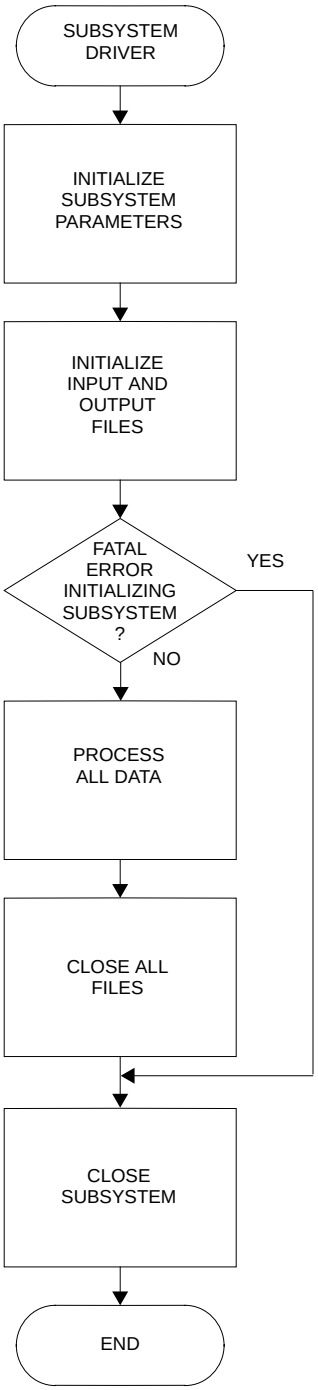


Figure 6.2-5. General Flow of the Monthly Time/Space Averaging Subsystem

that the physical albedos calculated from the normalized input albedo and adjusted to the local solar half hour may be greater than 1.0. This is permissible since the energy within the total scene is only being redistributed. This may occur many times during processing. Module ADJUST keeps track of which scene types had adjusted albedo values greater than 1.0 and the number of estimates for which this occurred. This information is printed to the informative message file in Module TSAVER.

6.2.5.2 Subsystem Initialization. The first set of modules executed within the T/S Averaging Subsystem initializes the subsystem. All COMMON Block variables are initialized in Module BLKDTA. Definitions of what the COMMON Block variable names represent are also found here. Necessary changes to input-output unit numbers and definitions of those parameters associated with a particular grid resolution are done in Module INITSC/INIT. These changes are accomplished through the use of NAMELIST. The parameters, definitions, and default values for NAMELIST input are listed in Table 6.2-3. In addition, the on-line files containing information about the solar constant and solar declination for each day in the month and the SW normalized directional function table must be read into core. This is accomplished in Module LDTBLS/LDTABL. The file definitions with corresponding array names and sizes are listed in Table 6.2-4 The file containing the distance corrected solar constant and solar declination angle for each day of the month is created by an off-line program which is discussed in Appendix D. The files (a separate file for each month) containing the SW normalized direction function tables are created by the Inversion Subsystem.

6.2.5.3 File Initialization. Regardless of what type of data is being processed, all the input and output files are opened and verified in Module FILESC/FILES.

Initialization of the data base files for single satellite scanner processing is performed by INITMS. In order to retrieve data records from the 36 latitudinal band files (see Section 6.2.5.5.1), certain information must be

Table 6.2-3 Parameters, Definitions, and Default Values for NAMELIST Input

NAMELIST NAMES	PARAMETER	DEFINITION	DEFAULT
$GENRAL	INLAT	Initial latitude band number to process	1
	IPRTS1(20)	Array of regions used to print out the shape factor statistics summary	**
	IPRTS2(20)	Array of regions used to print out the scanner statistics summary	**
	IPRTS5(20)	Array of regions used to print out the numerical filter statistics summary	**
	IPRTV1(20)	Array of regions used to print out the shape factor PCV summary	**
	IPRTV2(20	Array of regions used to print out the scanner PCV summary	**
	IPRTV5(20)	Array of regions used to print out the numerical filter PCV summary	**
	IRES*	Grid resolution to process	0
	ISATCD*	Satellite code	0
	IYEAR*	Integer representation of the year	0
	MONTH*	Integer representation of the month	0
	NCOL25	Number of regions in a latitude band for 2.5° file	144
	NCOL50	Number of regions in a latitude band for 5.0° file	72
	NCOL10	Number of regions in a latitude band for 10.0° file	36
	NHOURS	Number of hours in a day	24
	NMODSC	The number of scanner SW scene types	4
	NMODNS	The number of nonscanner SW scene types	9
	NPRTS	The number of region numbers in IPRTS	20
	NPRTV	The number of region numbers in IPRTV	20
	NROW25	Number of latitude bands for the 2.5° file	72
	NROW50	Number of latitude bands for the 5.0° file	36
	NROW10	Number of latitude bands for the 10.0° file	18
	NTAPES*	Number of tapes processed during the month	0
	EROTRT	Rotation rate of the Earth in radians per hour	0.26179938
	KIND	Multiple satellite indicator for non-scanner data (whether ‘MFOV’ or ‘WFOV’)	blank
	FILVAL	Bad data indicator	32767.0

* These values must be input for subsystem to run.
**Standard ERBE validation regions used. See Table 6.2-2

Table 6.2-4 On-Line Input Files

FILE DEFINITION	ARRAY NAME	SIZE	INIT PARAMETER NAME
Distance correction for the solar constant for each day of the month	DEO	31	ISOL
Solar declination angle for each day of the month	SOLDEC	31	ISOL
SW normalized directional function table* (scanner)	DIRSW	16 x 10	ISWDF
SW normalized directional function table* (nonscanner)	DIRSW	9 x 10	ISWDF

* The same matrix in the program is used for both of these tables and the correct file must be attached prior to entering the program

read from the housekeeping file which is associated with the scanner data base. The structure of this housekeeping file is shown in Table 6.1-4 Not all of the information shown on this table is used by MTSA. Records 77 - 79 on this table are associated with the pre-sorted scanner data base (see Daily Data Base Section) and do not appear on the housekeeping file used by MTSA.

The sequence of events in initialization of the scanner data base begins by ATTACHing and opening the housekeeping file. The ATTACH is needed to make the file local to the processing and is performed through the FORTRAN/NOS permanent file interface routine, PF. Next, the ERBE logical header is retrieved using the key stored on record 73 and the ERBELIB module GDAHED. The file is validated via the standard ERBE file validation utility IVLHED. Errors occurring at this point in the processing cause subsystem termination.

The next step in data base initialization is to read the file sorted flags from record 76 into core and check them to make sure that all the files have been sorted in regional order. Subsystem termination results if any files are unsorted. Next the days with data information from record 75 and the scale factors from record 74 are read into core. These data are used later in the processing. Finally, the beginning and ending whole and fractional Julian dates from the ERBE logical header are converted to real numbers and stored into separate variables to be used later.

Nonscanner data base initialization is performed by INITMN and begins by initializing resolution specific parameters. Next the nonscanner housekeeping file is opened. An ATTACH through the PF utility is not needed for the nonscanner housekeeping file because this file is made local to the processing through the CCL command file. The structure of the nonscanner housekeeping file is shown in Table 6.1-9. Records 1 - 39 on the numerical filter housekeeping file and records 1 - 21 on the shape factor housekeeping file are used by MTSA, the other records shown in the table are used only by the Daily Data Base Subsystem.

After the file is opened, the logical header is retrieved using the key stored on record 37 (numerical filter housekeeping file) or record 19 (shape factor

housekeeping file) and the ERBELIB routine GDAHED. The file is validated using the ERBELIB utility IVLHED.

After successful validation, the days with data information and the scale factors are read into core to be used later in the processing. The beginning and ending whole and fractional Julian dates are converted to real numbers and stored in separate variables for later processing. The final step in nonscanner initialization is to retrieve the logical header and validate the linked list file. The ERBE key is stored on the first record of the file. Note that this step is absent from scanner data base initialization because only one logical header is used for all the scanner files.

All processing produces, on paper, an error message summary and a global processing summary. The scanner processing also produces an output tape summary. If requested, a processing control vector summary and/or a statistics summary can be produced. These files are opened in module FILESC/ FILES. The regional average data base, consisting of daily, monthly hourly, and grand monthly averages to be used as input for the nested radiant exitance product is opened. This data base is produced on tape for scanner data and as direct access files for nonscanner processing is opened. After this file is opened, the ERBELIB Module WRTKEY is called to write the Header Record Key to the file. The S-9 or S-10 output tape is now opened. These tapes consist of daily, monthly hourly, and grand monthly averages and their associated statistics as fixed length records plus variable length data records containing the hourly entries as retrieved from the input file. After this file is opened, the ERBELIB Module W16KEY is called to write the 16-bit header record key to the file. The scale factors are packed into 16-bit representation by the ERBELIB Module SPREAD and an even 60-bit word boundary is computed by Module IWORDS. These values are then written to the tape as the second record on the tape. These products are more fully discussed in Section 6.2.6.

6.2.5.4 Latitude Band Processing. Processing of data from a given input file proceeds by stages or logical division. Certain calculations, e.g., calculation of the cosine of the solar zenith angle at the local solar half hour and the associated diurnal models are valid for any data processed within

a given latitude band (see Section 6.2.3.1). Module LATDRS/LATDR drives the processing. The calculation of cosine of the solar zenith angle is done in Module COSZSC/COSZEN. It is an implementation of equation 12 of the ERBE Science Reference Manual, Revision 1 (Reference 2). A pseudo code implementation follows:

The sine and the cosine of the center of the latitude band are computed:

RES = FLOAT (IRES)/10.0 (25)

CNLAT = 90.0 + (RES/2.0) - (RES * FLOAT(LAT)) (26)

CLAT = CNLAT * DEGRAD (27)

SNLAT = SIN(CLAT) (28)

CSLAT = COS(CLAT) (29)

where

IRES is the degree of resolution

LAT represents the latitude band number

DEGRAD is the degrees to the radians conversion factor

SIN means sine

COS means cosine

The sine and the cosine of the solar declination angle are calculated for the day:

SODEC = SOLDEC(IDAY) * DEGRAD (30)

CD = COS(SODEC) (31)

SD = SIN(SODEC) (32)

where

SOLDEC= solar declination

IDAY = day number

The local solar half hour angle is calculated

```
IHOUR = JHOUR - 1                                          (33)

R     = -180. + 15. * FLOAT(IHOUR) + 7.5                   (34)

HB    = B * DEGRAD                                         (35)
```

where JHOUR is local half hour index (1 to 24)

The cosine of the solar zenith angle at the local solar half hour for the local half hour can now be calculated. If the cosine is negative, the value is set to zero.

```
CSZNHH(JHOUR,IDAY) = AMAX1((CD * CSLAT * COS(HB) + SD * SNALT), 0.0)(36)
```

where

AMAX1 is a FORTRAN intrinsic function which returns the value of the largest argument.

The calculation of SW normalized directional values found in Module DIMODS/DIMOD proceeds as per the discussion on page 6-22 of the ERBE Science Reference Manual, Revision 1 (Reference 2) and is briefly described here.

If the cosine of the solar zenith angle is less than or equal to zero, all modeled directional values are set to zero. If the cosine of the solar zenith angle is greater than zero but less than, or equal to, .05, the modeled directional values are set to those values which correspond to a cosine of the solar zenith angle of .05 in the normalized directional function table. If the cosine of the solar zenith is greater than, or equal to, .95, the modeled directional values are set to the values in the normalized directional function table which correspond to a cosine solar zenith angle of .95. Otherwise the directional values are calculated using the following method. Indices which point to the nearest high and low modeled directional values in the normalized directional function table are computed using the following pseudo code:

IHI = 11 - INT(CSZNHH(IHOURS, IDAY) * 10.0 + .5) (37)

ILO = IHI - 1 (38)

where

IHOURS is the hour of the day

IDAY is the day of the month

CSZNHH represents the cosine of the solar zenith angle for the hour

A constant value used later to simplify an equation used to compute modeled values is calculated:

DICON = (FLOAT(10-ILO)/10.0 + .05 - CSZNHH(IHOURS,IDAY))/.1 (39)

Using the indices computed above to access table values, interpolation between high and low modeled values is done to compute the modeled directional values for each scene type which is associated with the cosine of the solar zenith angle:

DIMDH(I) = DIRSW(I,ILO) - ((DIRSW(I,IHI) - DIRSW(I,ILO)) * DICON) (40)

where

I denotes scene type

DIRSW is the array holding the SW directional function table.

These calculations are done once at the beginning of processing for a new latitude band. For nonscanner processing, a new set of latitudinal band head pointers for the linked list are loaded into core. For scanner processing, a new set of number of records per region counters are loaded into core. Processing within a latitude band is done on a region by region basis.

6.2.5.5 Processing By Region Number. The latitude bands are numbered from north to south and the first region for each band includes and lies east of

the Greenwich Meridian. The northern and western boundaries of a region are included in the definition of a region, but its southern and eastern boundaries are excluded (see Appendix C). Module REGDRS/REGDR oversees all processing for a region. The first step is to retrieve the data from the input file and store it in the regional data matrix. This is done in Module LOADSC/LOADMN. Data is retrieved as a vector of information which includes not only the inverted radiant exitances, but also measurement times, viewing and Sun location parameters, albedos, and scene identification. Tables 6.2-5, 6.2-6, and 6.2-7 show respectively the vector for the scanner, numerical filter and shape factor inversions.

6.2.5.5.1 Data Retrieval. The method of data retrieval used depends upon whether single satellite or multiple satellite data is being processed. The following sections concern themselves with single satellite processing data retrieval. Multiple satellite processing data retrieval will be discussed in Section 6.2.7.

Data retrieval for the scanner processing is accomplished in module READSD. The first step is to check to see if processing for a new latitudinal band has begun. Since the scanner data base consists of 36 files, each containing records for two latitudinal bands, another check must be made to determine whether to close the existing file and open a new one. If a new file is to be opened, then a call to the FORTRAN/NOS permanent file interface utility, PF, must be made first to make the file local to the processing. Latitudinal band processing also requires reading a new set of number of records per region counters into core from the scanner housekeeping file (see Table 6.1-4). Records 1 - 72 on this file contain these counters which are used as end-of-region flags. A record is read from the file, unpacked, and a flag is set to signal to MTSA regarding the status of the data record. The flag has one of the following values:

0 = the data array contains a valid record and there are more records in the region;

1 = the data array contains a valid record and there are no more records in the region;

Table 6.2-5 Daily Data Base Input to Monthly Time/Space Averaging: Scanner (2.5°)

WORD POSITION IN UNPACKED ARRAY	DATA DESCRIPTION	UNITS	NO. OF VALUES
1	Region Number	----	1
2	Hour/day number indicator	----	1
3	Average of whole Julian days	days	1
4	Average of fractional Julian days	days	1
5	Estimate of average SW radiant exitance	wm^{-2}	1
6	Estimate of average LW radiant exitance	wm^{-2}	1
7	Number of individual SW estimates	----	1
8	Standard deviation of individual SW estimates	wm^{-2}	1
9	Minimum individual SW estimate	wm^{-2}	1
10	Maximum individual SW estimate	wm^{-2}	1
11	Number of individual LW estimates	----	1
12	Standard deviation of individual LW estimates	wm^{-2}	1
13	Minimum individual LW estimate	wm^{-2}	1
14	Maximum individual LW estimate	wm^{-2}	1
15	Geographic scene type	----	1
16	Fraction of clear areas	----	1
17	Fraction of partly cloudy areas	----	1
18	Fraction of mostly cloudy areas	----	1
19	Fraction of overcast areas	----	1
20	Albedo of clear areas	----	1
21	Albedo of partly cloudy areas	----	1
22	Albedo of mostly cloudy areas	----	1
23	Albedo of overcast areas	----	1
24	Average of individual cosines of solar zenith angles at target point for all SW estimates	----	1
25	Average of individual zenith angles of satellite from target point for all estimates	degrees	1
26	Average of individual azimuth angles at target point from negative sun direction for SW estimates	degrees	1
27	Standard deviation of clear sky albedos	wm^{-2}	1
28	Average of clear sky, LW radiant exitances	wm^{-2}	1
29	Standard deviation of clear sky, LW radiant exitances	wm^{-2}	1
30	Number of clear sky estimates, LW	----	1
31	Spare	----	1
32	Spare	----	1

Table 6.2-6 Daily Data Base Input to Monthly Time/Space Averaging: Numerical Filter (5.0°)

WORD POSITION IN UNPACKED ARRAY	DATA DESCRIPTION	UNITS	NO. OF VALUES
1	Region Number	----	1
2	Hour/day number indicator	----	1
3	Whole Julian Date	days	1
4	Fractional Julian Date	days	1
5	MFOV numerical filter estimate of average SW radiant exitance	wm^{-2}	1
6	MFOV numerical filter estimate of average LW radiant exitance	wm^{-2}	1
7	WFOV numerical filter estimate of average SW radiant exitance	wm^{-2}	1
8	WFOV numerical filter estimate of average LW radiant exitance	wm^{-2}	1
9	Cosine of solar zenith angle at center of region	----	1
10	Zenith angle of satellite from center of region	degrees	1
11	Azimuth angle at center of region from negative sun direction to satellite direction	degrees	1
12	Fraction of ocean	----	1
13	Fraction of land	----	1
14	Fraction of snow	----	1
15	Fraction of desert	----	1
16	Fraction of partly cloudy over ocean	----	1
17	Fraction of partly cloudy over land or desert	----	1
18	Fraction of mostly cloudy over ocean	----	1
19	Fraction of mostly cloudy over land or desert	----	1
20	Fraction of overcast	----	1
21	Normalized albedo for fraction of ocean	----	1
22	Normalized albedo for fraction of land	----	1
23	Normalized albedo for fraction of snow	----	1
24	Normalized albedo for fraction of desert	----	1
25	Normalized albedo for fraction of partly cloudy over ocean	----	1
26	Normalized albedo for fraction of partly cloudy over land or desert	----	1
27	Normalized albedo for fraction of mostly cloudy over ocean	----	1
28	Normalized albedo for fraction of mostly cloudy over land or desert	----	1
29	Normalized albedo for fraction of overcast	----	1
30	Geotype (land plus desert fractions)	----	1
31	Spare	----	1
32	Spare	----	1
33	Spare	----	1
34	Next pointer	----	1

Table 6.2-7 Daily Data Base Input to Monthly Time/Space Averaging: Shape Factor (10.0°)

WORD POSITION IN UNPACKED ARRAY	DATA DESCRIPTION	UNITS	NO. OF VALUES
1	Region Number	----	1
2	Hour/day number indicator	----	1
3	Whole Julian Date	days	1
4	Fractional Julian Date	days	1
5	MFOV shape factor estimate of average SW radiant exitance	wm^{-2}	1
6	MFOV shape factor estimate of average LW radiant exitance	wm^{-2}	1
7	WFOV shape factor estimate of average SW radiant exitance	wm^{-2}	1
8	WFOV shape factor estimate of average LW radiant exitance	wm^{-2}	1
9	Cosine of solar zenith angle at center of region	----	1
10	Zenith angle of satellite from center of region	degrees	1
11	Azimuth angle at center of region from negative sun direction to satellite direction	degrees	1
12	Fraction of ocean	----	1
13	Fraction of land	----	1
14	Fraction of snow	----	1
15	Fraction of desert	----	1
16	Fraction of partly cloudy over ocean	----	1
17	Fraction of partly cloudy over land or desert	----	1
18	Fraction of mostly cloudy over ocean	----	1
19	Fraction of mostly cloudy over land or desert	----	1
20	Fraction of overcast	----	1
21	Normalized albedo for fraction of ocean	----	1
22	Normalized albedo for fraction of land	----	1
23	Normalized albedo for fraction of snow	----	1
24	Normalized albedo for fraction of desert	----	1
25	Normalized albedo for fraction of partly cloudy over ocean	----	1
26	Normalized albedo for fraction of partly cloudy over land or desert	----	1
27	Normalized albedo for fraction of mostly cloudy over ocean	----	1
28	Normalized albedo for fraction of mostly cloudy over land or desert	----	1
29	Normalized albedo for fraction of overcast	----	1
30	Geotype (land plus desert fractions)	----	1
31	Spare	----	1
32	Spare	----	1
33	Spare	----	1
34	Next pointer	----	1

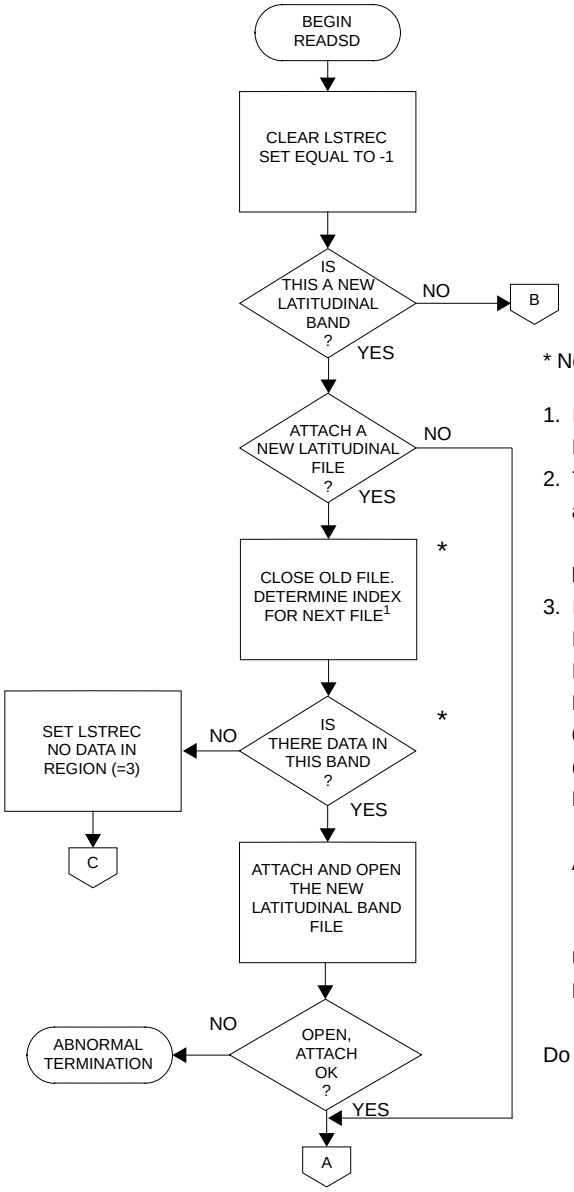
2 = attempted to retrieve a record after the last record in the region (this is an error condition, the data array does not contain a valid record);

3 = there is no data for this region, the data array does not contain a valid record.

A detailed processing flowchart for this module is shown in Figure 6.2-6.

Data retrieval for the nonscanner processing is accomplished in module READLK. Data is retrieved by using the head pointers to find the last record stored for the region being processed. The head pointers are stored on records 1-36 of the numerical filter housekeeping file and records 1 - 18 of the shape factor housekeeping file (see Figure). Each record stores the head pointers for one latitudinal band so the processing must keep track of when a latitudinal band boundary is crossed so a new set of head pointers can be read off the file. Unlike the scanner processing, all the data records are stored on a single file which is made local to the processing through the MTSA CCL. The head pointer for a region is used to find the last record stored for that region. Subsequent records for the region are found by following the chain of link pointers through the file until an end-of-region flag is encountered (this is identified by finding a link pointer equal to zero). Regional records are read, unpacked and the same flag as described above for scanner processing is set to signal MTSA regarding the status of the record in the data array. A detailed processing flowchart for this module is shown in Figure 6.2-7.

6.2.5.5.2 Loading Data Into the Matrices. ‘The data record is stored in a set of region data matrices according to the day and time of the measurement. Figure 6.2-4 describes one T/S Averaging data matrix. The 31 x 24 submatrix corresponds to the days and local hour of the month for the region. Each x represents information corresponding to inverted data for that particular hour and day. The 25th column contains the daily averages for the month. The 32nd row contains the monthly hourly averages. The two grand monthly averages are located in the lower right hand box. The second word of the data vector retrieved contains an integer value between 1-744. This is the hour index



* Notes for flowchart:

1. Equation to calculate index for the new latitudinal band file is:
   INDXLT = (LAT - 1) / 2 + 1
2. To see if there is any data in the new region:
   a. Calculate the index into total number records per region array
      INDXHD = IREG - ((LAT - 1) * NREG)
   b. Check file-sorted flag at array position INDXHD
3. Parameters to pass to SPREAD are:

IPCLNK	= Packed linked list array
IHOLD	= Array to hold unpacked integer linked list record
NBITS	= Number of bits in packed array
60	= Number of bits for unpacked array
(LENPAC-1)	= Number of words to be unpacked
N	= Parameter returned by SPREAD which indicates number of words that were unpacked

After SPREAD is called, use SCALE to restore decimal places to values in linked list record and store in UPCLNK. The whole Julian Date in IHOLD(3) should be rescaled as follows:

UPCLNK(3) = FLOAT(IHOLD(3) + 2.4 * 1.E06)

Remember to get the pointer to the next record from IPCLNK (LENPAC) and put it into UPCLNK (LENUPC + 1)

Do not apply scale factor to a default value

Figure 6.2-6. Data Retrieval for Scanner Processing (1 of 2)

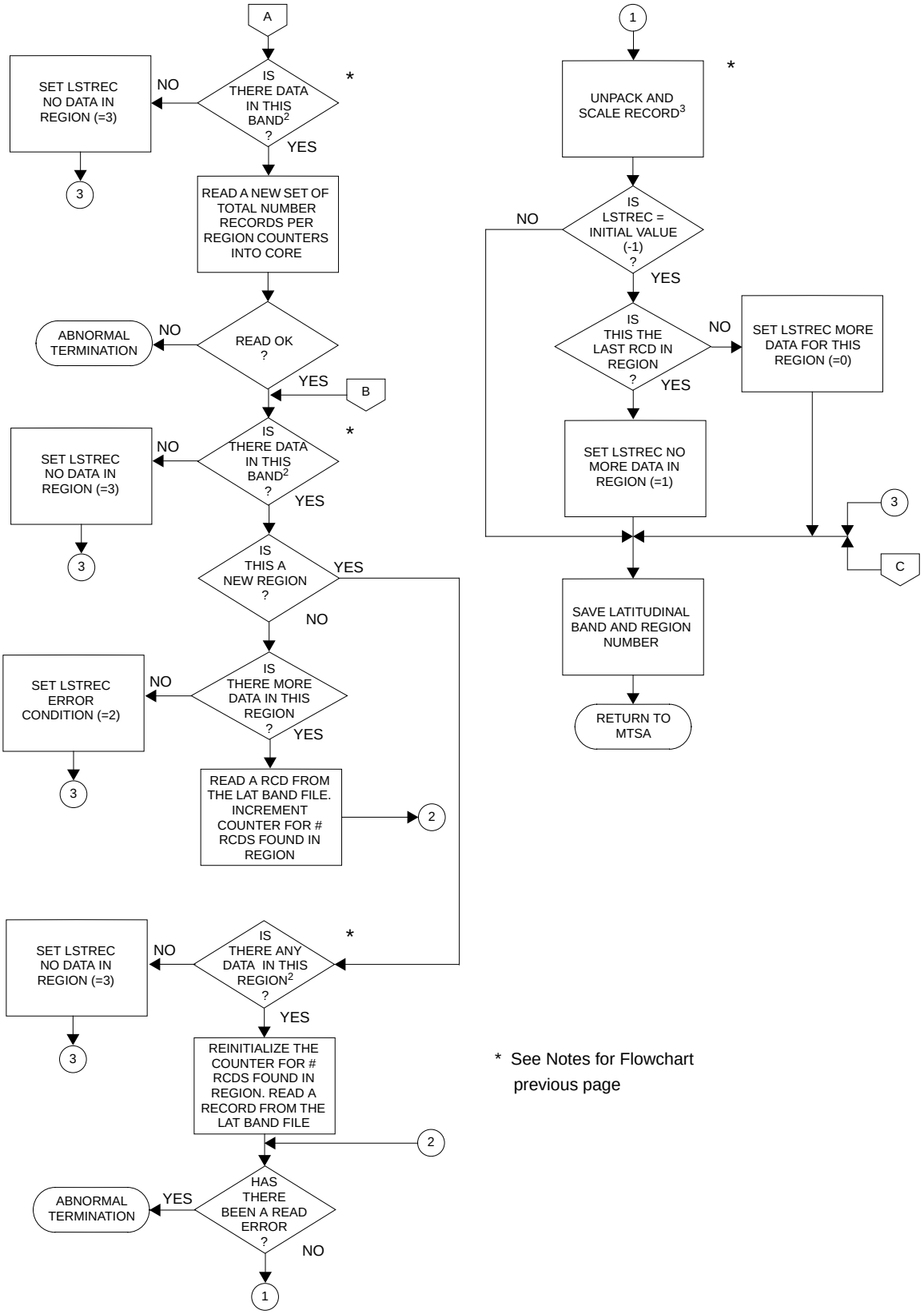
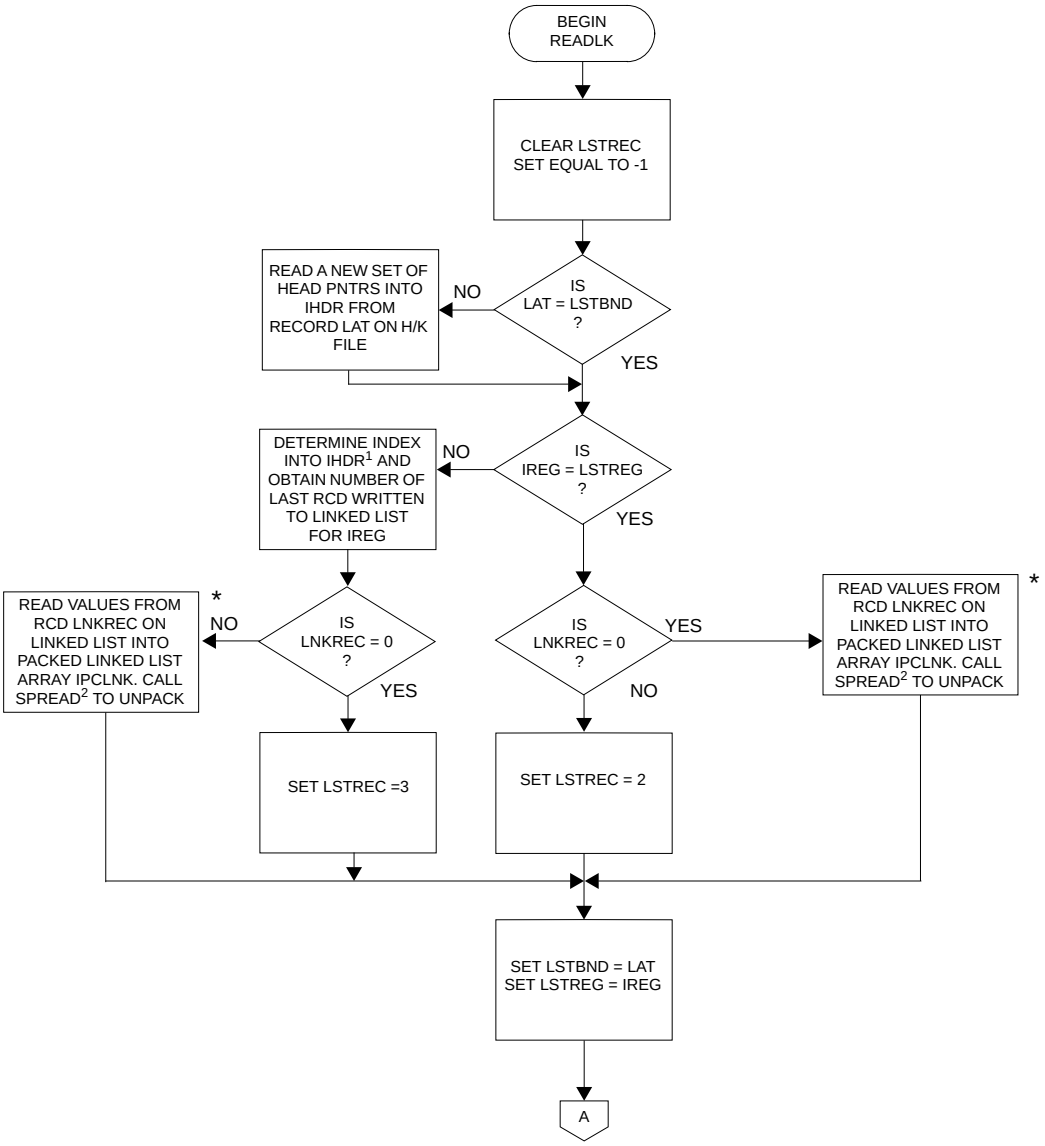


Figure 6.2-6. Data Retrieval for Scanner Processing (2 of 2)



* Notes for flowchart:

1. Equation to calculate index into IHDR for a particular region is:
   IHPTR = IREG - ((LAT -1) * NREG)
2. Parameters to pass to SPREAD are:
   IPCLNK - Packed linked list array
   IHOLD - Array to hold unpacked integer linked list record
   NBITS - Number of bits in packed array
   60 - Number of bits for unpacked array
   (LENPAC-1) - Number of words to be unpacked
   N - Parameter returned by SPREAD which indicates number of words that were unpacked
   After SPREAD is called, use SCALE to restore decimal places to values in linked list record and store in UPCLNK. The whole Julian Date in IHOLD(3) should be rescaled as follows:
   UPCLNK(3) = FLOAT(IHOLD(3) + 2.4 * 1.E06
   Remember to get the pointer to the next record from IPCLNK (LENPAC) and put it into UPCLNK (LENUPC + 1)
3. Pointer should be in UPCLNK (LENUPC) + 1.

Figure 6.2-7. Data Retrieval for Nonscanner Processing (1 of 2)

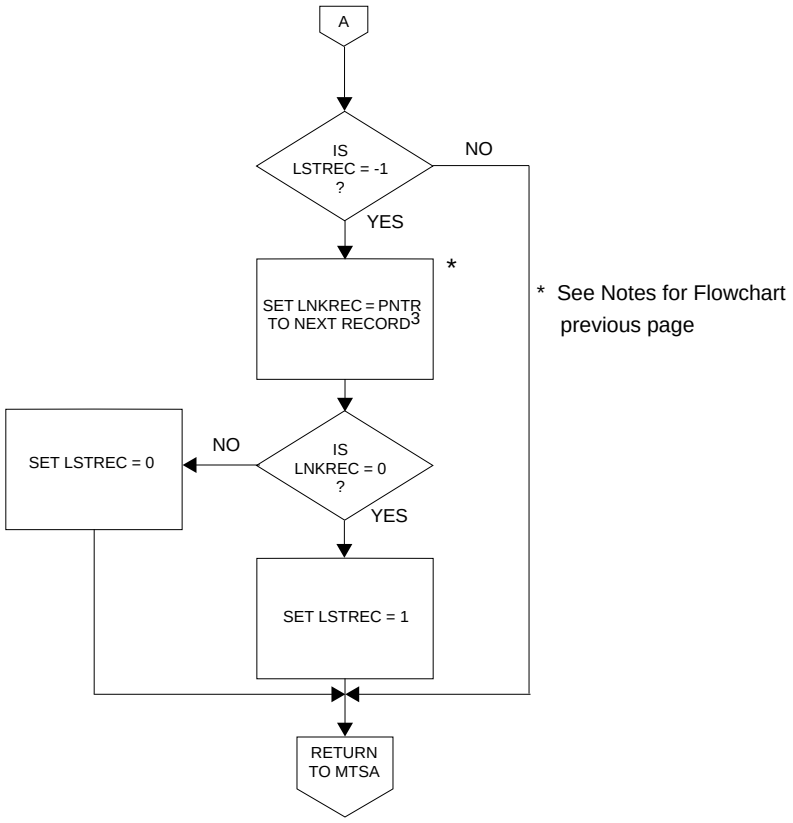


Figure 6.2-7. Data Retrieval for Nonscanner Processing (2 of 2)

in the month for which the data was taken. Module BRKOUT converts this number into an hour/day index which can be used to directly access a section of the MTSA data matrix.

SW Radiant Exitance. The initial calculation done is to extrapolate all SW radiant exitant values in the data record to the local solar half hour within the hour box (see Section 6.2.3.2). The extrapolation requires the albedos for each scene type being observed, the diurnal model for each scene type and the assumption of constant scene fractions (constant meteorology). With this knowledge the albedos and SW radiant exitance can be calculated at the local solar half hour using the discussion in Appendix A.

The model values for the conversion are linearly interpolated from tabulated values in Module DIMODT. The conversion itself is done in Module ADJUST. The scene albedos adjusted to the local solar half hour are computed using equation (1) for each scene type.

$$ADALB(I) = ALB(I) * DMODH(IND) / DIMDT(IND) \quad (41)$$

where

ALB is the scene albedo as input from the Inversion subsystem

I denotes the scene type

DMODH contains the modeled directional values at the local solar half hour for the latitude band

DIMDT contains the modeled directional values at the local solar half hour associated with the estimate

IND denotes the index into the SW normalized directional function table

These are combined using the scene fraction as a weighted factor (equation (2)).

$$SUMA = SUMA + ADALB(I) * SF(I) \quad (42)$$

where

SF represents the scene fraction

The SW radiant exitance adjusted to the local solar half hour of the local hour box is then computed.

$$ADSW = EODAY * CSZNH * SUMA \quad (43)$$

where

EODAY is the distance corrected solar constant for the day

CSZNH is the cosine of the solar zenith angle at the local solar hour as computed on a latitude band basis.

If the file being processed contains nonscanner data, there will be two sets of radiant exitant measurements representing the medium and wide field-of-view inversions. Rather than giving the albedos for each scene type, the nonscanner "albedo" vector is a normalized vector containing the relative contribution of each scene type to the total scene SW radiant exitance. Therefore, for each instrument, the albedo for scene type "i" is calculated by multiplying the SW radiant exitances, divided by the distance corrected solar constant multiplied by the cosine of the solar zenith angle for the measurement nonscanner times the "ith" component of the normalized nonscanner "albedo" vector (eq. 44).

$$ALBM(I) = ALB(I) * M_{SW} / (DEO * CSZNT) \quad (44)$$

where

I = scene type

ALRM = calculated albedo for measurement

ALB = albedo given in the data vector

M_{SW} = SW radiant exitance from the data vector

DEO = distance corrected solar constant for the day

CSZNT = cosine of the solar zenith angle at the time of the measurement (from the data vector)

These scene albedos are then the ones which are adjusted to the local solar half hour and used in the calculation of the adjusted SW radiant exitance.

LW Radiant Exitance. LW radiant exitance values are much less sensitive to the diurnal solar cycle and do not warrant adjustment to the local solar half hour; they are simply associated with the appropriate local hour. This association is done even for those regions which are later treated with the LW diurnal model (see Section 6.2.3.3).

Scanner Data. Module SCAN oversees the loading of scanner data into the MTSA data matrix. Due to the way local solar time is calculated in the Daily Data Base Subsystem it is possible to have an estimate erroneously placed into the hour before sunrise or after sunset. Corrections to the hour box indicator are made here. There should only be one measurement per hour box. In some circumstances, e.g., where processing for a region falls at the end of one day and the beginning of the next, there may be two entries for a given hour box. In this case, the estimate associated with the larger number of pixels is retained. There may also be more than one measurement for a given hour box when multiple satellite data is processed. Section 6.2.3.6 discusses the algorithms used to combine this type of data. A counter indicating how many hour boxes had data is incremented each time a new hour box is seen. The SW data is then adjusted to the local solar half hour and the data is placed into the MTSA matrix.

Nonscanner Data. Module FILENS oversees the loading of nonscanner data into the MTSA data matrix. Due to the way local solar time is calculated in the Daily Data Base it is possible to have an estimate erroneously placed into the hour before sunrise or after sunset. Corrections to the hour box indicator are made here. Where nonscanner measurements are involved, there may be more than one record of input data for a given hour box. This duplication is due to the rate at which inversions are done along the spacecraft ground track. The first step in loading the data into the MTSA data matrix is to calculate the MFOV and WFOV physical albedo values from the input normalized albedo value. The physical albedos are adjusted to the local solar half hour and are used to adjust the SW radiant exitance in Module ADJUST. Since the SW

extrapolations are done first, it assures that the SW averages (radiant exitance to the local solar half hour and albedo) are done at a uniform local time. Module ACCNS then accumulates all data for the multiple estimates. A continuously updated average is maintained for all values except the scene fraction vector. By continuously updated average we mean that an average is always maintained in the matrix for the measurement. This is done in Module RUNAVG by recovering the prior sum from the current average, adding in the new value, and then recomputing the average:

$$NEWAVG = (OLDAVG * (NREC - 1) + VALUE)/NREC \quad (45)$$

where

NEWAVG = the recomputed average

OLDAVG = the current average

VALUE = value to be added to average

NREC = number of values in the new average

The scene fractions are accumulated over the records and normalized for the hour box in Module FILENS. Standard deviations for the new estimates are calculated in Module STDDEV.

Multiple Satellites. When multiple satellite data is processed, the algorithms discussed in Section 6.2.3.6 are used to combine the data points. Section 6.2.3.7 discusses how these algorithms are implement.

6.2.5.5.3 Matrix Storage. At completion of the data retrieval cycle there is stored in memory a set of 31 x 24 matrices containing all the data available for the region. If this is single satellite processing and if the data being processed is the numerical filter or shape factor file, there is also a second set of matrices which contain the albedo, mean SW and LW radiant exitant values and their associated statistics for the wide field-of-view measurements. The numerical filter or shape factor file processing now divides into two phases due to memory storage considerations. Processing proceeds first on those matrices associated with the medium field-of-view.

Upon completion of the regional processing for this data the wide field-of-view data is processed.

At this point single satellite and multiple satellite processing converges. Any differences occurring in the processing is noted in Section 6.2.7. Even with multiple satellites, most hour boxes will be empty.

Module TRNSMS/TRANSM examines the matrices to determine whether there is data available for a given hour box. If there is data in the hour box it is scaled and transferred to consecutive locations of an output array. The information from the next hour box with data is transferred to the output array starting in the next available word. The output array becomes the variable length record (record 2) of the science output product (see Table 6.2-9 and Table 6.2-12). Care must be used to scale the data. If there is a fill value in the data to be transferred, applying a scale factor to it would result in garbage being transferred. All values which may contain a fill value are transferred to the output array using the Module ISCVAL. This module checks to see if the scale factor should be applied.

6.2.5.5.4 Daily and Monthly Hourly Averages. Once the information for a region has been extracted the daily and monthly hourly averages can be calculated. Module DYHRAS/DAYHRA drives the daily and monthly hourly averaging. It first calls Module AVINTS/AVINIT to initialize all the averaging arrays. The empty boxes in the radiant exitant matrices must then be filled. Module FLLINS/FILLIN drives this function. For SW radiant exitant matrix, the empty boxes are filled for only those days that have at least one real data point. For the LW radiant exitant matrix, all the empty boxes are filled. The empty boxes are filled by extrapolating from an observed box or interpolating between two observed boxes. A separate processing control vector (PCV), which indicates which of the methods to use, is defined for each of the matrices. These vectors are described in more detail in Section 6.2.5.5.4.1.

Module SWFILL determines which method is used to fill in the SW radiant exitant matrix. If an extrapolation is required, Module EXTRAS is called. The sum of the scene albedos projected from the known local solar hour to the empty local solar hour is calculated:

$$SUMAX = SUMAX + ALBEDO(IXS,IDAY,I) * SCFR(IXS,IDAY,I) * DIMDH(IHOUR,IDAY,IND) / DIMDH(IXS,IDAY,IND) \quad (46)$$

where

ALBEDO represents the array containing the albedo

SCFR represents the array containing the scene fraction

IXS represents the hour number with real data

IDAY is the day number

I represents the scene fraction (see Appendix A)

DIMDH represents the array containing the SW directional model table values

IHOUR is the hour to extrapolate to

IND is the index into the SW directional function table (see Appendix A)

Note that the scene fractions are used as weighting factors. Once this sum is computed, the SW exitance at the empty local solar hour can be calculated:

$$SW = EODAY * CSZNH * SUMAX \quad (47)$$

where

EODAY is the distance corrected solar constant for the day

CSZNH is the cosine of the solar zenith angle for the hour to extrapolate to

If an interpolation is required, Module INTERS is called. The SW radiant exitance for the empty local solar hour is extrapolated from each of the two known local solar hours. The SW radiant exitance at the empty local solar hour is then calculated as follows:

RADSW(IHOUR,IDAY) = ((FLOAT(IYS-IHOUR) * SWRADX) (48)

+ (FLOAT(IHOUR-IXS) * SWRADY))/FLOAT(IYS-IXS)

where

IXS is the previous hour index with real data

IYS is the next hour index with real data

SWRADX is the SW radiant exitance extrapolated from hour IXS

SWRADY is the SW radiant exitance extrapolated from hour IYS

Module LWFILL controls the filling in of the LW radiant exitance matrix. Extrapolation is simply extending the current hour data back to the beginning of the month or forward to the end of the month as a constant. Interpolation is done as follows:

RADLW(IHOUR,IDAY) = RELWX + ((RELWY - RELWX) * (49)

FLOAT(IHOUR-IXL)) / FLOAT(IYL-IXL)

where

RELWX is the LW radiant exitance estimate for the previous hour with real data

RELWY is the LW radiant exitance estimate for the next hour with real data

After the LW matrix is complete, Module LWMOD applies the LW model as discussed in Appendix B.

6.2.5.5.4.1 The Processing Control Vector. The concept of the processing control vector has been discussed in Sections 6.2.3.3 and 6.2.3.4. For further clarification, it is reiterated here. Module DEFPCV defines the initial PCV which contains 0's and 1's. Module REPCV redefines the 0's and 1's into the correct six-digit extrapolation/interpolation code.

The SW PCV. Although the PCV is defined for all the hours in a month, the SW radiant exitance can only be interpolated or extrapolated over the course of a day due to the strong diurnal variation associated with SW measurements. It is, therefore, convenient to think of the PCV as a series of 24-hour days stacked one behind the other. In the example of Section 6.2.3.3, the redefined PCV would be:

Hour # for the day

```
   1         6   7    8        11    12  13         19   20   21         24
007000,..,007000,1,007012,..,007012, 1,012020,...,012020,1,020000,...,020000
```

for any 24-hour period with data for hours 7, 12, and 20. This means that the data for the first six hours of the day are extrapolated from hour 7, hours 8-11 are interpolated using the observations from hours 7 and 12, hours 13-19 are interpolated using hours 12 and 20, and the last four hours are extrapolated from hour 20.

The LW PCV. Since there is usually no strong diurnal variation associated with LW measurements, the LW PCV can be thought of as one long “day” consisting of 744 hours (the number of hours in a 31 day month).

If the example of Section 6.2.3.3 is applied to the fifth day of the month, the redefined PCVV would be:

Hour # for 5th day

```
     1          6   7     8        11  12   13        19   20  21         24
..092103,...,092103,1,103108,...,103108,1,108116,...108116,1,116127,...116127
```

This example assumes data at hour 7, 12, and 20 for the fourth, fifth and sixth day of the month. Note that the 6-digit values in the PCV reflect the LW radiant exitance being treated as a very long “day.”

6.2.5.5.4.2 Averaging. The methods used for averaging the data are discussed in Section 6.2.3.7. Module AVGDLY averages daily values. Modules AMHSWS/AVMHSW and AMHLWS/AVMHLW average the monthly hourly SW and LW data,

respectively. Standard deviations are computed in Module STDDEV.

6.2.5.5.4.3 Correcting the Daily SW Average. Integrated solar incidence is computed in Module COSZEN using the following equation:

$$DSOL(IDAY) = 2.0 * (DEO(IDAY)/EROTRT) * (SUNHR * SD * SNLAT + SIN(SUNHR) * CD * CSLAT) \quad (50)$$

where

DEO(IDAY) is the distance corrected solar constant for the day

EROTRT is the rotational rate of the earth in radians/hour with the assumption of a fixed sun

SD is the sine of the solar declination angle

SNLAT is the sine of the latitude band

SIN stands for take the sine of

CD is the cosine of the solar declination angle

CSLAT is the cosine of the latitude band

SUNHR is dependent upon both the solar declination angle and the latitude and is calculated as follows:

$$CS = -SD * SNLAT / (CD * CSLAT) \quad (51)$$

If CS is less than or equal to -1.0, SUNHR is set to the value of PI. (The value of PI is taken from the global NAMELIST which is discussed in the utilities document.) If CS is greater than or equal to 1.0, then SUNHR is set to 0.0. For all other values of CS SUNHR is set to the arc cosine of CS.

The integrated solar incidence, DSOL, is one of the values which only needs to be calculated once per latitude band and is applied to daily SW radiant exitance and daily albedo in Module DSWABS/DSWALB.

6.2.5.5.5 Grand Monthly Averages. Monthly averages are calculated in Module CGMASC/CALGMA. Simple averages of the daily and monthly hourly averages are

calculated in Module SIMAVG and standard deviations are calculated in Module STDDEV.

6.2.5.5.6 Albedo and Net Calculations. Average albedo calculations are required on a daily, monthly hourly and grand monthly basis. Average daily albedos are computed by summing the "corrected" SW radiant exitance (see Section 6.2.3.7) and dividing the sum by the total integrated solar incidence for the day:

$$\text{ALBEDO}_{\text{DAY}} = \sum_{I=1}^{24} \text{“corrected” SW radiant exitance} \Big/ \sum_{I=1}^{24} \text{integrated solar incidence} \quad (52)$$

Average monthly hourly albedos are computed by this same method except the hourly SW radiant exitance and solar incidence (not the corrected values as used in (52)) are summed over each hour for all days with data for the month:

$$\text{ALBEDO}_{\text{HOUR}} = \sum_{\substack{\text{DAYS WITH} \\ \text{DATA}}} \text{SW radiant exitance} \Big/ \sum_{\substack{\text{DAYS WITH} \\ \text{DATA}}} \text{solar incidence} \quad (53)$$

The grand monthly average regional albedos are calculated by totaling all the SW radiant exitance values for the month and dividing this by the corresponding solar incidence value.

A further requirement for the T/S Averaging Subsystem is to calculate the monthly net radiation. The net radiation has been defined in two separate ways (see Section 6.2.3.7 and Equations 20 and 24):

$$\text{NET}_{\text{DAILY}} = ((1.0\text{-ALBEDO}_{\text{DAY}}) * \text{SOLAR INCIDENCE}_{\text{TOTAL DAILY INTEGRATED}} \quad (54)$$

$$\text{-(LW RADIANT EXITANCE}_{\text{TOTAL}} * \text{NHOURS)) /NHOURS * NDAYS}$$

$$\text{NET}_{\text{HOURLY}} = (1.0\text{-ALBEDO}_{\text{HOUR}}) * \text{SOLAR INCIDENCE}_{\text{DAYS WITH SW(NON-INTEGRATED)}} \quad (55)$$

$$\text{/NDAYS}_{\text{SW}} \text{ /NHOURS-(LWRE}_{\text{DAYS WITH LW}} \text{ /NDAYS}_{\text{LW}} \text{ /NHOURS)}$$

Module CDRANS/CADRAN performs both these functions.

6.2.5.5.7 Transfer of Average Data and Statistics for Output. The averaged regional data, their associated statistics, and some other pertinent information, i.e., region number and scene identification, are now transferred to consecutive locations of an array for later output to tape (Module TRNSRS/TRANSR) to save tape storage by decreasing the number of end-of-record marks written to the tape. Tables 6.2-8 and 6.2-9 show the scanner and nonscanner values, respectively, in the order of their transfer to the array which becomes the fixed length record of the science products described in Section 6.2.6.1.1. Table 6.2-10 contains the key which describes the symbols used in Tables 6.2-8 and 6.2-9. Values which may contain fill values are transferred using Module ISCVAL for the reason noted in Section 6.2.5.5.3.

Module TRNSS/TRANSS transfers data for the regional data base. Table 6.2-11 shows the values in order of their transfer to this array. The data is kept in 60-bit unscaled values as this data base is for internal use only.

6.2.5.6 Leaving the Subsystem. After all processing is complete Module CLSESF/CLOSEF is called. All input files and output files are closed as well as the files which contain summary and processing information. Information used to uniquely identify the product is gathered and Module PUTHED is called to write this information to the ERBE Header File.

6.2.6 OUTPUT FROM MONTHLY T/S AVERAGING - DETAILS

All output files, tape or disc, start with an abbreviated header record which contains the ERBE product key. This key is used to access the file header record which is stored on a separate header record disc file (see the Utilities Reference Manual).

6.2.6.1 Data Files. Two tape files are produced from scanner data input to the Subsystem. One tape file and one direct access disc file are produced from each type of nonscanner (numerical filter MFOV, numerical filter WFOV, shape factor MFOV, shape factor WFOV) data input to the Subsystem.

Table 6.2-8 Scanner Output Product (S-9) (1 of 2)

TEMPORAL SCALE	STATISTICS/PARAMETERS	OUTPUT STRUCTURE	
		NO. OF WORDS	RECORD
	Region number, Geographic scene type, Scene fraction histogram(4)	6	1
Monthly (Day)	$\bar{M}_{SW}$, $M_{MIN_{SW}}$, $M_{MAX_{SW}}$, σ_{SW}, N_{SW}, $\bar{M}_{LW}$, $M_{MIN_{LW}}$, $M_{MAX_{LW}}$, σ_{LW}, N_{LW}, $\overline{ALB}$, $\overline{NET}$, TSOLRD(2), $\bar{M}_{SW_{CS}}$, $M_{MIN_{SW_{CS}}}$, $M_{MAX_{SW_{CS}}}$, $\sigma_{SW_{CS}}$, $N_{SW_{CS}}$, $\bar{M}_{LW_{CS}}$, $M_{MIN_{LW_{CS}}}$, $M_{MAX_{LW_{CS}}}$, $\sigma_{LW_{CS}}$, $N_{LW_{CS}}$, $\overline{ALB}_{CS}$, $\overline{NET}_{CS}$, $TSOLRD_{CS}(2)$	28 x 1	
Monthly (Hour)	$\bar{M}_{SW}$, $M_{MIN_{SW}}$, $M_{MAX_{SW}}$, σ_{SW}, N_{SW}, $\bar{M}_{LW}$, $M_{MIN_{LW}}$, $M_{MAX_{LW}}$, σ_{LW}, N_{LW}, $\overline{ALB}$, $\overline{NET}$, TSOLRH(2), $\bar{M}_{SW_{CS}}$, $M_{MIN_{SW_{CS}}}$, $M_{MAX_{SW_{CS}}}$, $\sigma_{SW_{CS}}$, $N_{SW_{CS}}$, $\bar{M}_{LW_{CS}}$, $M_{MIN_{LW_{CS}}}$, $M_{MAX_{LW_{CS}}}$, $\sigma_{LW_{CS}}$, $N_{LW_{CS}}$, $\overline{ALB}_{CS}$, $\overline{NET}_{CS}$, $TSOLRH_{CS}(2)$	28 x 1	
Daily	DEO, $\bar{M}_{SW}$, $M_{MIN_{SW}}$, $M_{MAX_{SW}}$, σ_{SW}, N_{SW}, $\bar{M}_{LW}$, $M_{MIN_{LW}}$, $M_{MAX_{LW}}$, σ_{LW}, N_{LW}, $\overline{ALB}$, SOLARD(2), $\bar{M}_{SW_{CS}}$, $M_{MIN_{SW_{CS}}}$, $M_{MAX_{SW_{CS}}}$, $\sigma_{SW_{CS}}$, $N_{SW_{CS}}$, $\bar{M}_{LW_{CS}}$, $M_{MIN_{LW_{CS}}}$, $M_{MAX_{LW_{CS}}}$, $\sigma_{LW_{CS}}$, $N_{LW_{CS}}$, $\overline{ALB}_{CS}$	25 x 31	

Note: The key to the symbols is found in Table 6.2-10

Table 6.2-8 Scanner Output Product (S-9) (2 of 2)

TEMPORAL SCALE	STATISTICS/PARAMETERS	OUTPUT STRUCTURE	
		NO. OF WORDS	RECORD
Monthly Hourly	$\bar{M}_{SW}$, $M_{MIN_{SW}}$, $M_{MAX_{SW}}$, σ_{SW}, N_{SW}, $SUM_{SW}(2)$, $SUM2_{SW}(2)$, $\bar{M}_{LW}$, $M_{MIN_{LW}}$, $M_{MAX_{LW}}$, σ_{LW}, N_{LW}, $SUM_{LW}(2)$, $SUM2_{LW}(2)$, $\overline{ALB}$, $SOLARH(2)$, $\bar{M}_{SW_{CS}}$, $M_{MIN_{SW_{CS}}}$, $M_{MAX_{SW_{CS}}}$, $\sigma_{SW_{CS}}$, $N_{SW_{CS}}$, $SUM_{SW_{CS}}(2)$, $SUM2_{SW_{CS}}(2)$, $\bar{M}_{LW_{CS}}$, $M_{MIN_{LW_{CS}}}$, $M_{MAX_{LW_{CS}}}$, $\sigma_{LW_{CS}}$, $N_{LW_{CS}}$, $SUM_{LW_{CS}}(2)$, $SUM2_{LW_{CS}}(2)$, $\overline{ALB}_{CS}$, $SOLARH_{CS}(2)$	42 x 24	1 (cont.)
Monthly	$N_{HR\text{-}DAY}$	1	
Hourly/ day	Hour box, Whole Julian Date(2), Fractional Julian Date, Scene fracion(4), ALB(4) $COS(ZEN)_{SUN}$, Satellite zenith angle Azimuth angle, SOLAR, $\bar{M}_{SW}$, $M_{MIN_{SW}}$, $M_{MAX_{SW}}$, σ_{SW}, N_{SW}, $\bar{M}_{LW}$, $M_{MIN_{LW}}$, $M_{MAX_{LW}}$, σ_{LW}, N_{LW}, $\bar{M}_{DIFF_{SW}}$, $\bar{M}_{DIFF_{LW}}$, $\sigma_{ALB_{CS}}$, $\bar{M}_{LW_{CS}}$, $\sigma_{LW_{CS}}$, $N_{LW_{CS}}$	32 x $N_{HR\text{-}DAY}$	2

Table 6.2-9 Nonscanner Output Product (S-10)

TEMPORAL SCALE	STATISTICS/PARAMETERS	OUTPUT STRUCTURE	
		NO. OF WORDS	RECORD
	Region number, Geographic scene type, Scene fraction histogram(9)	11	1
Monthly (Day)	$\bar{M}_{SW}$, $M_{MIN_{SW}}$, $M_{MAX_{SW}}$, σ_{SW}, N_{SW}, $\bar{M}_{LW}$, $M_{MIN_{LW}}$, $M_{MAX_{LW}}$, σ_{LW}, N_{LW}, $\overline{ALB}$, $\overline{NET}$, TSOLRD(2)	28 x 1	
Monthly (Hour)	$\bar{M}_{SW}$, $M_{MIN_{SW}}$, $M_{MAX_{SW}}$, σ_{SW}, N_{SW}, $\bar{M}_{LW}$, $M_{MIN_{LW}}$, $M_{MAX_{LW}}$, σ_{LW}, N_{LW}, $\overline{ALB}$, $\overline{NET}$, TSOLRH(2)		
Daily	DEO, $\bar{M}_{SW}$, $M_{MIN_{SW}}$, $M_{MAX_{SW}}$, σ_{SW}, N_{SW}, $\bar{M}_{LW}$, $M_{MIN_{LW}}$, $M_{MAX_{LW}}$, σ_{LW}, N_{LW}, $\overline{ALB}$, SOLARD(2)	14 x 31	
Monthly Hourly	$\bar{M}_{SW}$, $M_{MIN_{SW}}$, $M_{MAX_{SW}}$, σ_{SW}, N_{SW}, $SUM_{SW}(2)$, $SUM2_{SW}(2)$, $\bar{M}_{LW}$, $M_{MIN_{LW}}$, $M_{MAX_{LW}}$, σ_{LW}, N_{LW}, $SUM_{LW}(2)$, $SUM2_{LW}(2)$, $\overline{ALB}$, SOLARH(2)	21 x 24	
Monthly	$N_{HR\text{-}DAY}$	1	
Hourly/ Day	Hour box, Whole Julian Date(2), Fractional Julian Date, Scene fracion(9), ALR(9) $COS(ZEN)_{SUN}$, Satellite zenith angle Azimuth angle, SOLAR, $\bar{M}_{SW}$, $M_{MIN_{SW}}$, $M_{MAX_{SW}}$, σ_{SW}, N_{SW}, $\bar{M}_{LW}$, $M_{MIN_{LW}}$, $M_{MAX_{LW}}$, σ_{LW}, N_{LW}, $M_{DIFF_{SW}}$, $M_{DIFF_{LW}}$	38 x $N_{HR\text{-}DAY}$	2

Note: The key to the symbols is found in Table 6.2-10

Table 6.2-10 Key to the Science Output Tape Products (S-9, S-10)

DEFINITION OF SYMBOLS	
TERM	DEFINITION
σ	Standard deviation of
$\overline{ALB}$	Mean albedo
CS	Clear sky
DAYS	Days
DEO	Distance corrected solar constant
DIFF	Maximum absolute difference of
HR-DAY	Hour-day bins
HRS	Hours
LW	Longwave
M	Measurement of
$\overline{M}$	Mean value of
MAX	Maximum
MIN	Minimum
N	Number of
$\overline{NET}$	Mean net
SOLAR	Solar incidence for an hour
SOLARD	Daily integrated solar incidence over a day
SOLARH	Non-integrated solar incidence over those days with SW data for a given hour
SUM	Sum
SUM2	Sum of the squares
SUN	Sun
SW	Shortwave
TSOLRD	Total of daily integrated solar incidence for the month for days with SW data
TSOLRH	Total non-integrated solar incidence over those days with SW data for hour of a day, then summed up over 24 hours
ZEN	Zenith angle

Table 6.2-11 Regional Average Data Base

TEMPORAL SCALE	STATISTICS/PARAMETERS	OUTPUT STRUCTURE	
		NO. OF WORDS	RECORD
	REGION NUMBER	1	1
	GEOTYPE	1	
Monthly (Day)	M_{LW}, M_{SW}, M_{NET}, TSOLRD, $M_{LW_{CS}}$, $M_{SW_{CS}}$, $M_{NET_{CS}}$, $TSOLRD_{CS}$	16 x 1	
Monthly (Hour)	M_{LW}, M_{SW}, M_{NET}, TSOLRH, $M_{LW_{CS}}$, $M_{SW_{CS}}$, $M_{NET_{CS}}$, $TSOLRH_{CS}$		
Daily	M_{LW}, ND_{LW}, M_{SW}, ND_{SW}, SOLARD $M_{LW_{CS}}$, $ND_{LW_{CS}}$, $M_{SW_{CS}}$, $ND_{SW_{CS}}$	9 x 31	
Monthly Hourly	M_{LW}, NH_{LW}, M_{SW}, NH_{SW}, SOLARH $M_{LW_{CS}}$, $NH_{LW_{CS}}$, $M_{SW_{CS}}$, $NH_{SW_{CS}}$ $SOLARH_{CS}$	10 x 24	

Keys to Above Table:

CS - Clear sky
GEOTYPE - Geographic scene type in scanner. Cloud fraction in nonscanner
LW - Longwave
M - Mean value of radiant exitance
ND - Number of hours that contain real data for a given day
NET - Net radiant exitance
NH - Number of days that contain real data for a given hour
SOLARD - Daily integrated solar incidence over a day
SOLARH - Nonintegrated solar incidence over those days with SW data for a given hour
SW - Shortwave
TSOLRD - Total of daily integrated solar incidence for the month for days with SW data
TSOLRH - Total nonintegrated solar incidence over those days with SW data for each hour of a day, then summed up over 24 hours

6.2.6.1.1 Science Tape File. One tape output is the science (scanner (S-9 or nonscanner (S-10)) output product shown in Tables 6.2-8 and 6.2-9. The key to the symbols used in these tables is found in Table 6.2-10. There are two preliminary records on this tape. The first of these records is a header record. The contents of this record are described in the Utilities Reference Manual (see Reference 1). The second record contains the scale factors used to pack the data. The scale factors have been applied to the data in the following manner:

$$IAVMON(1) = NINT(VALUE * SCALE) \quad (56)$$

where

IAVMON(I) = the next available location in the output array

VALUE = parameter being transferred

SCALE = scale value for the parameter

NINT = intrinsic FORTRAN nearest integer function

Default scale factors used in packing the data are found in Table 6.2-12 for scanner data and Table 6.2-13 for nonscanner data. The output product consists of two records for each region processed. The first record is of fixed length and contains the values described in Section 6.2.5.5.7. The second record is of variable length and contains the "actual" hour box matrix information accumulated in the output array described in Section 6.2.5.5.3. Module RITESC/RITEAG writes the tape in binary format with each data value in a record being represented by a 16-bit integer value on the tape. The tape is written at a density of 1600 bpi. The internal 60-bit floating point values in the output are converted to 16-bit integers values by using the above mentioned set of scale factors. These 16-bit integers are packed into consecutive bit locations in an array of 60-bit words for output to the tape by Module SPREAD. Module IWORDS determines how many words are needed to form an even 16-bit/60-bit word boundary. The "worst case" number of reels output for each grid resolution processed is shown in Tables 6.2-14 and 6.2-15. Note that due to the limits imposed by the use of 16-bit values special handling must be used to pack the total solar incidence monthly hourly average sum, total solar incidence monthly hourly average sum of the squares values, and the whole Julian Date.

Table 6.2-12 Scale Factors for Scanner Output Tape (S-9) (1 of 5)

TEMPORAL SCALE	PARAMETER NAME	SCALE FACTOR	
		NAME	VALUE
	Region number	SCALE1(1)	1
	Geographic scene type	SCALE1(2)	100
	Scene fraction histogram(4)	SCALE1(3)	100
Monthly (day)	$\bar{M}_{SW}$	SCALE1(4)	10
	$M_{MIN_{SW}}$	SCALE1(5)	10
	$M_{MAX_{SW}}$	SCALE1(6)	10
	σ_{SW}	SCALE1(7)	100
	N_{SW}	SCALE1(8)	1
	$\bar{M}_{LW}$	SCALE1(9)	10
	$M_{MIN_{LW}}$	SCALE1(10)	10
	$M_{MAX_{LW}}$	SCALE1(11)	10
	σ_{LW}	SCALE1(12)	100
	N_{LW}	SCALE1(13)	1
	$\overline{ALB}$	SCALE1(14)	10000
	$\overline{NET}$	SCALE1(15)	100
	TSOLRD(1)	SCALE1(16)	1
	TSOLRD(2)	SCALE1(17)	10
	$\bar{M}_{SW_{CS}}$	SCALE1(4)	10
	$\bar{M}_{MIN_{CS}}$	SCALE1(5)	10
	$M_{MAX_{SW_{CS}}}$	SCALE1(6)	10
	$\sigma_{SW_{CS}}$	SCALE1(7)	100
	$N_{SW_{CS}}$	SCALE1(8)	1
	$\bar{M}_{LW_{CS}}$	SCALE1(9)	10
	$M_{MIN_{LW_{CS}}}$	SCALE1(10)	10
	$M_{MAX_{LW_{CS}}}$	SCALE1(11)	10
	$\sigma_{LW_{CS}}$	SCALE1(12)	100
	$N_{LW_{CS}}$	SCALE1(13)	1
	$\overline{ALB}_{CS}$	SCALE1(14)	10000
	$\overline{NET}_{CS}$	SCALE1(15)	100
	$TSOLRD_{CS}(1)$	SCALE1(16)	1
	$TSOLRD_{CS}(2)$	SCALE1(17)	10

Table 6.2-12 Scale Factors for Scanner Output Tape (S-9) (2 of 5)

TEMPORAL SCALE	PARAMETER NAME	SCALE FACTOR	
		NAME	VALUE
Monthly (hour)	$\bar{M}_{SW}$	SCALE1(18)	10
	$M_{MIN_{SW}}$	SCALE1(19)	10
	$M_{MAX_{SW}}$	SCALE1(20)	10
	σ_{SW}	SCALE1(21)	100
	N_{SW}	SCALE1(22)	1
	$\bar{M}_{LW}$	SCALE1(23)	10
	$M_{MIN_{LW}}$	SCALE1(24)	10
	$M_{MAX_{LW}}$	SCALE1(25)	10
	σ_{LW}	SCALE1(26)	100
	N_{LW}	SCALE1(27)	1
	$\overline{ALB}$	SCALE1(28)	10000
	$\overline{NET}$	SCALE1(29)	100
	TSOLRH(1)	SCALE1(30)	1
	TSOLRH(2)	SCALE1(31)	10
	$\bar{M}_{SW_{CS}}$	SCALE1(18)	10
	$M_{MIN_{SW_{CS}}}$	SCALE1(19)	10
	$M_{MAX_{SW_{CS}}}$	SCALE1(20)	10
	$\sigma_{SW_{CS}}$	SCALE1(21)	100
	$N_{SW_{CS}}$	SCALE1(22)	1
	$\bar{M}_{LW_{CS}}$	SCALE1(23)	10
	$M_{MIN_{LW_{CS}}}$	SCALE1(24)	10
	$M_{MAX_{LW_{CS}}}$	SCALE1(25)	10
	$\sigma_{LW_{CS}}$	SCALE1(26)	100
	$N_{LW_{CS}}$	SCALE1(27)	1
	$\overline{ALB}_{CS}$	SCALE1(28)	10000
	$\overline{NET}_{CS}$	SCALE1(29)	100
	$TSOLRH_{CS}(1)$	SCALE1(30)	1
	$TSOLRH_{CS}(2)$	SCALE1(31)	10

Table 6.2-12 Scale Factors for Scanner Output Tape (S-9) (3 of 5)

TEMPORAL SCALE	PARAMETER NAME	SCALE FACTOR	
		NAME	VALUE
Daily	DEO	SCALE1(32)	10
	$\bar{M}_{SW}$	SCALE1(33)	10
	$M_{MIN_{SW}}$	SCALE1(34)	10
	$M_{MAX_{SW}}$	SCALE1(35)	10
	σ_{SW}	SCALE1(36)	100
	N_{SW}	SCALE1(37)	1
	$\bar{M}_{LW}$	SCALE1(38)	10
	$M_{MIN_{LW}}$	SCALE1(39)	10
	$M_{MAX_{LW}}$	SCALE1(40)	10
	σ_{LW}	SCALE1(41)	100
	N_{LW}	SCALE1(42)	1
	$\overline{ALB}$	SCALE1(43)	10000
	SOLARD(1)	SCALE1(44)	1
	SOLARD(2)	SCALE1(45)	10
	$\bar{M}_{SW_{CS}}$	SCALE1(33)	10
	$M_{MIN_{SW_{CS}}}$	SCALE1(34)	10
	$M_{MAX_{SW_{CS}}}$	SCALE1(35)	10
	$\sigma_{SW_{CS}}$	SCALE1(36)	100
	$N_{SW_{CS}}$	SCALE1(37)	1
	$\bar{M}_{LW_{CS}}$	SCALE1(38)	10
	$M_{MIN_{LW_{CS}}}$	SCALE1(39)	10
	$M_{MAX_{LW_{CS}}}$	SCALE1(40)	10
	$\sigma_{LW_{CS}}$	SCALE1(41)	100
	$N_{LW_{CS}}$	SCALE1(42)	1
	$\overline{ALB}_{CS}$	SCALE1(43)	10000

Table 6.2-12 Scale Factors for Scanner Output Tape (S-9) (4 of 5)

TEMPORAL SCALE	PARAMETER NAME	SCALE FACTOR	
		NAME	VALUE
Monthly (hourly)	$\bar{M}_{SW}$	SCALE1(46)	10
	$M_{MIN_{SW}}$	SCALE1(47)	10
	$M_{MAX_{SW}}$	SCALE1(48)	10
	σ_{SW}	SCALE1(49)	100
	N_{SW}	SCALE1(50)	1
	$SUM_{SW}(1)$	SCALE1(51)	1
	$SUM_{SW}(2)$	SCALE1(52)	10
	$SUM2_{SW}(1)$	SCALE1(53)	1
	$SUM2_{SW}(2)$	SCALE1(54)	10
	$\bar{M}_{LW}$	SCALE1(55)	10
	$M_{MIN_{LW}}$	SCALE1(56)	10
	$M_{MAX_{LW}}$	SCALE1(57)	10
	σ_{LW}	SCALE1(58)	100
	N_{LW}	SCALE1(59)	1
	$SUM_{LW}(1)$	SCALE1(60)	1
	$SUM_{LW}(2)$	SCALE1(61)	10
	$SUM2_{LW}(1)$	SCALE1(62)	1
	$SUM2_{LW}(2)$	SCALE1(63)	10
	$\overline{ALB}$	SCALE1(64)	10000
	SOLARH(1)	SCALE1(65)	1
	SOLARH(2)	SCALE1(66)	10
	$\bar{M}_{SW_{CS}}$	SCALE1(46)	10
	$M_{MIN_{SW_{CS}}}$	SCALE1(47)	10
	$M_{MAX_{SW_{CS}}}$	SCALE1(48)	10
	$\sigma_{SW_{CS}}$	SCALE1(49)	100
	$N_{SW_{CS}}$	SCALE1(50)	1
	$SUM_{SW_{CS}}(1)$	SCALE1(51)	1
	$SUM_{SW_{CS}}(2)$	SCALE1(52)	10
	$SUM2_{SW_{CS}}(1)$	SCALE1(53)	1
	$SUM2_{SW_{CS}}(2)$	SCALE1(54)	10
	$\bar{M}_{LW_{CS}}$	SCALE1(55)	10
	$M_{MIN_{LW_{CS}}}$	SCALE1(56)	10
	$M_{MAX_{LW_{CS}}}$	SCALE1(57)	10
	$\sigma_{LW_{CS}}$	SCALE1(58)	100
	$N_{LW_{CS}}$	SCALE1(59)	1
	$SUM_{LW_{CS}}(1)$	SCALE1(60)	1
	$SUM_{LW_{CS}}(2)$	SCALE1(61)	10
	$SUM2_{LW_{CS}}(1)$	SCALE1(62)	1
	$SUM2_{LW_{CS}}(2)$	SCALE1(63)	10
	$\overline{ALB}_{CS}$	SCALE1(64)	10000
	$SOLARH_{CS}(2)$	SCALE1(65)	1
	$SOLARH_{CS}(2)$	SCALE1(66)	10

Table 6.2-12 Scale Factors for Scanner Output Tape (S-9) (5 of 5)

TEMPORAL SCALE	PARAMETER NAME	SCALE FACTOR	
		NAME	VALUE
Monthly	$N_{HR\text{-}DAY}$	SCALE1(67)	1
Hourly/ day	Hour box	SCALE2(1)	1
	Whole Julian Date(1)	SCALE2(2)	1
	Whole Julian Date(2)	SCALE2(3)	1
	Fractional Julian Date	SCALE2(4)	10000
	Scene fraction(4)	SCALE2(5)	10000
	ALB(4)	SCALE2(6)	10000
	$COS(ZEN)_{SUN}$	SCALE2(7)	10000
	Satellite zenith angle	SCALE2(8)	100
	Azimuth angle	SCALE2(9)	100
	SOLAR	SCALE2(10)	10
	$\bar{M}_{SW}$	SCALE2(11)	10
	$M_{MIN_{SW}}$	SCALE2(12)	10
	$M_{MAX_{SW}}$	SCALE2(13)	10
	σ_{SW}	SCALE2(14)	100
	N_{SW}	SCALE2(15)	1
	$\bar{M}_{LW}$	SCALE2(16)	10
	$M_{MIN_{LW}}$	SCALE2(17)	10
	$M_{MAX_{LW}}$	SCALE2(18)	10
	σ_{LW}	SCALE2(19)	10
	N_{LW}	SCALE2(20)	1
	$M_{DIFF_{SW}}$	SCALE2(21)	100
	$M_{DIFF_{LW}}$	SCALE2(22)	100
	$\sigma_{ALB_{CS}}$	SCALE2(23)	10000
	$\bar{M}_{LW_{CS}}$	SCALE2(24)	10
	$\sigma_{LW_{CS}}$	SCALE2(25)	100
	$N_{LW_{CS}}$	SCALE2(26)	1

Table 6.2-13 Scale Factors for Nonscanner Output Tape (S-10) (1 of 3)

TEMPORAL SCALE	PARAMETER NAME	SCALE FACTOR	
		NAME	VALUE
	Region number	SCALE1(1)	1
	Geographic scene type	SCALE1(2)	100
	Scene fraction histogram(9)	SCALE1(3)	100
Monthly (day)	$\bar{M}_{SW}$	SCALE1(4)	10
	$M_{MIN_{SW}}$	SCALE1(5)	10
	$M_{MAX_{SW}}$	SCALE1(6)	10
	σ_{SW}	SCALE1(7)	100
	N_{SW}	SCALE1(8)	1
	$\bar{M}_{LW}$	SCALE1(9)	10
	$M_{MIN_{LW}}$	SCALE1(10)	10
	$M_{MAX_{LW}}$	SCALE1(11)	10
	σ_{SW}	SCALE1(12)	100
	N_{SW}	SCALE1(13)	1
	$\overline{ALB}$	SCALE1(14)	10000
	$\overline{NET}$	SCALE1(15)	100
	TSOLRD(1)	SCALE1(16)	1
	TSOLRD(2)	SCALE1(17)	10
Monthly (hour)	$\bar{M}_{SW}$	SCALE1(18)	10
	$M_{MIN_{SW}}$	SCALE1(19)	10
	$M_{MAX_{SW}}$	SCALE1(20)	10
	σ_{SW}	SCALE1(21)	100
	N_{SW}	SCALE1(22)	1
	$\bar{M}_{LW}$	SCALE1(23)	10
	$M_{MIN_{LW}}$	SCALE1(24)	10
	$M_{MAX_{LW}}$	SCALE1(25)	10
	σ_{SW}	SCALE1(26)	100
	N_{SW}	SCALE1(27)	1
	$\overline{ALB}$	SCALE1(28)	10000
	$\overline{NET}$	SCALE1(29)	100
	TSOLRH(1)	SCALE1(30)	1
	TSOLRH(2)	SCALE1(31)	10

Table 6.2-13 Scale Factors for Nonscanner Output Tape (S-10) (2 of 3)

TEMPORAL SCALE	PARAMETER NAME	SCALE FACTOR	
		NAME	VALUE
Daily	DEO	SCALE1(32)	10
	$\bar{M}_{SW}$	SCALE1(33)	10
	$M_{MIN_{SW}}$	SCALE1(34)	10
	$M_{MAX_{SW}}$	SCALE1(35)	10
	σ_{SW}	SCALE1(36)	100
	N_{SW}	SCALE1(37)	1
	$\bar{M}_{LW}$	SCALE1(38)	10
	$M_{MIN_{LW}}$	SCALE1(39)	10
	$M_{MAX_{LW}}$	SCALE1(40)	10
	σ_{LW}	SCALE1(41)	100
	N_{LW}	SCALE1(42)	1
	$\overline{ALB}$	SCALE1(43)	10000
	SOLARD(1)	SCALE1(44)	1
	SOLARD(2)	SCALE1(45)	10
Monthly Hourly	$\bar{M}_{SW}$	SCALE1(46)	10
	$M_{MIN_{SW}}$	SCALE1(47)	10
	$M_{MAX_{SW}}$	SCALE1(48)	10
	σ_{SW}	SCALE1(49)	100
	N_{SW}	SCALE1(50)	1
	$SUM_{SW}(1)$	SCALE1(51)	1
	$SUM_{SW}(2)$	SCALE1(52)	10
	$SUM2_{SW}(1)$	SCALE1(53)	1
	$SUM2_{SW}(2)$	SCALE1(54)	10
	$\bar{M}_{LW}$	SCALE1(55)	10
	$M_{MIN_{LW}}$	SCALE1(56)	10
	$M_{MAX_{LW}}$	SCALE1(57)	10
	σ_{LW}	SCALE1(58)	100
	N_{LW}	SCALE1(59)	1
	$SUM_{LW}(1)$	SCALE1(60)	1
	$SUM_{LW}(2)$	SCALE1(61)	10
	$SUM2_{LW}(1)$	SCALE1(62)	1
	$SUM2_{LW}(2)$	SCALE1(63)	10
	$\overline{ALB}$	SCALE1(64)	10000
	SOLARH(1)	SCALE1(65)	1
	SOLARH(2)	SCALE1(66)	10

Table 6.2-13 Scale Factors for Nonscanner Output Tape (S-10) (3 of 3)

TEMPORAL SCALE	PARAMETER NAME	SCALE FACTOR	
		NAME	VALUE
Monthly	$N_{HR\text{-}DAY}$	SCALE1(67)	1
Hourly/ Day	Hour box	SCALE2(1)	1
	Whole Julian Date(1)	SCALE2(2)	1
	Whole Julian Date(2)	SCALE2(3)	1
	Fractional Julian Date	SCALE2(4)	10000
	Scene fraction(9)	SCALE2(5)	10000
	ALB(9)	SCALE2(6)	10000
	$COS(ZEN)_{SUN}$	SCALE2(7)	10000
	Satellite zenith angle	SCALE2(8)	100
	Azimuth angle	SCALE2(9)	100
	SOLAR	SCALE2(10)	10
	$\bar{M}_{SW}$	SCALE2(11)	10
	$M_{MIN_{SW}}$	SCALE2(12)	10
	$M_{MAX_{SW}}$	SCALE2(13)	10
	σ_{SW}	SCALE2(14)	100
	N_{SW}	SCALE2(15)	1
	$\bar{M}_{LW}$	SCALE2(16)	10
	$M_{MIN_{LW}}$	SCALE2(17)	10
	$M_{MAX_{LW}}$	SCALE2(18)	10
	σ_{LW}	SCALE2(19)	10
	N_{LW}	SCALE2(20)	1
	$M_{DIFF_{SW}}$	SCALE2(21)	100
	$M_{DIFF_{LW}}$	SCALE2(22)	100

Table 6.2-14 Sizing of the Single Satellite Scanner Science Output Product (S-9)

PER REGION:

Number of words in fixed length record = 1846 words

Number of bits output = 1846 words x 16 bits = 29536 bits

Number of inches output = (29536 bits/8 tracks/1600 bpi) + .6 in. per record gap = 2.91 inches

Expected number of hour boxes with data = 124

Number of words in the variable length record = 124 x 32 words = 3968 words

Number of bits output = 3968 words x 16 bits = 63488 bits

Number of inches output = (63488 bits/8 tracks/1600 bpi) + .6 in. per record gap = 5.56 inches

Total number of inches output = 2.91 in. + 5.56 in. = 8.47 in.

Total number of feet output = 8.47 in/12 = .71 ft.

PER RESOLUTION:

2.5° grid = .71 feet/region x 10368 regions = 7361.28 ft.

Number of feet/tape = 2200 feet

Number of reels for 2.5° grid = 7361.28 ft./2200 ft. = 3.35 reels

Table 6.2-15 Sizing of the Single Satellite Nonscanner Science Output Product (S-10)

PER REGION:

Number of words in fixed length record = 978 words

Number of bits output = 978 words x 16 bits = 15648 bits

Number of inches output = (15648 bits/8 tracks/1600 bpi) + .6 in. per record gap = 1.8225 inches

Expected number of hour boxes with data = 124

Number of words in the variable length record = 124 x 38 words = 4712 words

Number of bits output = 4712 words x 16 bits = 75392 bits

Number of inches output = (75392 bits/8 tracks/1600 bpi) + .6 in. per record gap = 6.49 inches

Total number of inches output = 1.8225 in. + 6.49 in. = 8.3125 in.

Total number of feet output = 8.3125 in/12 = .69 ft.

PER RESOLUTION:

5.0° grid = .69 feet/region x 2592 regions = 1788.48 ft.

10.0° grid = .69 feet/region x 648 regions = 447.12 ft.

Number of feet/tape = 2200 feet

Number of reels for 5.0° grid = 1788.48 ft./2200 ft. = .813 reels

10.0° grid = 447.12 ft./2200 ft. = .203 reels

Average radiant exitant values may reach an approximate value of 1000.0 WM-2. The square of this number added over 31 days is 31 x 10^6. The total solar incidence may reach 43400. Since truncating any of these digits will result in these values becoming useless, two 16-bit values are used to represent each one of these values. They are packed in the following manner: The value is divided by 1000 and then truncated to an integer. This yields a number less than 2^{15}-1 and is placed, using a scale factor of 1, into the first of the 16-bit words. This number is then multiplied by 1000 and subtracted from the original value. The result of this operation is scaled by 10, truncated and placed in the second 16-bit word. An example follows:

ORIGINAL NUMBER	30,123,456.78	
DIVIDED BY 1000	30,123.45678	
TRUNCATE	30123	→first 16-bit word
MULTIPLY BY 1000	30,123,000	
SUBTRACT FROM ORIGINAL	456.78	
MULTIPLY BY SCALE FACTOR	4567	→second 16-bit word

The above same scheme is used to pack the whole Julian Date except the number 10000 is used in division and multiplication and the scale factor used for the second 16-bit word is one. Module SPLIT splits the number into two values to be scaled and transferred to the output array in Module TRNSRS/TRANSR.

As seen in Table 6.2-14, scanner data will occupy more than one tape. It is therefore necessary to define which region numbers occur on any one tape. The number of usable space on a tape is defined at 2200 feet. For ease in processing, all regions located in a given latitude band are written to the same tape. The number of inches of tape the regions in a given latitude band occupies is calculated and accumulated in Module RITEAG. After each latitude band is processed, the number of feet written is subtracted from the tape available for use number. The next latitude band will be placed on the current tape if the feet available for use is greater than the feet used for the last latitude band. This comparison is done in Module LATDRV.

Details of the S-9 - S-10 tape format and contents are given in S-9 - S-10 User's Guide (Reference 4).

6.2.6.1.2 Regional Average Data Base File. The regional average data base consists of the monthly, daily, and monthly hourly averages as well as the total solar incidence and net radiation. This information has been accumulated in an output array similar to the one described in Section 6.2.5.5.7. The tape format is binary with one 60-bit floating point word representing one data value, and one record being written for each region processed (see Table 6.2-11). The number of words in each regional record is equal to 537. This product is provided for subsequent use as an input source for the monthly nested output products (S-4). The scanner regional data base resides on a 6250 bpi tape. The nonscanner regional data bases are direct access disc files.

6.2.6.2 Paper Output. There are five types of paper output which may be produced by MTSA. They are the error message report, the global processing summary, the output tape summary, the PCV summary, and the statistics summary.

6.2.6.2.1 Error Message Report. The error message report contains a listing of all NAMELIST values used during the run, information about product keys for input and output files and any error messages produced during the processing. Valid error messages for MTSA are found in Table 6.2-16. This report should always be checked.

6.2.6.2.2 Global Summary. The global summary is produced after all processing is completed and shows which regions had data. Those regions seen by the satellite are indicated by a “1”. Figure 6.2-8 shows the format of this report. The report is generated by the ERBELIB Module REGPRT so that each page displays the regions which correspond to a section of the globe as defined by the ERBE grid system. Figure 6.2-9 shows which page of the report corresponds to which section of the globe for each of the three spatial resolutions. The data necessary for the report header is set in Module LATDRS/LATDRV which calls Module REGPRT.

6.2.6.2.3 Tape Processing Summary. The tape processing summary, shown in Figure 6.2-10, is created only during scanner processing by the ERBELIB Module REGRPT. The call to Module REGRPT is done in Module LATDRS. The purpose of

Table 6.2-16 Possible ERBE Error Messages

```
msgnum   6101                        msgtype  0
msg1     FILES:                     SCIENCE OUTPUT FILE PRODUCT CODE:
msg2
msgnum   6102                        msgtype  0
msg1     FILES:                      REGIONAL DATA BASE PRODUCT CODE:
msg2
msgnum   6103                        msgtype  2
msg1     INIT:  ERROR WHILE READING NAMELIST INPUT. MUST BE FROM UNIT
msg2            ACCEPTED NAMES:   GENRAL, FLAGS, SCALE, UNITS, NAMGLB
msgnum   6104                        msgtype  2
msg1     INIT: NAMELIST "NAMGLB" NOT FOUND.              UNIT NUMBER:
msg2           MUST BE INPUT ON UNIT SHOWN.
msgnum   6105                        msgtype  2
msg1     INIT: NAMELIST "GENRAL" NOT FOUND.              UNIT NUMBER:
msg2
msgnum   6106                        msgtype  2
msg1     INIT: NAMELIST "GENRAL" DID NOT INCLUDE VALID "MONTH"VALUE.
msg2
msgnum   6107                        msgtype  2
msg1     INIT: NAMELIST "GENRAL" DID NOT INCLUDE VALID "IYEAR" VALUE.
msg2
msgnum   6108                        msgtype  2
msg1     INIT: NAMELIST "GENRAL" DID NOT INCLUDE VALID GRID SIZE.
msg2           VALID VALUES ARE 25, 50, OR 100.                IRES:
msgnum   6109                        msgtype  2
msg1     LDTABL: ERROR OPENING ANCILLARY FILE.           UNIT NUMBER:
msg2                                                    ERROR NUMBER:
msgnum   6110                        msgtype  2
msg1     LDTABL: SOLAR CONSTANT/DECLINATION FILE         UNIT NUMBER:
msg2           DOES NOT CONTAIN DATA FOR MONTH.        ERROR NUMBER:
msgnum   6111                        msgtype  2
msg1     LDTABL: ERROR READING ANCILLARY FILE.           UNIT NUMBER:
msg2                                                    ERROR NUMBER:
msgnum   6112                        msgtype  2
msg1     LDTABL: SOLAR CONSTANT/DECLINATION FILE           DAYS READ:
msg2           DATA HAS ERROR.                       DAYS CALCULATED:
msgnum   6113                        msgtype  2
msg1     LDTABL: SOLAR CONSTANT/DECLINATION FILE           YEAR READ:
msg2           FOR WRONG YEAR.                         YEAR INPUT:
msgnum   6114                        msgtype  0
msg1     MFILES:  MULTIPLE SATELLITE INTERMEDIARY FILE PRODUCT CODE :
msg2
msgnum   6115                        msgtype  2
msg1     LDTABL: NUMBER OF SW MODELS ON        NUMBER READ FROM FILE:
msg2             FILE IN ERROR.             NUMBER MODELS CALCULATED:
msgnum   6116                        msgtype  2
msg1     FILES: MUST MATCH:INPUT NUMBER OF INVERSION TAPES PROCESSED:
msg2              LINKED LIST NUMBER OF INVERSION TAPES PROCESSED:
msgnum   6117                        msgtype  0
msg1     STDDEV: (SUMSQ-SUM**2/N)) .LT. 0;               REGION NUMBER:
msg2           SIGMA SET TO -77.0.             HOUR BOX OR DATA TYPE:
msgnum   6118                        msgtype  0
msg1     STDDEV: NOT ENOUGH VALUES SUMMED.               REGION NUMBER:
msg2           SIGMA SET TO -99.0.             HOUR BOX OR DATA TYPE:
msgnum   6119                        msgtype  0
msg1     RUNAVG: NUMBER OF RECORDS TO AVERAGE IS LESS THAN OR EQUAL
msg2           TO 1;  NUMBER OF RECORDS USED SET TO 1.
msgnum   6120                        msgtype  2
msg1     LOADMN:   GEOGRAPHIC SCENE TYPE INCONSISTENT WITHIN REGION:
msg2             ORIGINAL AND CURRENT VALUES SHOWN BELOW.
msgnum   6121                        msgtype  0
msg1     PRTPCV:     NO DATA FOUND FOR EITHER SW OR LW PCV FOR REGION
msg2
msgnum   6122                        msgtype  0
msg1     SCAN: ERROR IN LOCAL SOLAR HOUR CALCULATION.            HOUR:
msg2           SW DATA IGNORED. REGION NUMBER ON NEXT LINE.       DAY:
msgnum   6123                        msgtype  2
msg1     VERIFY: ERROR OPENING INTERMEDIARY INPUT FILE.  UNIT NUMBER:
msg2                                                    ERROR NUMBER:
msgnum   6124                        msgtype  2
msg1     FILES: ERROR OPENING OUTPUT FILE.               UNIT NUMBER:
msg2                                                    ERROR NUMBER:
msgnum   6125                        msgtype  2
msg1     REGDR: ERROR WRITING RECORD TO REGIONAL         ERROR NUMBER:
msg2           DATA BASE.                               REGION NUMBER:
msgnum   6126                        msgtype  0
msg1     ADJUST: ADJUSTED ALBEDO FRACTION .GT. 1.       REGION NUMBER:
msg2           FRACTION SET TO 1.0.                   FRACTION NUMBER:
msgnum   6127                        msgtype  2
msg1     RITEAG: ERROR WRITING TO SCIENCE PRODUCT.       ERROR NUMBER:
msg2                                                    REGION NUMBER:
msgnum   6128                        msgtype  2
msg1     MINIT: ERROR WHILE READING NAMELIST INPUT. MUST BE FROM UNIT
msg2           ACCEPTED NAMES:  GENRAL, UNITS, NAMGLB
msgnum   6129                        msgtype  2
msg1     FILES: ERROR WRITING SCALE FACTORS TO           UNIT NUMBER:
msg2           SCIENCE PRODUCT.                         ERROR NUMBER:
msgnum   6130                        msgtype  2
msg1     MVERIF: INPUT SATELLITE CODE IS NOT FOR MULTIPLE SATELLITES.
msg2             CODE S/B 4,5,6 OR 7.                   CODE INPUT IS:
msgnum   6131                        msgtype  2
msg1     VERIFY: ERROR WHILE READING SCALE FACTORS       ERROR NUMBER:
msg2           FROM INTERMEDIARY FILE.                  UNIT NUMBER:
msgnum   6132                        msgtype  0
msg1     VERIFY: INVALID TAPE FOR         TAPE MOUNTED ON UNIT NUMBER:
msg2           THIS RUN                              NUMBER OF ERRORS:
msgnum   6133                        msgtype  2
msg1     RDDATA: ERROR OCCURRED READING TAPE.           REGION NUMBER:
msg2           ERROR NUMBER ON NEXT LINE.               UNIT NUMBER:
msgnum   6134                        msgtype  2
msg1     WRDATA: ERROR WRITING TO INTERMEDIARY FILE.    REGION NUMBER:
msg2           ERROR NUMBER SHOWN ON NEXT LINE.         UNIT NUMBER:
msgnum   6135                        msgtype  2
msg1     MVERIF: ERROR OPENING INPUT FILE.               UNIT NUMBER:
msg2                                                    ERROR NUMBER:
msgnum   6136                        msgtype  0
msg1     LWMOD: ATTEMPT TO MODEL LW DATA RESULTED       REGION NUMBER:
msg2           IN AN OVERSCALE VALUE.                   MORNING HOUR:
msgnum   6137                        msgtype  2
msg1     MFILES: ERROR WRITING SCALE FACTORS TO          UNIT NUMBER:
msg2             INTERMEDIARY FILE.                     ERROR NUMBER:
msgnum   6138                        msgtype  2
msg1     MLOAD: ERROR WRITING TO INTERMEDIARY FILE.      ERROR NUMBER:
msg2                                                    REGION NUMBER:
msgnum   6139                        msgtype  2
msg1     RDFILE: ERROR OCCURRED READING TAPE.           REGION NUMBER:
msg2     DUMRD:  ERROR NUMBER ON NEXT LINE.               UNIT NUMBER:
msgnum   6140                        msgtype  2
msg1     LOADSC: ERROR OCCURRED READING TAPE.           REGION NUMBER:
msg2           ERROR NUMBER ON NEXT LINE.               UNIT NUMBER:
msgnum   6141                        msgtype  2
msg1     LOAD: ERROR WRITING PACKED INTERMEDIARY        ERROR NUMBER:
msg2           DATA TO SCIENCE PRODUCT TAPE            REGION NUMBER:
msgnum   6142                        msgtype  2
msg1     LOAD: ERROR WRITING SELECTED ITEMS TO          ERROR NUMBER:
msg2           THE REGIONAL DATA BASE                  REGION NUMBER:
msgnum   6143                        msgtype  0
msg1     LOADMN(SC):--OVERLAP GEOTYPE DIFFERS FROM MONTH'S- REGION:
msg2     GEOTYPES(PREV,CUR) ARE BELOW, MONTH OF CURRENT RECORD:
```

GLOBAL PROCESSING SUMMARY

PAGE: 1

ERBE PRODUCT: QC-25
DATE PROCESSED: 93/05/21.
SATELLITE: NOAA 9
TEMPORAL SPAN: 87/01/15 0000 - 87/01/15 2359
INSTRUMENT: SCANNER
SYSTEM RELEASE: 3
CHANNEL: LW & SW
SOFTWARE VERSION: 6
UNITS: NONE
DATA ALTITUDE: REFERENCE ALTITUDE

REGIONS	REGIONS SEEN DURING OBSERVING PERIOD
1- 36	1 - - -

GLOBAL PROCESSING SUMMARY

PAGE: 2

ERBE PRODUCT: QC-25
DATE PROCESSED: 93/05/21.
SATELLITE: NOAA 9
TEMPORAL SPAN: 87/01/15 0000 - 87/01/15 2359
INSTRUMENT: SCANNER
SYSTEM RELEASE: 3
CHANNEL: LW & SW
SOFTWARE VERSION: 6
UNITS: NONE
DATA ALTITUDE: REFERENCE ALTITUDE

REGIONS	REGIONS SEEN DURING OBSERVING PERIOD
37- 72	- - -

GLOBAL PROCESSING SUMMARY

PAGE: 3

ERBE PRODUCT: QC-25
DATE PROCESSED: 93/05/21.
SATELLITE: NOAA 9
TEMPORAL SPAN: 87/01/15 0000 - 87/01/15 2359
INSTRUMENT: SCANNER
SYSTEM RELEASE: 3
CHANNEL: LW & SW
SOFTWARE VERSION: 6
UNITS: NONE
DATA ALTITUDE: REFERENCE ALTITUDE

REGIONS	REGIONS SEEN DURING OBSERVING PERIOD
73- 108	- - -

GLOBAL PROCESSING SUMMARY

PAGE: 4

ERBE PRODUCT: QC-25
DATE PROCESSED: 93/05/21.
SATELLITE: NOAA 9
TEMPORAL SPAN: 87/01/15 0000 - 87/01/15 2359
INSTRUMENT: SCANNER
SYSTEM RELEASE: 3
CHANNEL: LW & SW
SOFTWARE VERSION: 6
UNITS: NONE
DATA ALTITUDE: REFERENCE ALTITUDE

REGIONS	REGIONS SEEN DURING OBSERVING PERIOD
109- 144	- - -

GLOBAL PROCESSING SUMMARY

PAGE: 5

ERBE PRODUCT: QC-25
DATE PROCESSED: 93/05/21.
SATELLITE: NOAA 9
TEMPORAL SPAN: 87/01/15 0000 - 87/01/15 2359
INSTRUMENT: SCANNER
SYSTEM RELEASE: 3
CHANNEL: LW & SW
SOFTWARE VERSION: 6
UNITS: NONE
DATA ALTITUDE: REFERENCE ALTITUDE

REGIONS	REGIONS SEEN DURING OBSERVING PERIOD
5185- 5220	1 1 1

GLOBAL PROCESSING SUMMARY

PAGE: 6

ERBE PRODUCT: QC-25
DATE PROCESSED: 93/05/21.
SATELLITE: NOAA 9
TEMPORAL SPAN: 87/01/15 0000 - 87/01/15 2359
INSTRUMENT: SCANNER
SYSTEM RELEASE: 3
CHANNEL: LW & SW
SOFTWARE VERSION: 6
UNITS: NONE
DATA ALTITUDE: REFERENCE ALTITUDE

REGIONS	REGIONS SEEN DURING OBSERVING PERIOD
5221- 5256	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5365- 5400	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5509- 5544	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5653- 5688	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5797- 5832	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5941- 5976	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6085- 6120	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6229- 6264	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6373- 6408	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6517- 6552	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6661- 6696	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6805- 6840	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6949- 6984	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7093- 7128	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7237- 7272	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7381- 7416	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7525- 7560	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7669- 7704	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7813- 7848	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7957- 7992	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8101- 8136	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8245- 8280	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8389- 8424	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8533- 8568	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8677- 8712	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8821- 8856	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8965- 9000	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9109- 9144	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9253- 9288	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9397- 9432	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9541- 9576	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9685- 9720	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9829- 9864	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9973-10008	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
10117-10152	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
10261-10296	- -

Figure 6.2-8. Format of Global Summary Report for Single Satellite (6 of 8)

GLOBAL PROCESSING SUMMARY

PAGE: 7

ERBE PRODUCT: QC-25
DATE PROCESSED: 93/05/21.
SATELLITE: NOAA 9
TEMPORAL SPAN: 87/01/15 0000 - 87/01/15 2359
INSTRUMENT: SCANNER
SYSTEM RELEASE: 3
CHANNEL: LW & SW
SOFTWARE VERSION: 6
UNITS: NONE
DATA ALTITUDE: REFERENCE ALTITUDE

REGIONS	REGIONS SEEN DURING OBSERVING PERIOD
5257- 5292	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5401- 5436	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5545- 5580	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5689- 5724	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5833- 5868	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5977- 6012	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6121- 6156	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6265- 6300	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6409- 6444	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6553- 6588	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6697- 6732	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6841- 6876	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6985- 7020	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7129- 7164	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7273- 7308	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7417- 7452	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7561- 7596	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7705- 7740	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7849- 7884	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7993- 8028	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8137- 8172	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8281- 8316	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8425- 8460	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8569- 8604	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8713- 8748	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8857- 8892	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9001- 9036	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9145- 9180	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9289- 9324	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9433- 9468	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9577- 9612	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9721- 9756	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9865- 9900	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
10009-10044	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
10153-10188	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
10297-10332	- -

Figure 6.2-8. Format of Global Summary Report for Single Satellite (7 of 8)

GLOBAL PROCESSING SUMMARY

PAGE: 8

ERBE PRODUCT: QC-25
DATE PROCESSED: 93/05/21.
SATELLITE: NOAA 9
TEMPORAL SPAN: 87/01/15 0000 - 87/01/15 2359
INSTRUMENT: SCANNER
SYSTEM RELEASE: 3
CHANNEL: LW & SW
SOFTWARE VERSION: 6
UNITS: NONE
DATA ALTITUDE: REFERENCE ALTITUDE

REGIONS	REGIONS SEEN DURING OBSERVING PERIOD
5293- 5328	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5437- 5472	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5581- 5616	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5725- 5760	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5869- 5904	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6013- 6048	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6157- 6192	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6301- 6336	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6445- 6480	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6589- 6624	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6733- 6768	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6877- 6912	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7021- 7056	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7165- 7200	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7309- 7344	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7453- 7488	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7597- 7632	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7741- 7776	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7885- 7920	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8029- 8064	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8173- 8208	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8317- 8352	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8461- 8496	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8605- 8640	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8749- 8784	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8893- 8928	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9037- 9072	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9181- 9216	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9325- 9360	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9469- 9504	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9613- 9648	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9757- 9792	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9901- 9936	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
10045-10080	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
10189-10224	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
10333-10368	- -

Figure 6.2-8. Format of Global Summary Report for Single Satellite (8 of 8)

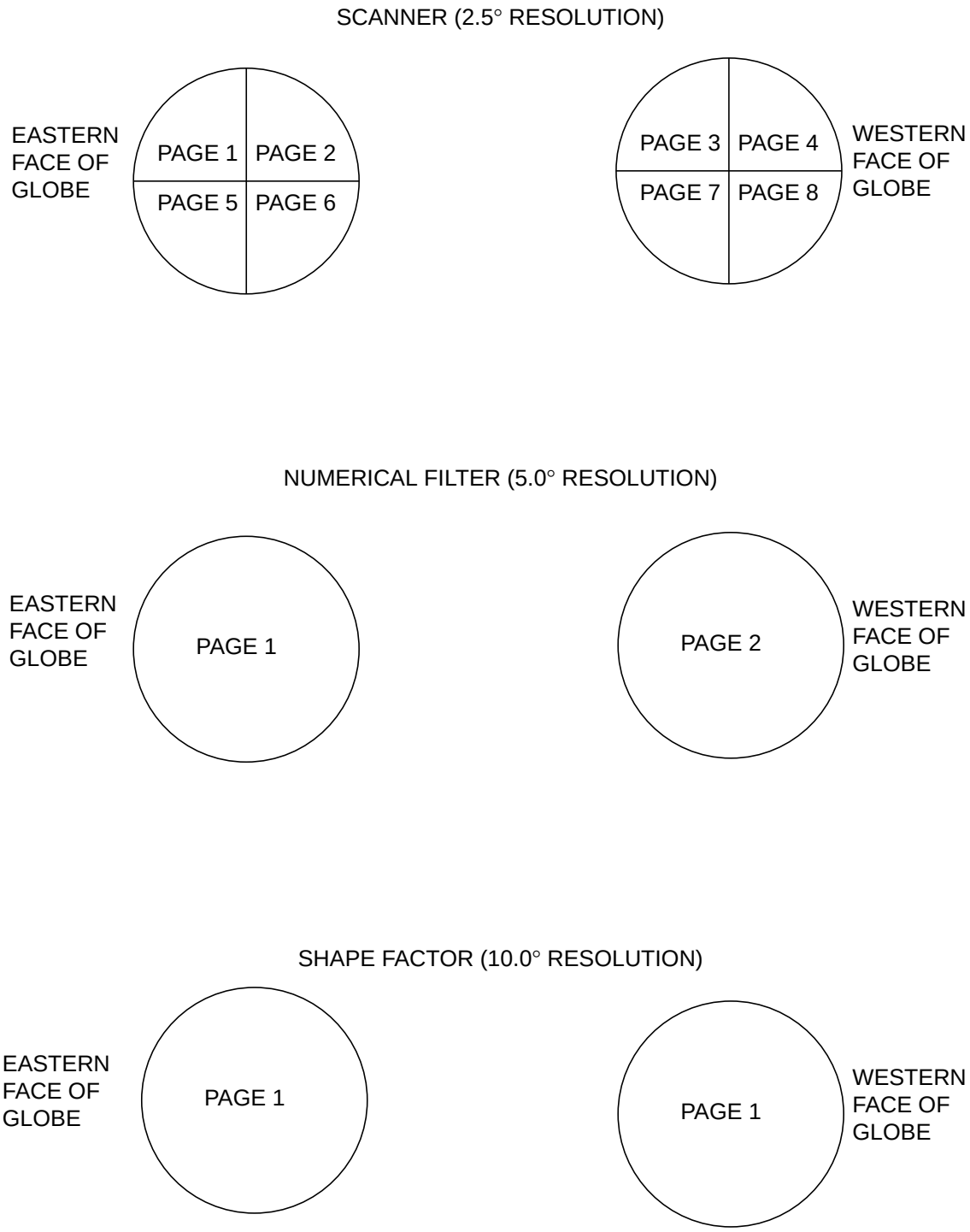


Figure 6.2-9. Correspondence of Report Pages to Globe

OUTPUT TAPE PROCESSING SUMMARY

PAGE: 1

ERBE PRODUCT: QC-41
DATE PROCESSED: 93/05/21.
SATELLITE: NOAA 9
TEMPORAL SPAN: 87/01/15 0000 - 87/01/15 2359
INSTRUMENT: SCANNER
SYSTEM RELEASE: 3
CHANNEL: LW & SW
SOFTWARE VERSION: 6
UNITS: NONE
DATA ALTITUDE: REFERENCE ALTITUDE

REGIONS	OUTPUT TAPE NUMBER REGION IS LOCATED ON
1- 36	1 - - -

OUTPUT TAPE PROCESSING SUMMARY

PAGE: 2

ERBE PRODUCT: QC-41
DATE PROCESSED: 93/05/21.
SATELLITE: NOAA 9
TEMPORAL SPAN: 87/01/15 0000 - 87/01/15 2359
INSTRUMENT: SCANNER
SYSTEM RELEASE: 3
CHANNEL: LW & SW
SOFTWARE VERSION: 6
UNITS: NONE
DATA ALTITUDE: REFERENCE ALTITUDE

REGIONS	OUTPUT TAPE NUMBER REGION IS LOCATED ON
37- 72	- - -

OUTPUT TAPE PROCESSING SUMMARY

PAGE: 3

ERBE PRODUCT: QC-41
DATE PROCESSED: 93/05/21.
SATELLITE: NOAA 9
TEMPORAL SPAN: 87/01/15 0000 - 87/01/15 2359
INSTRUMENT: SCANNER
SYSTEM RELEASE: 3
CHANNEL: LW & SW
SOFTWARE VERSION: 6
UNITS: NONE
DATA ALTITUDE: REFERENCE ALTITUDE

REGIONS	OUTPUT TAPE NUMBER REGION IS LOCATED ON
73- 108	- - -

OUTPUT TAPE PROCESSING SUMMARY

PAGE: 4

ERBE PRODUCT: QC-41
DATE PROCESSED: 93/05/21.
SATELLITE: NOAA 9
TEMPORAL SPAN: 87/01/15 0000 - 87/01/15 2359
INSTRUMENT: SCANNER
SYSTEM RELEASE: 3
CHANNEL: LW & SW
SOFTWARE VERSION: 6
UNITS: NONE
DATA ALTITUDE: REFERENCE ALTITUDE

REGIONS	OUTPUT TAPE NUMBER REGION IS LOCATED ON
109- 144	- - -

OUTPUT TAPE PROCESSING SUMMARY

PAGE: 5

ERBE PRODUCT: QC-41
DATE PROCESSED: 93/05/21.
SATELLITE: NOAA 9
TEMPORAL SPAN: 87/01/15 0000 - 87/01/15 2359
INSTRUMENT: SCANNER
SYSTEM RELEASE: 3
CHANNEL: LW & SW
SOFTWARE VERSION: 6
UNITS: NONE
DATA ALTITUDE: REFERENCE ALTITUDE

REGIONS	OUTPUT TAPE NUMBER REGION IS LOCATED ON
5185- 5220	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5329- 5364	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5473- 5508	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5617- 5652	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5761- 5796	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5905- 5940	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6049- 6084	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6193- 6228	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6337- 6372	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6481- 6516	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6625- 6660	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6769- 6804	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6913- 6948	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7057- 7092	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7201- 7236	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7345- 7380	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7489- 7524	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7633- 7668	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7777- 7812	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7921- 7956	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
8065- 8100	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
8209- 8244	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
8353- 8388	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
8497- 8532	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
8641- 8676	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
8785- 8820	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
8929- 8964	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9073- 9108	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9217- 9252	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9361- 9396	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9505- 9540	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9649- 9684	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9793- 9828	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9937- 9972	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
10081-10116	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
10225-10260	2 -

Figure 6.2-10. Format of Output Tape Processing Summary for Scanner Data (5 of 8)

OUTPUT TAPE PROCESSING SUMMARY

PAGE: 6

ERBE PRODUCT: QC-41
DATE PROCESSED: 93/05/21.
SATELLITE: NOAA 9
TEMPORAL SPAN: 87/01/15 0000 - 87/01/15 2359
INSTRUMENT: SCANNER
SYSTEM RELEASE: 3
CHANNEL: LW & SW
SOFTWARE VERSION: 6
UNITS: NONE
DATA ALTITUDE: REFERENCE ALTITUDE

REGIONS	OUTPUT TAPE NUMBER REGION IS LOCATED ON
5221- 5256	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5365- 5400	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5509- 5544	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5653- 5688	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5797- 5832	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5941- 5976	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6085- 6120	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6229- 6264	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6373- 6408	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6517- 6552	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6661- 6696	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6805- 6840	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6949- 6984	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7093- 7128	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7237- 7272	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7381- 7416	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7525- 7560	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7669- 7704	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7813- 7848	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7957- 7992	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
8101- 8136	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
8245- 8280	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
8389- 8424	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
8533- 8568	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
8677- 8712	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
8821- 8856	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
8965- 9000	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9109- 9144	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9253- 9288	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9397- 9432	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9541- 9576	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9685- 9720	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9829- 9864	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9973-10008	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
10117-10152	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
10261-10296	- -

Figure 6.2-10. Format of Output Tape Processing Summary for Scanner Data (6 of 8)

OUTPUT TAPE PROCESSING SUMMARY

PAGE: 7

ERBE PRODUCT: QC-41
DATE PROCESSED: 93/05/21.
SATELLITE: NOAA 9
TEMPORAL SPAN: 87/01/15 0000 - 87/01/15 2359
INSTRUMENT: SCANNER
SYSTEM RELEASE: 3
CHANNEL: LW & SW
SOFTWARE VERSION: 6
UNITS: NONE
DATA ALTITUDE: REFERENCE ALTITUDE

REGIONS	OUTPUT TAPE NUMBER REGION IS LOCATED ON
5257- 5292	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5401- 5436	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5545- 5580	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5689- 5724	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5833- 5868	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5977- 6012	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6121- 6156	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6265- 6300	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6409- 6444	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6553- 6588	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6697- 6732	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6841- 6876	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6985- 7020	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7129- 7164	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7273- 7308	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7417- 7452	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7561- 7596	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7705- 7740	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7849- 7884	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7993- 8028	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
8137- 8172	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
8281- 8316	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
8425- 8460	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
8569- 8604	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
8713- 8748	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
8857- 8892	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9001- 9036	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9145- 9180	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9289- 9324	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9433- 9468	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9577- 9612	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9721- 9756	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9865- 9900	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
10009-10044	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
10153-10188	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
10297-10332	- -

Figure 6.2-10. Format of Output Tape Processing Summary for Scanner Data (7 of 8)

OUTPUT TAPE PROCESSING SUMMARY

PAGE: 8

ERBE PRODUCT: QC-41
DATE PROCESSED: 93/05/21.
SATELLITE: NOAA 9
TEMPORAL SPAN: 87/01/15 0000 - 87/01/15 2359
INSTRUMENT: SCANNER
SYSTEM RELEASE: 3
CHANNEL: LW & SW
SOFTWARE VERSION: 6
UNITS: NONE
DATA ALTITUDE: REFERENCE ALTITUDE

REGIONS	OUTPUT TAPE NUMBER REGION IS LOCATED ON
5293- 5328	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5437- 5472	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5581- 5616	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5725- 5760	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5869- 5904	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6013- 6048	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6157- 6192	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6301- 6336	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6445- 6480	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6589- 6624	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6733- 6768	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6877- 6912	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7021- 7056	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7165- 7200	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7309- 7344	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7453- 7488	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7597- 7632	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7741- 7776	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
7885- 7920	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
8029- 8064	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
8173- 8208	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
8317- 8352	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
8461- 8496	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
8605- 8640	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
8749- 8784	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
8893- 8928	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9037- 9072	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9181- 9216	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9325- 9360	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9469- 9504	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9613- 9648	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9757- 9792	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9901- 9936	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
10045-10080	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
10189-10224	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
10333-10368	- -

Figure 6.2-10. Format of Output Tape Processing Summary for Scanner Data (8 of 8)

the summary is to show which region of the globe data resides on for a given science product output tape. Section 6.2.6.1.1 discusses how the data for this summary is accumulated. Figure 6.2-9 shows which page of the report corresponds to which section of the globe.

6.2.6.2.4 Processing Control Vector Summary. At the option of the user a print out of the processing control vector for up to 20 different regions is produced. The region numbers are input to the Subsystem by the NAMELIST $GENRAL input parameters IPRTV1, IPRTV2 and IPRTV5 as described in Table 6.2-3. If region numbers are not input, the 20 default validation regions (Table 6.2-2) are used. Figure 6.2-11 shows the format for one region in the summary. The summary is created by Module PRTPCV.

6.2.6.2.5 Statistics Summary. Also at the option of the user, a two page statistical summary containing the daily, monthly hourly, and grand monthly number of measurements, means, standard deviations, minimums, and maximums for both SW and LW measurements for a given region is produced. This information may be displayed for up to 20 different regions. Region numbers to display are input via NAMELIST $GENRAL input parameters IPRTS1, IPRTS2 and IPRTS5 as described in Table 6.2-3. If region numbers are not input, the 20 default validation regions (Table 6.2-2) are used. Figure 6.2-12 shows the statistics summary for one region. The summary is created by Module PRSTAT.

6.2.7 MULTIPLE SATELLITE PROCESSING

Multiple satellite processing is accomplished using the same Time/Space Averaging algorithms used in single satellite processing. The main differences in processing are the input data file used and the method used to place the data into the regional data matrices. Two restrictions are placed on the input data; there must be two or three input tapes and the tapes must contain the same resolution data.

The input data files used for multiple satellite processing are the science output products (S-9 or S-10) created by single satellite processing. These

COMBINED LW & SW PROCESSING CONTROL VECTOR SUMMARY

PAGE: 1

SATELLITE: NOAA 9
INSTRUMENT: SCANNER
CHANNEL: LW & SW
UNITS: NONE

ERBE PRODUCT: QC-9
DATE PROCESSED: 93/05/21.
TEMPORAL SPAN: 87/01/15 0000 - 87/01/15 2359
SYSTEM RELEASE: 3
SOFTWARE VERSION: 6
DATA ALTITUDE: REFERENCE ALTITUDE

DATA ID: REGION 9901 RESOLUTION 2.5

HOURS

DAYS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1																								
2																								
3																								
4																								
5																								
6																								
7																								
8																								
9																								
10																								
11																								
12																								
13																								
14																				1	1		1	
15	1	1		1										1		1		1						
16																								
17																								
18																								
19																								
20																								
21																								
22																								
23																								
24																								
25																								
26																								
27																								
28																								
29																								
30																								
31																								

Figure 6.2-11. Processing Control Vector Summary

STATISTICS EACH CHANNEL BY DAY

PAGE: 1

ERBE PRODUCT: QC-34
DATE PROCESSED: 93/05/21.
SATELLITE: NOAA 9
TEMPORAL SPAN: 87/01/15 0000 - 87/01/15 2359
INSTRUMENT: SCANNER
SYSTEM RELEASE: 3
CHANNEL: LW & SW
SOFTWARE VERSION: 6
UNITS: WATTS/METER2
DATA ALTITUDE: REFERENCE ALTITUDE

DAILY STATISTICS: REGION 3547 RESOLUTION 2.5

		SHORTWAVE					LONGWAVE				
		NO.	MEAN	SIGMA	MAX	MIN	NO.	MEAN	SIGMA	MAX	MIN
	1	0	32767.00	.00	.00	.00	0	251.98	.00	251.98	251.98
	2	0	32767.00	.00	.00	.00	0	251.98	.00	251.98	251.98
	3	0	32767.00	.00	.00	.00	0	251.98	.00	251.98	251.98
	4	0	32767.00	.00	.00	.00	0	251.98	.00	251.98	251.98
	5	0	32767.00	.00	.00	.00	0	251.98	.00	251.98	251.98
	6	0	32767.00	.00	.00	.00	0	251.98	.00	251.98	251.98
	7	0	32767.00	.00	.00	.00	0	251.98	.00	251.98	251.98
	8	0	32767.00	.00	.00	.00	0	251.98	.00	251.98	251.98
D	9	0	32767.00	.00	.00	.00	0	251.98	.00	251.98	251.98
	10	0	32767.00	.00	.00	.00	0	251.98	.00	251.98	251.98
A	11	0	32767.00	.00	.00	.00	0	251.98	.00	251.98	251.98
	12	0	32767.00	.00	.00	.00	0	251.98	.00	251.98	251.98
Y	13	0	32767.00	.00	.00	.00	0	251.98	.00	251.98	251.98
	14	0	32767.00	.00	.00	.00	0	251.98	.00	251.98	251.98
S	15	1	70.51	91.86	222.24	.00	2	235.34	10.83	251.98	225.36
	16	0	32767.00	.00	.00	.00	0	225.36	.00	225.36	225.36
	17	0	32767.00	.00	.00	.00	0	225.36	.00	225.36	225.36
	18	0	32767.00	.00	.00	.00	0	225.36	.00	225.36	225.36
	19	0	32767.00	.00	.00	.00	0	225.36	.00	225.36	225.36
	20	0	32767.00	.00	.00	.00	0	225.36	.00	225.36	225.36
	21	0	32767.00	.00	.00	.00	0	225.36	.00	225.36	225.36
	22	0	32767.00	.00	.00	.00	0	225.36	.00	225.36	225.36
	23	0	32767.00	.00	.00	.00	0	225.36	.00	225.36	225.36
	24	0	32767.00	.00	.00	.00	0	225.36	.00	225.36	225.36
	25	0	32767.00	.00	.00	.00	0	225.36	.00	225.36	225.36
	26	0	32767.00	.00	.00	.00	0	225.36	.00	225.36	225.36
	27	0	32767.00	.00	.00	.00	0	225.36	.00	225.36	225.36
	28	0	32767.00	.00	.00	.00	0	225.36	.00	225.36	225.36
	29	0	32767.00	.00	.00	.00	0	225.36	.00	225.36	225.36
	30	0	32767.00	.00	.00	.00	0	225.36	.00	225.36	225.36
	31	0	32767.00	.00	.00	.00	0	225.36	.00	225.36	225.36
FOR THE MEANS (GMA):							FOR THE MEANS (GMA):				
		NO: 1	MEAN: 71.36	SIGMA: .00	MAX: 70.51	MIN: 70.51	NO: 1	MEAN: 237.70	SIGMA: 13.29	MAX: 251.98	MIN: 225.36

Figure 6.2-12. Statistical Summary (1 of 2)

STATISTICS EACH CHANNEL BY HOUR

PAGE: 2

ERBE PRODUCT: QC-34
DATE PROCESSED: 93/05/21.
SATELLITE: NOAA 9
TEMPORAL SPAN: 87/01/15 0000 - 87/01/15 2359
INSTRUMENT: SCANNER
SYSTEM RELEASE: 3
CHANNEL: LW & SW
SOFTWARE VERSION: 6
UNITS: WATTS/METER2
DATA ALTITUDE: REFERENCE ALTITUDE

HOURLY STATISTICS: REGION 3547 RESOLUTION 2.5

		SHORTWAVE					LONGWAVE				
		NO.	MEAN	SIGMA	MAX	MIN	NO.	MEAN	SIGMA	MAX	MIN
	1	0	.00	.00	.00	.00	0	251.98	.00	251.98	251.98
	2	0	.00	.00	.00	.00	0	251.98	.00	251.98	251.98
	3	0	.00	.00	.00	.00	0	251.98	.00	251.98	251.98
	4	0	.00	.00	.00	.00	1	251.98	.00	251.98	251.98
	5	0	.00	.00	.00	.00	0	249.56	.00	249.56	249.56
	6	0	.00	.00	.00	.00	0	247.14	.00	247.14	247.14
	7	0	.00	.00	.00	.00	0	244.72	.00	244.72	244.72
	8	0	79.90	.00	79.90	79.90	0	242.30	.00	242.30	242.30
	9	0	149.65	.00	149.65	149.65	0	239.88	.00	239.88	239.88
H	10	0	187.76	.00	187.76	187.76	0	237.46	.00	237.46	237.46
	11	0	208.73	.00	208.73	208.73	0	235.04	.00	235.04	235.04
O	12	0	222.24	.00	222.24	222.24	0	232.62	.00	232.62	232.62
	13	0	222.24	.00	222.24	222.24	0	230.20	.00	230.20	230.20
U	14	0	208.73	.00	208.73	208.73	0	227.78	.00	227.78	227.78
	15	1	187.76	.00	187.76	187.76	1	225.36	.00	225.36	225.36
R	16	0	149.65	.00	149.65	149.65	0	225.36	.00	225.36	225.36
	17	0	79.90	.00	79.90	79.90	0	225.36	.00	225.36	225.36
S	18	0	.00	.00	.00	.00	0	225.36	.00	225.36	225.36
	19	0	.00	.00	.00	.00	0	225.36	.00	225.36	225.36
	20	0	.00	.00	.00	.00	0	225.36	.00	225.36	225.36
	21	0	.00	.00	.00	.00	0	225.36	.00	225.36	225.36
	22	0	.00	.00	.00	.00	0	225.36	.00	225.36	225.36
	23	0	.00	.00	.00	.00	0	225.36	.00	225.36	225.36
	24	0	.00	.00	.00	.00	0	225.36	.00	225.36	225.36

FOR THE MEANS (GMA):	
(NO.)	1
(MEAN)	71.36
(SIGMA)	91.86
(MAX)	222.24
(MIN)	.00

FOR THE MEANS (GMA):	
(NO.)	2
(MEAN)	235.34
(SIGMA)	10.83
(MAX)	251.98
(MIN)	225.36

Figure 6.2-12. Statistical Summary (2 of 2)

science products are “recycled” by a preprocessor which combines the data from two or three input files into one file. This procedure assumes that all measurements are equivalent. There is no way within the present data analysis system to implement other weighting schemes which might represent some proposed preference based on satellite instrument or viewing conditions. This new file is the input that is used by the multiple satellite processor.

6.2.7.1 Multiple Satellite Preprocessor. The multiple satellite preprocessor structure chart is shown in Figure 6.2-13. Note that the preprocessor design closely follows that of the MTSA processors, i.e. using logical divisions based on latitude bands and region numbers.

6.2.7.1.1 The Preprocessor Driver. THe purpose of the multiple satellite preprocessor driver (MULT) is to oversee all processing which is done by executing the preprocessor. The first step is to initialize the preprocessor. The input files are then opened and verified and the output file is opened. If no errors are found, the data is processed and combined into one file which is used as input to the multiple satellite MTSA processing. The flow of the preprocessor is the same regardless of the data being processed.

6.2.7.1.2 Preprocessor Initialization. All COMMON Block variables are defined and initialized in Module BLKDTA. Necessary changes to input-output unit numbers and definitions of those parameters associated with a particular grid resolution are done in Module MINIT. This is accomplished through the use of NAMELIST. The parameters, definitions, and default values for NAMELIST input are listed in Table 6.2-17. In addition, the on-line file containing information about the solar constant and solar declination angle for each day in the month must be read into core. This is accomplished in Module MLDTBL.

6.2.7.1.3 File Initialization. Regardless of what type of data is being processed, all input and output files are opened in Module MFILES. The first major consideration in preprocessing multiple satellite data is to ensure that the proper tapes are mounted. This is done in Module VERIF. A three-dimensional array (MUNIT) contains default (40, 41, 42) unit numbers upon which the tapes are mounted. A restriction on mounting tapes is that if

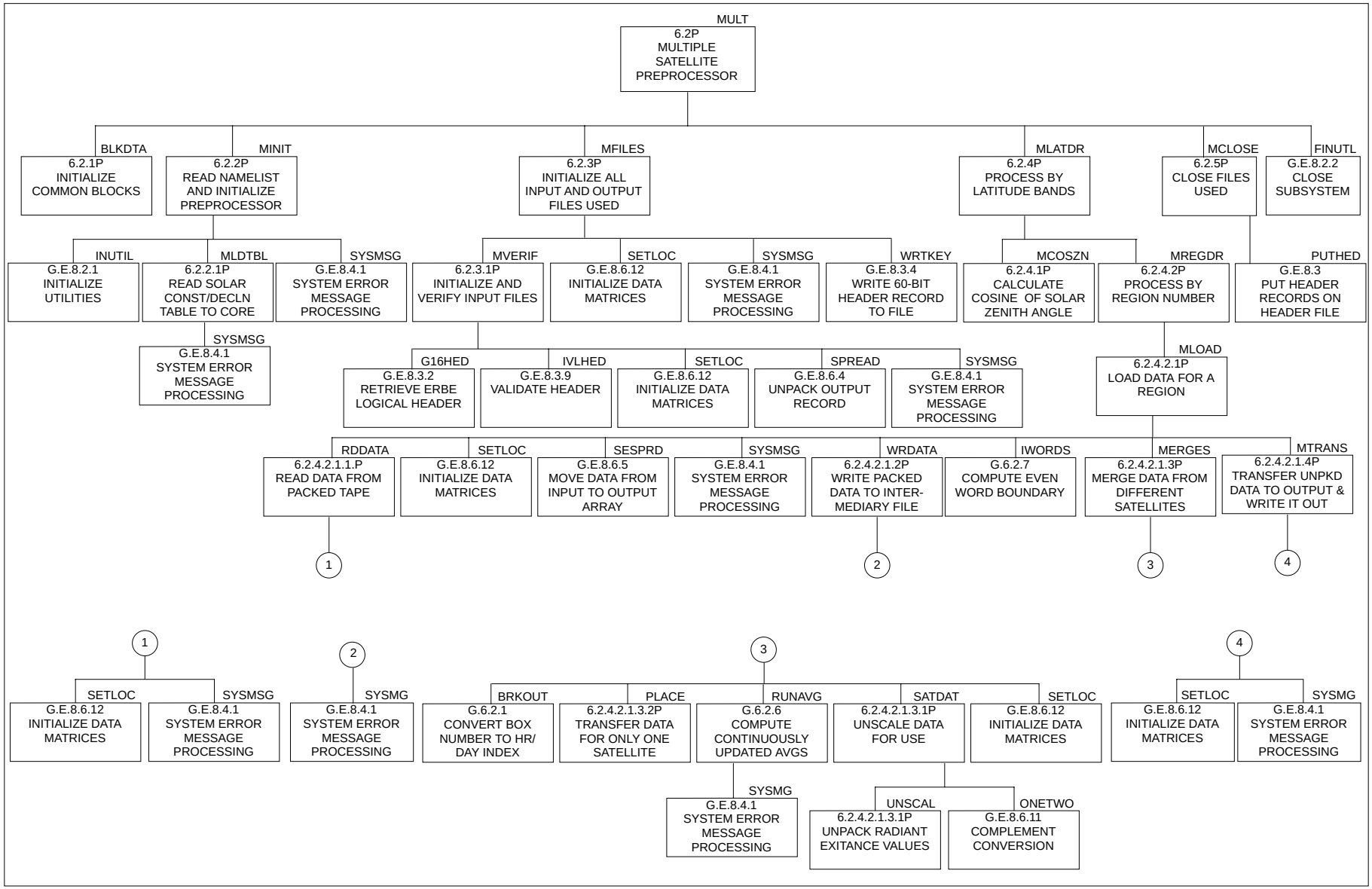


Figure 6.2-13. Multiple Satellite Preprocessor Structure Chart

Table 6.2-17 Parameters, Definitions, and Default Values for Multiple Satellite Preprocessor NAMELIST Input

NAMELIST NAMES	PARAMETER	DEFINITION	DEFAULT
$GENRAL	INLAT	Initial latitude band number to process	1
	IRES	Grid resolution to process	0
	KIND	Multiple satellite indicator for non-scanner data (whether 'MFOV' or 'WFOV')	blank
	FILVAL	Bad data indicator	32767.0
	NFILSC(3)	Number of output files on the scanner (S-9) internal tape	1,1,1
	ISATCD	Satellite code	0
	IYEAR	Integer representation of the year	0
	MONTH	Integer representation of the month	0
	NCOL25	Number of regions in a latitude band for 2.5° file	144
	NCOL50	Number of regions in a latitude band for 5.0° file	72
	NCOL10	Number of regions in a latitude band for 10.0° file	36
	NHOURS	Number of hours in a day	24
	NMODSC	The number of scanner SW scene types	4
	NMODNS	The number of nonscanner SW scene types	9
	NROW25	Number of latitude bands for the 2.5° file	72
	NROW50	Number of latitude bands for the 5.0° file	36
	NROW10	Number of latitude bands for the 10.0° file	18
$UNITS	IOUT	Unit numbers for intermediary file	31
	MUNIT(3)	Unit numbers for input tapes for multiple satellite processing	40,41,42
	ISOL	Unit number for reading solar constant/ declination file	14

there are only two satellites to merge they must be mounted to the first two unit devices in this array. A check on the value in variable ISATCD allows the determination of what satellite data is to be merged. If ISATCD is equal to seven, data from all three satellites is to be merged. A value of six means data from satellites two and three are to be merged, a five means data from satellites one and two are to be merged, and a four means merge data from satellites one and three. Any other value in ISATCD will result in the termination of processing. The header information for the first unit number is retrieved by ERBELIB Module G16HED and checked to see if it is valid for any of the satellites indicated by variable ISATCD. By comparing every combination of header data, there is no need to order the satellite tapes with the positional unit devices used. If an error is detected during the course of validation, an error message will be produced and the processing will be terminated. If the input file is valid, the scale factor record is read from record 2 of the file and unpacked into an array.

After all input files are validated Module MFILES opens the output file. ERBELIB Module WRTKEY places the header record key on the file. The scale factor record is then placed on the file as record number two. An indexed sequential file is also opened. This file is used in the preprocessor to sort and merge the data from the different satellites.

6.2.7.1.4 Retrieval of Multiple Satellite Data. Processing now proceeds on a latitude band basis (Module MLATDR). The cosine of the solar zenith angle is calculated once per latitude band (in Module MCOSZN) at the beginning of processing for the latitude band (see Sections 6.2.3.1 and 6.2.5.2). Within a latitude band, data is processed on a region-by-region basis (Module MREGDR). After input validation has been completed, each satellite tape is positioned at the record containing the first region number processed during single satellite processing. Module MLOAD oversees the reading of the data from the individual satellite tapes. The method of processing the data depends on how many of the satellite tapes contain data for the desired region number. To determine how many contain data for the required region, the first (fixed length) record of the regional data is read (Module RDDATA), unpacked into 60-bit words (ERBELIB Module SESPRD), and the region number, number of hour

boxes processed information, and geotype are extracted. If the region number extracted matches the region number wanted, a communication flag is incremented by one. After all the input files are checked, the communication flag contains the number of satellites that had data for the region.

If only one satellite had data for the region, certain indicators (i.e., region number, number of satellites with data, the number of hour boxes with data, and the geotype) are written (Module WRDATA) to the output file. This is followed by the two packed records from the input tape.

If more than one satellite had data for the region, record number two (the variable length record) is read (Module RDDATA) from the input tapes. These data are unpacked by ERBELIB Module SESPRD and the data for the individual hour boxes are retrieved. The hour box number is used as the key word to store the information for the hour box in an indexed sequential file. After all the data for the region is retrieved the data can be merged.

6.2.7.1.5 Merging of Multiple Satellite Data. All data for the region now reside on an indexed sequential file. Each satellite has its own indicator array. The merge process begins by checking the indicators for hour box one. A “1” indicates there was data for a given hour box. If hour box one has no data, hour box two data is checked, and so forth, until data is found. The data is then retrieved from the temporary storage file. A check is then made to see how many satellites had data for the hour box. If only one satellite had data for the hour box, the data is just written out to the intermediary tape (Module MTRANS). If more than one satellite had data for the hour box, the data is merged in Module MERGES using the algorithms found in Section 6.2.3.6. It is then written to the intermediary tape preceded by the hour and day number indices. Each hour box is written as a separate data record.

6.2.7.2 The MTSA Multiple Satellite Processing. The data being processed has already been merged in the multiple satellite preprocessor. The only difference between multiple and single satellite MTSA Subsystem processing is in the way the data is retrieved and placed in the regional data matrix.

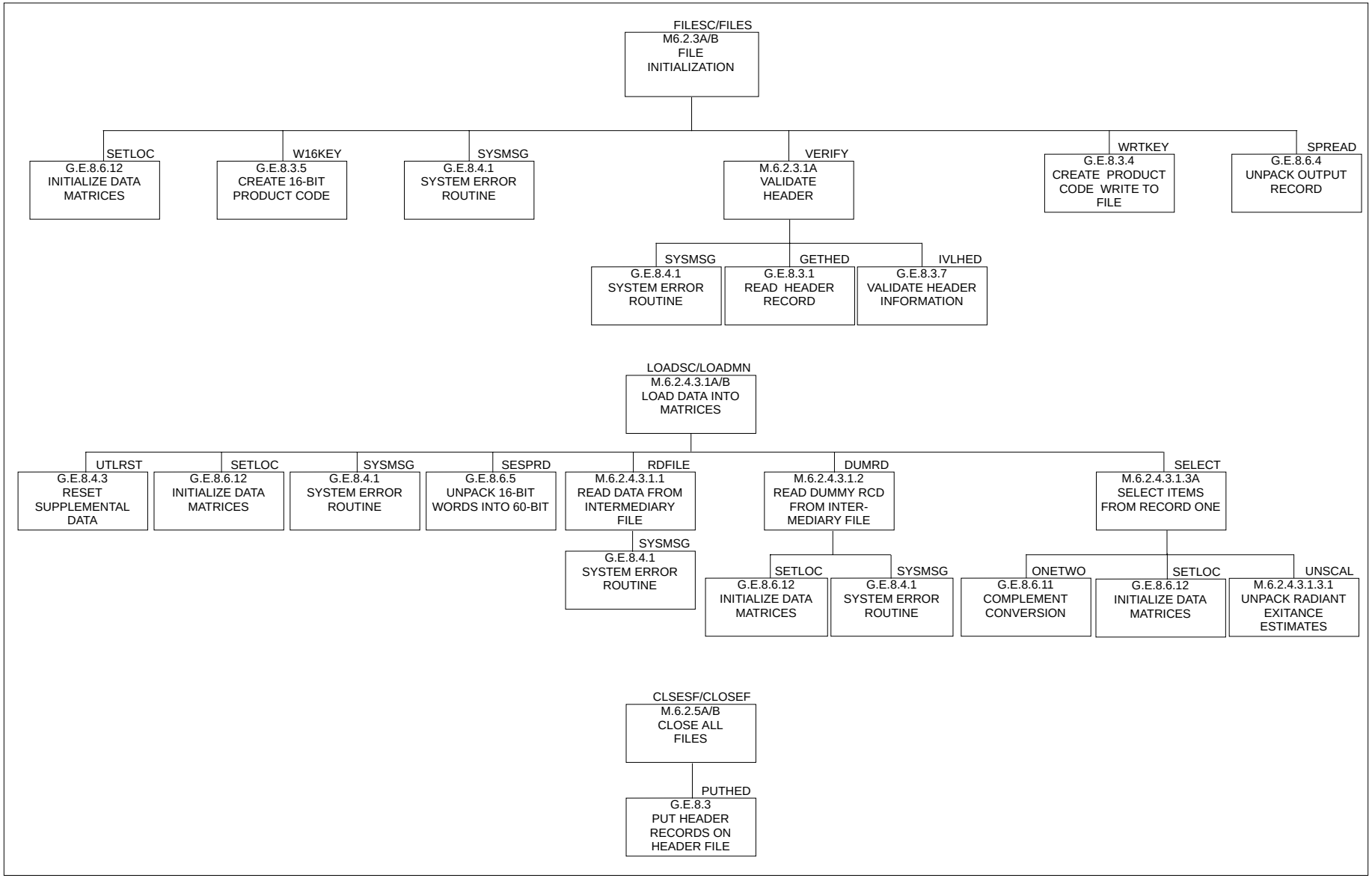


Figure 6.2-14. Changes to the Single Satellite Processing Structure Charts for Multiple Satellite Processing

6.2.7.2.1 Loading the Subsystem into Memory. Figure 6.2-14 shows the modifications necessary to the T/S Averaging Structure Chart for multiple satellite processing. A note must be made in regard to the loading of the Subsystem into memory. Those modules used only by single satellite processing form one library while those subroutines used only by multiple satellite processing form another. The proper library must be loaded using a LDSET system control card before execution of the program begins. The results will be unweighted averages of calculated quantities based on the combination of data being processed.

6.2.7.2.2 Loading the Data into the T/S Averaging Data Matrix. The first record read for any hour box contains four words of information; the region number, the number of satellites with data for the region, the number of hours with data for the region, and the geographic scene type. The region number is used to determine whether the data is to be processed. If this region is to be processed, the next word tells how many satellites had data for the region.

If only one satellite had data, the next two records on the tape contain the exact records to be written to the science output product (S-9 or S-10). The records are read from the input file and written to the output file in Module LOADSC/LOADMN. Note that the information for the regional data base file must be retrieved from record one. This is done by unpacking record one (ERBELIB Module SESPRD) and retrieving the information needed. Module SELECT retrieves the proper information and creates the array to be written. Module LOADSC/ LOADMN writes the array to the regional data base file.

If more than one satellite has data for the region, the hour box data may be read directly into the T/S Averaging data matrix. This is due to the fact that each hour box with data has its own record on the input file. The number of records for a given region is given by number of hours with data value read in earlier. The first two words of each record are the hour and day indices that are used to directly access the T/S Averaging data matrix.

Processing now proceeds as per single satellite processing, the one difference in output products is described below.

6.2.7.2.3 Global Summary for Multiple Satellite Processing. This summary shows which regions had data. Those regions seen by the satellites are indicated by a number (1, 2, or 3). If only one satellite had data for a region a “1” will appear under the region number. If two satellites had data for the same region number a “2” will appear under that region number, and a “3” will appear if all three satellites had data for the same region. Figure 6.2-15 shows the format of this report. The report is generated by the ERBLIB Module REGPRT so that each page displays the regions, as defined by the ERBE grid system, which corresponds to a section of the globe. Figure 6.2-9 shows which page of the report corresponds to which section of the globe for each of the three spatial resolutions. The Module REGPRT is called from the Module LATDRS/LATDRV which sets the data necessary for the report header.

6.2.8 MAINTENANCE ISSUES

The MTSA Subsystem comprises two base programs, four libraries, and a preprocessor which must all be considered as a whole when changes need to be made to the code. Changes made to the single satellite scanner code (base program SSBSSC and library SS1SC), for instance, may very well apply to the single satellite nonscanner code (base program SSBSNS and library SS1NS) as well. Less frequently, these changes may also need to be made to the multiple satellite libraries (SSMSC and SSMNS) and the preprocessor, SSMULT.

There are certain areas of MTSA which are more susceptible to change than others. These areas include the longwave and shortwave modeling; the directional model input file; the solar declination input file (and the program which creates it, SSDEC); the CCL file, PSTSASU; the Subsystem interfaces (particularly the interface between MTSA and the Regional Zonal and Global Averages Output Product (S-4)); and the data arrays. These areas are discussed below.

This section concludes with descriptions of the Module COMMON Block Matrix (6.2.8.8) and the Module Names/Numbers Table (6.2.8.9). These tables should prove very useful in the MTSA maintenance effort.

GLOBAL PROCESSING SUMMARY

PAGE: 1

ERBE PRODUCT: QC-26
DATE PROCESSED: 93/05/25.
SATELLITE: NOAA 9/ERBS /NOAA10
TEMPORAL SPAN: 87/01/15 0000 - 87/01/15 2359
INSTRUMENT: SCANNER
SYSTEM RELEASE: 3
CHANNEL: LW & SW
SOFTWARE VERSION: 6
UNITS: NONE
DATA ALTITUDE: REFERENCE ALTITUDE

REGIONS	NUMBER OF SATELLITES MERGED PER REGION DURING OBSERVING PERIOD
1- 36	2 - - -

GLOBAL PROCESSING SUMMARY

PAGE: 2

ERBE PRODUCT: QC-26
DATE PROCESSED: 93/05/25.
SATELLITE: NOAA 9/ERBS /NOAA10
TEMPORAL SPAN: 87/01/15 0000 - 87/01/15 2359
INSTRUMENT: SCANNER
SYSTEM RELEASE: 3
CHANNEL: LW & SW
SOFTWARE VERSION: 6
UNITS: NONE
DATA ALTITUDE: REFERENCE ALTITUDE

REGIONS	NUMBER OF SATELLITES MERGED PER REGION DURING OBSERVING PERIOD
37- 72	- - -

GLOBAL PROCESSING SUMMARY

PAGE: 3

ERBE PRODUCT: QC-26
DATE PROCESSED: 93/05/25.
SATELLITE: NOAA 9/ERBS /NOAA10
TEMPORAL SPAN: 87/01/15 0000 - 87/01/15 2359
INSTRUMENT: SCANNER
SYSTEM RELEASE: 3
CHANNEL: LW & SW
SOFTWARE VERSION: 6
UNITS: NONE
DATA ALTITUDE: REFERENCE ALTITUDE

REGIONS	NUMBER OF SATELLITES MERGED PER REGION DURING OBSERVING PERIOD
73- 108	- - -

GLOBAL PROCESSING SUMMARY

PAGE: 4

ERBE PRODUCT: QC-26
DATE PROCESSED: 93/05/25.
SATELLITE: NOAA 9/ERBS /NOAA10
TEMPORAL SPAN: 87/01/15 0000 - 87/01/15 2359
INSTRUMENT: SCANNER
SYSTEM RELEASE: 3
CHANNEL: LW & SW
SOFTWARE VERSION: 6
UNITS: NONE
DATA ALTITUDE: REFERENCE ALTITUDE

REGIONS	NUMBER OF SATELLITES MERGED PER REGION DURING OBSERVING PERIOD
109- 144	- - -

GLOBAL PROCESSING SUMMARY

PAGE: 5

ERBE PRODUCT: QC-26
DATE PROCESSED: 93/05/25.
SATELLITE: NOAA 9/ERBS /NOAA10
TEMPORAL SPAN: 87/01/15 0000 - 87/01/15 2359
INSTRUMENT: SCANNER
SYSTEM RELEASE: 3
CHANNEL: LW & SW
SOFTWARE VERSION: 6
UNITS: NONE
DATA ALTITUDE: REFERENCE ALTITUDE

REGIONS	NUMBER OF SATELLITES MERGED PER REGION DURING OBSERVING PERIOD																																				
5185- 5220	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
5329- 5364	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
5473- 5508	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
5617- 5652	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
5761- 5796	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
5905- 5940	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
6049- 6084	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
6193- 6228	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
6337- 6372	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
6481- 6516	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
6625- 6660	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
6769- 6804	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
6913- 6948	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
7057- 7092	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
7201- 7236	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
7345- 7380	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
7489- 7524	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
7633- 7668	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
7777- 7812	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
7921- 7956	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
8065- 8100	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
8209- 8244	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
8353- 8388	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
8497- 8532	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
8641- 8676	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
8785- 8820	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
8929- 8964	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
9073- 9108	3	3	2	2	2	2	2	2	2	3	3	3	2	3	2	2	2	2	2	3	3	3	2	2	3	2	2	2	2	3	3	2	2	2	2	2	2
9217- 9252	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9361- 9396	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9505- 9540	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9649- 9684	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9793- 9828	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9937- 9972	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10081-10116	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10225-10260	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Figure 6.2-15. Format of Global Summary Report for Multiple Satellite (5 of 8)

GLOBAL PROCESSING SUMMARY

PAGE: 6

ERBE PRODUCT: QC-26
DATE PROCESSED: 93/05/25.
SATELLITE: NOAA 9/ERBS /NOAA10
TEMPORAL SPAN: 87/01/15 0000 - 87/01/15 2359
INSTRUMENT: SCANNER
SYSTEM RELEASE: 3
CHANNEL: LW & SW
SOFTWARE VERSION: 6
UNITS: NONE
DATA ALTITUDE: REFERENCE ALTITUDE

REGIONS	NUMBER OF SATELLITES MERGED PER REGION DURING OBSERVING PERIOD
5221- 5256	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
5365- 5400	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
5509- 5544	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
5653- 5688	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
5797- 5832	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
5941- 5976	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
6085- 6120	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
6229- 6264	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
6373- 6408	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
6517- 6552	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
6661- 6696	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
6805- 6840	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
6949- 6984	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
7093- 7128	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
7237- 7272	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
7381- 7416	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
7525- 7560	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
7669- 7704	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
7813- 7848	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
7957- 7992	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
8101- 8136	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
8245- 8280	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
8389- 8424	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
8533- 8568	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
8677- 8712	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
8821- 8856	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
8965- 9000	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
9109- 9144	2 2 2 3 3 3 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 3 3 3 2 2 3 2 2 2 2 2 3 3 2 3
9253- 9288	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9397- 9432	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9541- 9576	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9685- 9720	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9829- 9864	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9973-10008	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
10117-10152	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
10261-10296	- -

Figure 6.2-15. Format of Global Summary Report for Multiple Satellite (6 of 8)

GLOBAL PROCESSING SUMMARY

PAGE: 7

ERBE PRODUCT: QC-26
DATE PROCESSED: 93/05/25.
SATELLITE: NOAA 9/ERBS /NOAA10
TEMPORAL SPAN: 87/01/15 0000 - 87/01/15 2359
INSTRUMENT: SCANNER
SYSTEM RELEASE: 3
CHANNEL: LW & SW
SOFTWARE VERSION: 6
UNITS: NONE
DATA ALTITUDE: REFERENCE ALTITUDE

REGIONS	NUMBER OF SATELLITES MERGED PER REGION DURING OBSERVING PERIOD
5257- 5292	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
5401- 5436	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
5545- 5580	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
5689- 5724	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
5833- 5868	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
5977- 6012	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
6121- 6156	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
6265- 6300	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
6409- 6444	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
6553- 6588	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
6697- 6732	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
6841- 6876	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
6985- 7020	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
7129- 7164	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
7273- 7308	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
7417- 7452	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
7561- 7596	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
7705- 7740	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
7849- 7884	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
7993- 8028	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
8137- 8172	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
8281- 8316	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
8425- 8460	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
8569- 8604	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
8713- 8748	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
8857- 8892	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
9001- 9036	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
9145- 9180	3 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 3 2 2 2
9289- 9324	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9433- 9468	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9577- 9612	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9721- 9756	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
9865- 9900	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
10009-10044	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
10153-10188	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
10297-10332	- -

Figure 6.2-15. Format of Global Summary Report for Multiple Satellite (7 of 8)

GLOBAL PROCESSING SUMMARY

PAGE: 8

ERBE PRODUCT: QC-26
DATE PROCESSED: 93/05/25.
SATELLITE: NOAA 9/ERBS /NOAA10
TEMPORAL SPAN: 87/01/15 0000 - 87/01/15 2359
INSTRUMENT: SCANNER
SYSTEM RELEASE: 3
CHANNEL: LW & SW
SOFTWARE VERSION: 6
UNITS: NONE
DATA ALTITUDE: REFERENCE ALTITUDE

REGIONS	NUMBER OF SATELLITES MERGED PER REGION DURING OBSERVING PERIOD																																				
5293- 5328	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
5437- 5472	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
5581- 5616	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
5725- 5760	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
5869- 5904	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
6013- 6048	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
6157- 6192	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
6301- 6336	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
6445- 6480	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
6589- 6624	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
6733- 6768	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
6877- 6912	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
7021- 7056	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
7165- 7200	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
7309- 7344	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
7453- 7488	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
7597- 7632	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
7741- 7776	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
7885- 7920	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
8029- 8064	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
8173- 8208	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
8317- 8352	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
8461- 8496	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
8605- 8640	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
8749- 8784	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
8893- 8928	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
9037- 9072	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
9181- 9216	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	2	2	2	2	2	2	2	2	2	2	2
9325- 9360	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9469- 9504	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9613- 9648	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9757- 9792	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9901- 9936	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10045-10080	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10189-10224	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10333-10368	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Figure 6.2-15. Format of Global Summary Report for Multiple Satellite (8 of 8)

6.2.8.1 Longwave Modeling. MTSA implements a longwave diurnal model in both the scanner and nonscanner base programs (SSBSSC and SSBSNS). If the algorithm used produces values greater than 400.00 wm^{-2} the modeling effort is terminated for the given day. Any modifications to the modeling algorithm or to the upper limit of 400.00 wm^{-2} will be made in Module LWMOD.

MTSA also attempts to fill in missing longwave data by interpolating and extrapolating from available hour boxes. This processing is done in Module LWFILL in both the scanner (SSBSSC) and nonscanner (SSBSNS) base programs. A more detailed description of this process is given in Section 6.2.3.3.

6.2.8.2 Shortwave Modeling. The shortwave radiant exitant values for each hour box are calculated in Modules SCAN and ADJUST in the scanner library SS1SC and Modules FILENS and ADJUST in the nonscanner library SS1NS. These calculations also make use of modeled directional values which are computed in Module ADJUST. These values are derived from the directional model file described below.

MTSA also attempts to fill in missing shortwave data by interpolating and extrapolating from available hour boxes. This processing is basically controlled from Module SWFILL which calls routines EXTRAS and INTERS to do the actual extrapolations and interpolations as needed. These routines are named the same in both the scanner base program SSBSSC and the nonscanner base program SSBSNS. This process is described in Section 6.2.3.4.

6.2.8.3 Directional Model File -- ISDMxx. This file is created by the Inversion Subsystem and is named ISDMxx where xx is the current version number (xx = 01 through 99). This file contains the directional models used in calculating the shortwave values. Any changes made to the structure of this file (e.g., as in the number of scene types), will most likely affect the following base programs, libraries and modules:

	SCANNER	NONSCANNER
	SSBSSC	SSBSNS
Base Programs	LDTABLS DIMODS EXTRAS	LDTABL DIMOD EXTRAS
	SS1SC	SS1NS
Library	SCAN ADJUST DIMODT	FILENS ADJUST DIMODT

The values in this file are updated from time to time. The Inversion subroutine sends the MTSA lead programmer a printout detailing the changes made. If there is a new version number the programmer will pass it on to the production staff on the next production run sheet.

6.2.8.4 Solar Declination File -- TSEOxx. File TSEOxx (where xx stands for the last two digits of the data year) contains the solar constant values and the solar declination angle values for each day of each month of the given year. This file is created off-line using program SSDEC (see Appendix D) in the ERBRUN account. It is listed as one of the ancillary programs in the MTSA CCL interactive procedure file. This program must be run wherever a new year of data is to be processed or whenever the current file needs to be updated. SSDEC uses the solar constant value found in the ERBE NAMELIST $NAMGLB. Whenever this value is modified, it may be necessary to recreate TSEOxx for the given year. However, the same value must be used throughout the processing of a given month of data. The same solar constant value must be used by MTSA as was used by the Inversion Subsystem.

TSEOxx is also used by the S-4 Subsystem to create its housekeeping file containing the area weighting factors and polar day-night indicators. The S-4 lead programmer must be notified whenever TSEOxx is updated so that the housekeeping file can also be updated. S-4 must also be notified whenever a

new solar declination file is created (for a new data year) so that a new housekeeping file can be created.

6.2.8.5 CCL File PSTSASU. PSTSASU contains all the CCL procedures needed to run the MTSA Subsystem, including on-line and off-line programs. PSTSASU is interactive in nature and includes menus and prompts. It prompts the user for all the parameters needed to build the submit files and the NAMELIST files.

These procedures must be reviewed carefully whenever there are changes made to the NOS system and to the system commands, especially commands involving input and output such as tape, disc, and direct access files. MTSA also makes use of microfiche. More detailed information about the CCL file PSTSASU and the I/O used by MTSA can be found in the MTSA Operator's Guide (Reference 3).

6.2.8.6 Subsystem Interface. MTSA has two subsystem interfaces. The Daily Data Base Subsystem basically rearranges the time-ordered data from the Inversion Subsystem into regionally-ordered data and passes it on to MTSA. MTSA then passes on geographically averaged data to the Regional, Zonal, and Global Output Product, S-4.

6.2.8.6.1 The Daily Data Base Interface. Any changes here will involve extensive changes throughout MTSA. The greatest impact will be in the following modules:

SCANNER - SS1SC	NONSCANNER - SS1NS
INITMS LOADSC READSD SCAN	FILES INITMN LOADMN READLK

The above modules initialize the data arrays, read the data records, and unpack the data (using ERBE utility SPREAD).

The addition or deletion of a data item will have an impact on most of the data averaging modules in the base modules.

6.2.8.6.2 The S-4 Interface. Any changes to the S-4 interface will primarily affect the base programs SSBSSC and SSBSNS. The modules which actually output data to the ID-9 data products are TRNSSS (scanner) and TRANSS (nonscanner). TRNSSS is called from REGDRS in the base program while TRANSS is called from REGDR which is in the library SS1NS (SSMNS for nonscanner multiple satellite).

6.2.8.7 Data Arrays. Any changes to the MTSA interfaces will most likely affect the data arrays. Some of the large data arrays used by MTSA are in COMMON Blocks. These tend to be the arrays containing averaged data such as the daily averages and monthly hourly averages. The data arrays containing the input data for a given region (the hour box data matrices) are normally passed as parameters from module to module in the preliminary stages of the data reduction effort involving the definition of the processing control vectors and the filling in of missing hour boxes of data.

6.2.8.8 Subroutine COMMON Block Matrix. The subroutine COMMON Block Matrix shown in Tables 6.2-18 - 6.2-24 is a cross reference between COMMON Blocks and the modules that contain them.

6.2.8.9 Module Names/Numbers Table. THe Module Names/Numbers Table (Tables 6.2-25 - 6.2-31) is a cross reference between the module names in alphabetical order with the module numbers, and also between the module numbers in increasing numerical order with the module names.

Table 6.2-18 COMMON Block Matrix - Scanner Single Satellite Library

SUBROUTINE NAMES	COMMON BLOCK NAMES														
	CHARCM	CHRDAT	CONSTS	DATES	ERROR	GLOBAL	INUNIT	LATDSC	OUTUNT	PACK	SCALE	SCIPRO	SOLAR	STATFL	
ADJUST	✔				✔	✔									
CLSESF			✔	✔			✔		✔					✔	
FILESC			✔	✔	✔	✔	✔		✔	✔	✔	✔		✔	
INITMS	✔	✔		✔		✔		✔							
LOADSC			✔		✔	✔	✔								
READSD	✔	✔	✔			✔		✔							
SCAN	✔		✔		✔	✔							✔		

Table 6.2-19 COMMON Block Matrix - Scanner Base Library

SUBROUTINE NAMES	COMMON BLOCK NAMES																											
	CDAVER	CDGMA	CHARCM	CHAVER	CHGMA	CHRDAT	CONSTS	DATES	DAVER	DGMA	ERROR	GLOBAL	GLOBL	HAVER	HGMA	INUNIT	LATDSC	MERGE	OUTUNT	PACK	SCALE	SCIPRO	SOLAR	STATFL		
ABEND												✔														
AMHSWS				✔	✔		✔							✔	✔								✔			
AMHLWS				✔			✔							✔												
AVGDLY							✔																			
AVINTS	✔	✔		✔	✔		✔		✔	✔				✔	✔											
BLKDTA	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔		
CDRANS	✔	✔		✔	✔		✔		✔	✔	✔			✔	✔								✔			
CGMASC	✔	✔	✔	✔	✔		✔		✔	✔				✔	✔											
COSZSC							✔		✔			✔											✔			
DEFPCV							✔																			
DIMODS							✔																✔			
DSWABS	✔						✔		✔														✔			
DYHRAS	✔			✔			✔		✔			✔														
FLLINS	✔	✔	✔	✔	✔		✔		✔	✔	✔	✔		✔	✔				✔					✔		
INITSC			✔			✔	✔				✔	✔	✔			✔		✔	✔		✔	✔	✔	✔		
ISCVAL							✔																			
LATDRS			✔				✔	✔			✔	✔				✔			✔			✔		✔		
LDTBLS			✔				✔				✔	✔	✔										✔			
LWFILL							✔																✔			
LWMOD			✔				✔				✔	✔	✔													
PRSTAT			✔				✔	✔	✔	✔		✔		✔	✔				✔							
PRTPCV			✔				✔	✔			✔	✔							✔							
REGDRS							✔				✔	✔							✔	✔				✔		
RITESC			✔								✔	✔								✔		✔				
SIMAVG							✔																			
STDDEV											✔	✔														
SWFILL																								✔		
TRNSMS							✔											✔		✔	✔		✔			
TRNSRS	✔	✔		✔	✔		✔		✔	✔				✔	✔					✔	✔		✔			
TRNSSS	✔	✔		✔	✔				✔	✔				✔	✔					✔						

Table 6.2-20 COMMON Block Matrix - Nonscanner Single Satellite Library

SUBROUTINE NAMES	COMMON BLOCK NAMES														
	ANBMSG	CHARCM	CONSTS	DATES	DGMA	ERROR	GLOBAL	INUNIT	LNKDAT	OUTUNT	PACK	SCALE	SOLAR	STATFL	
ADJUST	✔	✔				✔	✔								
CLOSEF			✔	✔				✔		✔				✔	
FILENS			✔				✔						✔		
FILES			✔	✔		✔	✔	✔		✔	✔	✔		✔	
INITMN		✔		✔			✔		✔						
LOADMN			✔			✔	✔	✔							
READLK		✔	✔				✔		✔						
REGDR			✔		✔	✔	✔			✔	✔		✔		

Table 6.2-21 COMMON Block Matrix - Nonscanner Base Library

SUBROUTINE NAMES	COMMON BLOCK NAMES																										
	ALBMSG	CHARCM	CONSTS	DATES	DAVER	DGMA	ERROR	GLOBAL	GLOBL	HAVER	HGMA	INUNIT	LNKDAT	MERGE	OUTUNT	PACK	SCALE	SOLAR	STATFL								
ABEND								✔																			
AVGDLY			✔																								
AVINIT			✔		✔	✔				✔	✔																
AVMHLW			✔							✔																	
AVMHSW			✔							✔	✔							✔									
BLKDTA	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔								
CDRAN			✔		✔	✔	✔			✔	✔							✔									
CALGMA		✔	✔		✔	✔				✔	✔																
COSZEN			✔		✔				✔									✔									
DAYHRA		✔	✔		✔			✔																			
DEFPCV			✔																								
DIMOD			✔															✔									
DSWALB			✔		✔													✔									
FILLIN		✔	✔		✔	✔	✔	✔		✔	✔				✔				✔								
INIT		✔	✔				✔	✔	✔			✔		✔	✔		✔	✔	✔								
ISCUAL			✔																								
LATDRV		✔	✔	✔				✔							✔												
LDTABL		✔	✔				✔	✔	✔									✔									
LWFILL			✔																								
LWMOD		✔	✔				✔	✔	✔									✔									
PRSTAT		✔	✔	✔	✔	✔		✔		✔	✔				✔												
PRTPCV		✔	✔	✔			✔	✔							✔												
RITEAG		✔					✔	✔								✔											
RUNAVG							✔																				
SIMAVG			✔																								
STDDEV							✔	✔																			
SWFILL																		✔									
TRANSM			✔											✔		✔	✔	✔									
TRANSR			✔		✔	✔				✔	✔					✔	✔	✔									
TRANSS			✔		✔	✔				✔	✔					✔											
TSAVER	✔							✔																			

Table 6.2-22 COMMON Block Matrix - Multiple Satellite Preprocessor

		COMMON BLOCK NAMES														
		DATES	DIFF	ERROR	FIT	GLOBAL	GLOBL	MCONST	MMERGE	MPACK	MSOLAR	UNITS				
SUBROUTINE NAMES	BLKDTA	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔				
	MCLOSE	✔			✔			✔	✔			✔				
	MOCOSZN						✔	✔			✔					
	MERGES		✔					✔	✔		✔					
	MFILES	✔		✔	✔	✔		✔				✔				
	MINIT			✔		✔	✔	✔	✔			✔				
	MLOAD		✔	✔	✔	✔		✔	✔	✔	✔	✔				
	MLDTBL			✔		✔	✔	✔			✔					
	MTRANS			✔		✔		✔				✔				
	MVERIF	✔		✔		✔		✔	✔	✔		✔				
	PLACE							✔								
	RDDATA			✔		✔		✔	✔	✔						
	SATDAT							✔	✔		✔					
	UNSCAL							✔								
	WRDATA			✔		✔						✔				

Table 6.2-23 COMMON Block Matrix - Scanner Multiple Satellite Library

		COMMON BLOCK NAMES														
		CONSTS	DATES	ERROR	GLOBAL	INUNIT	MERGE	OUTUNT	PACK	SCALE	SCIPRO	SOLAR	STATFL			
SUBROUTINE NAMES	CLSESF	✔	✔			✔		✔					✔			
	DUMRD	✔		✔	✔		✔		✔							
	FILESC	✔	✔	✔	✔		✔	✔	✔	✔	✔		✔			
	LOADSC	✔		✔	✔		✔	✔	✔		✔	✔				
	RDFILE	✔		✔	✔		✔									
	SELECT	✔					✔		✔	✔						
	UNSCAL	✔														
	VERIFY	✔	✔	✔	✔	✔	✔	✔	✔	✔						

Table 6.2-24 COMMON Block Matrix - Nonscanner Multiple Satellite Library

		COMMON BLOCK NAMES														
		CONSTS	DATES	DGMA	ERROR	GLOBAL	INUNIT	MERGE	OUTUNT	PACK	SCALE	STATFL				
SUBROUTINE NAMES	CLOSEF	✔	✔				✔		✔			✔				
	DUMRD	✔			✔	✔		✔		✔						
	FILES	✔	✔		✔	✔		✔	✔	✔	✔	✔				
	LOADMN	✔			✔	✔		✔	✔	✔						
	RDFILE	✔			✔	✔		✔								
	REGDR	✔		✔	✔	✔			✔	✔		✔				
	SELECT	✔						✔		✔	✔					
	UNSCAL	✔														
	VERIFY	✔	✔		✔	✔	✔	✔	✔	✔	✔					

Table 6.2-25 Module Names/Numbers - Scanner Base Library

NAMES	NUMBERS	NUMBERS	NAMES
ABEND	6.2.6	6.2A	TSAVSC
AMHLWS	6.2.4.3.3.5A	6.2.1A	BLKDTA
AMHSWS	6.2.4.3.3.4A	6.2.2A	INITSC
AVGDLY	6.2.4.3.3.3	6.2.2.1A	LDTBLS
AVINTS	6.2.4.3.3.1A	6.2.3.2.8A	TRNSRS
BLKDTA	6.2.1A	6.2.4A	LATDRS
BRKOUT	G.6.2.1	6.2.4.1A	COSZSC
CDRANS	6.2.4.3.6A	6.2.4.2A	DIMODS
CGMASC	6.2.4.3.5A	6.2.4.3A	REGDRS
COSZSC	6.2.4.1A	6.2.4.3.2A	TRNSMS
DEFPCV	6.2.4.3.3.2.1	6.2.4.3.3A	DYHRAS
DIMODS	6.2.4.2A	6.2.4.3.3.1A	AVINTS
DSWABS	6.2.4.3.4A	6.2.4.3.3.2A	FLLINS
DYHRAS	6.2.4.3.3A	6.2.4.3.3.2.1	DEFPCV
EXTRAS	G.6.2.5	6.2.4.3.3.2.2	PRTPCV
FLLINS	6.2.4.3.3.2A	6.2.4.3.3.2.3	REPCV
INDAY	6.2.4.3.3.2.6.1	6.2.4.3.3.2.4	SWFILL
INITSC	6.2.2A	6.2.4.3.3.2.4.1	INTERS
INTERS	6.2.4.3.3.2.4.1	6.2.4.3.3.2.5	LWFILL
ISCVAL	G.6.2.8	6.2.4.3.3.2.6	LWMOD
IWORDS	G.6.2.7	6.2.4.3.3.2.6.1	INDAY
LATDRS	6.2.4A	6.2.4.3.3.3	AVGDLY
LDTBLS	6.2.2.1A	6.2.4.3.3.4A	AMHSWS
LWFILL	6.2.4.3.3.2.5	6.2.4.3.3.5A	AMHLWS
LWMOD	6.2.4.3.3.2.6	6.2.4.3.4A	DSWABS
PRSTAT	6.2.4.3.7	6.2.4.3.5	SIMAVG
PRTPCV	6.2.4.3.3.2.2	6.2.4.3.5A	CGMASC
REGDRS	6.2.4.3A	6.2.4.3.6A	CDRANS
REPCV	6.2.4.3.3.2.3	6.2.4.3.7	PRSTAT
RITESC	6.2.4.3.10A	6.2.4.3.8.1	SPLIT
SIMAVG	6.2.4.3.5	6.2.4.3.9A	TRNSSS
SPLIT	6.2.4.3.8.1	6.2.4.3.10A	RITESC
STDDEV	G.6.2.4	6.2.6	ABEND
SWFILL	6.2.4.3.3.2.4	G.6.2.1	BRKOUT
TRNSMS	6.2.4.3.2A	G.6.2.4	STDDEV
TRNSRS	6.2.3.2.8A	G.6.2.5	EXTRAS
TRNSSS	6.2.4.3.9A	G.6.2.7	IWORDS
TSAVSC	6.2.A	G.6.2.8	ISCVAL

Table 6.2-26 Module Names/Numbers - Nonscanner Base Library

NAMES	NUMBERS	NUMBERS	NAMES
ABEND	6.2.6	6.2B	TSAVER
AVGDLY	6.2.4.3.3.3	6.2.1B	BLKDTA
AVINIT	6.2.4.3.3.1B	6.2.2B	INIT
AVMHLW	6.2.4.3.3.5B	6.2.2.1B	LDTBL
AVMHSW	6.2.4.3.3.4B	6.2.3.2.8B	TRANSR
BLKDTA	6.2.1B	6.2.4B	LATDRV
BRKOUT	G.6.2.1	6.2.4.1B	COSZEN
CADRAN	6.2.4.3.6B	6.2.4.2B	DIMOD
CALGMA	6.2.4.3.5B	6.2.4.3.2B	TRANSM
COSZEN	6.2.4.1B	6.2.4.3.3B	DAYHRA
DAYHRA	6.2.4.3.3B	6.2.4.3.3.1B	AVINIT
DEFPCV	6.2.4.3.3.2.1	6.2.4.3.3.2B	FILLIN
DIMOD	6.2.4.2B	6.2.4.3.3.2.1	DEFPCV
DSWALB	6.2.4.3.4B	6.2.4.3.3.2.2	PRTPCV
EXTRAS	G.6.2.5	6.2.4.3.3.2.4	REPCV
FILLIN	6.2.4.3.3.2B	6.2.4.3.3.2.5	SWFILL
INDAY	6.2.4.3.3.2.7.1	6.2.4.3.3.2.5.1	INTERS
INIT	6.2.2B	6.2.4.3.3.2.6	LWFILL
INTERS	6.2.4.3.3.2.5.1	6.2.4.3.3.2.7	LWMOD
ISCVAL	G.6.2.8	6.2.4.3.3.2.7.1	INDAY
IWORDS	G.6.2.7	6.2.4.3.3.3	AVGDLY
LATDRV	6.2.4B	6.2.4.3.3.4B	ACMHSW
LDTABL	6.2.2.1B	6.2.4.3.3.5B	ACMHLW
LWFILL	6.2.4.3.3.2.6	6.2.4.3.4B	DSWALB
LWMOD	6.2.4.3.3.2.7	6.2.4.3.5	SIMAVG
PRSTAT	6.2.4.3.7	6.2.4.3.5B	CALGMA
PRTPCV	6.2.4.3.3.2.2	6.2.4.3.6B	CADRAN
REPCV	6.2.4.3.3.2.4	6.2.4.3.7	PRSTAT
RITEAG	6.2.4.3.10B	6.2.4.3.8.1	SPLIT
RUNAVG	G.6.2.6	6.2.4.3.9B	TRANSS
SIMAVG	6.2.4.3.5	6.2.4.3.10B	RITEAG
SPLIT	6.2.4.3.8.1	6.2.6	ABEND
STDDEV	G.6.2.4	G.6.2.1	BRKOUT
SWFILL	6.2.4.3.3.2.5	G.6.2.4	STDDEV
TRANSM	6.2.4.3.2B	G.6.2.5	EXTRAS
TRANSR	6.2.3.2.8B	G.6.2.6	RUNAVG
TRANSS	6.2.4.3.9B	G.6.2.7	IWORDS
TSAVER	6.2B	G.6.2.8	ISCVAL

Table 6.2-27 Module Names/Numbers - Scanner Single Satellite Library

NAMES	NUMBERS	NUMBERS	NAMES
ADJUST	S.6.2.4.3.1.2.1A	S.6.2.3A	FILESC
CLSESF	S.6.2.5A	S.6.2.3.1A	INITMS
DIMODT	S.6.2.4.3.1.2.1.1.	S.6.2.4.3.1A	LOADSC
FILESC	S.6.2.3A	S.6.2.4.3.1.1A	READSD
INITMS	S.6.2.3.1A	S.6.2.4.3.1.2A	SCAN
LOADSC	S.6.2.4.3.1A	S.6.2.4.3.1.2.1A	ADJUST
READSD	S.6.2.4.3.1.1A	S.6.2.4.3.1.2.1.1	DIMODT
SCAN	S.6.2.4.3.1.2A	S.6.2.5A	CLSESF

Table 6.2-28 Module Names/Numbers - Scanner Multiple Satellite Library

NAMES	NUMBERS	NUMBERS	NAMES
CLSESF	M.6.2.5	M.6.2.3A	FILESC
DUMRD	M.6.2.4.3.1.2	M.6.2.3.1A	VERIFY
FILESC	M.6.2.3A	M.6.2.4.3.1A	LOADSC
LOADSC	M.6.2.4.3.1A	M.6.2.4.3.1.1	RDFILE
RDFILE	M.6.2.4.3.1.1	M.6.2.4.3.1.2	DUMRD
SELECT	M.6.2.4.3.1.3A	M.6.2.4.3.1.3A	SELECT
UNSCAL	M.6.2.4.3.1.3.1	M.6.2.4.3.1.3.1	UNSCAL
VERIFY	M.6.2.3.1A	M.6.2.5	CLSESF

Table 6.2-29 Module Names/Numbers - Nonscanner Single Satellite Library

NAMES	NUMBERS	NUMBERS	NAMES
ACCNS	S.6.2.4.3.1.3.1B	S.6.2.3B	FILES
ADJUST	S.6.2.4.3.1.2.1B	S.6.2.3.1B	INITMN
CLOSEF	S.6.2.5B	S.6.2.4.3B	REGDR
DIMODT	S.6.2.4.3.1.2.1.1	S.6.2.4.3.1B	LOADMN
FILENS	S.6.2.4.3.1.3B	S.6.2.4.3.1.1B	READLK
FILES	S.6.2.3B	S.6.2.4.3.1.2.1B	ADJUST
INITMN	S.6.2.3.1B	S.6.2.4.3.1.2.1.1	DIMODT
LOADMN	S.6.2.4.3.1B	S.6.2.4.3.1.3B	FILENS
READLK	S.6.2.4.3.1.1B	S.6.2.4.3.1.3.1B	ACCNS
REGDR	S.6.2.4.3B	S.6.2.5B	CLOSEF

Table 6.2-30 Module Names/Numbers - Nonscanner Multiple Satellite Library

NAMES	NUMBERS	NUMBERS	NAMES
CLOSEF	M.6.2.5	M.6.2.3	FILES
DUMRD	M.6.2.4.3.1.2	M.6.2.3.1	VERIFY
FILES	M.6.2.3	M.6.2.4.3	REGDR
LOADMN	M.6.2.4.3.1	M.6.2.4.3.1	LOADMN
RDFILE	M.6.2.4.3.1.1	M.6.2.4.3.1.1	RDFILE
REGDR	M.6.2.4.3	M.6.2.4.3.1.2	DUMRD
SELECT	M.6.2.4.3.1.3	M.6.2.4.3.1.3	SELECT
UNSCAL	M.6.2.4.3.1.3.1	M.6.2.4.3.1.3.1	UNSCAL
VERIFY	M.6.2.3.1	M.6.2.5	CLOSEF

Table 6.2-31 Module Names/Numbers - Multiple Satellite Preprocessor

NAMES	NUMBERS	NUMBERS	NAMES
BLKDTA	6.2.1P	6.2P	MULT
BRKOUT	G.6.2.1	6.2.1P	BLKDTA
IWORDS	G.6.2.7	6.2.2P	MINIT
MCLOSE	6.2.5.P	6.2.2.1P	MLDTBL
MCOSZN	6.2.4.1P	6.2.3P	MFILES
MERGES	6.2.4.2.1.3P	6.2.3.1P	MVERIF
MFILES	6.2.3P	6.2.4P	MLATDR
MINIT	6.2.2P	6.2.4.1P	MCOSZN
MLATDR	6.2.4P	6.2.4.2P	MREGDR
MLDTBL	6.2.2.1P	6.2.4.2.1P	MLOAD
MLOAD	6.2.4.2.1P	6.2.4.2.1.1P	RDDATA
MREGDR	6.2.4.2P	6.2.4.2.1.2P	WRDATA
MTRANS	6.2.4.2.1.4P	6.2.4.2.1.3P	MERGES
MULT	6.2P	6.2.4.2.1.3.1P	SATDAT
MVERIF	6.2.3.1P	6.2.4.2.1.3.1.1P	UNSCAL
PLACE	6.2.4.2.1.3.2P	6.2.4.2.1.3.2P	PLACE
RDDATA	6.2.4.2.1.1P	6.2.4.2.1.4P	MTRANS
RUNAVG	G.6.2.6	6.2.5P	MCLOSE
SATDAT	6.2.4.2.1.3.1P	G.6.2.1	BRKOUT
UNSCAL	6.2.4.2.1.3.1.1P	G.6.2.6	RUNAVG
WRDATA	6.2.4.2.1.2P	G.6.2.7	IWORDS

References

1. ERBE Data Management System Reference Manual, Volume VIII, Utilities and User's Guide, October 1986.

2. ERBE Science Reference Manual, Revision 1, April, 1981.

3. Monthly Time/Space Averaging Operator's Guide, May, 1985.

4. ERBE Data Management System Earth Radiant Exitance and Albedo, Scanner S-9, Nonscanner S-10, User's Guides, June 1985.

5. Reviews of Geophysics, Vol. 24, No 2, Pages 422-438, Development of Algorithms for Understanding the Temporal and Spatial Variability of the Earth's Radiation Budget, May 1986.

6. ERBE Data Management System Reference Manual, Volume V, Inversion, 1986.

7. Journal of Climate and Applied Meteorology, Vol 23, No. 1, Comparison of Longwave Diurnal Models Applied to Simulations of the Earth Radiation Budget Experiment, January 1984.

8. NASA Technical Memorandum 83233, Grid Systems for Earth Radiation Budget Experiment Applications, December 1981.

APPENDIX A

Modeling Shortwave Radiant Exitance

The regionally averaged SWRE at time t is assumed to be given by:

$$M_{SW}(t) = E(d)\mu(t) \sum_{i=1}^{N} f_i a_i(t) \qquad \text{(A-1)}$$

where f_i is the fraction of the underlying scene of type i, E(d) is the distance corrected solar constant at $0^h0^m0^S$ UT for the day being processed, μ is the cosine of the solar zenith angle at time t, and a_i is the albedo for scene type i. Note that since μ is a function of t, a_i is, too. However, modeling albedo directly in terms of μ gives a model which applies globally for any season. N is the number of distinct scene types, which is not only the number of scene types for which independent albedo models can be produced a priori, but must also be the number of scene types which can be uniquely identified by the Inversion algorithms. This concept is easily understood as a set of surface types, like land or ocean, with clouds as an additional scene type. The geographic scene types can be stored a priori, so the Inversion algorithms need only estimate cloud cover. However, such a simplified approach can be shown to be inadequate in several ways. One proposal, since rejected, noted differences in reflective properties of various cloud types and suggested segregating clouds by altitude with different models for low, middle, and high clouds. The proposal implemented in Release 3 is based on evidence which suggests that, for example, the albedo of land area with 50% cloud cover is higher than that given by $.5a_l + .5a_c$. This result suggests either a rejection of linear hypotheses or the creation of a new “scene type” which defines partly cloudy behavior over land as a separate identifiable scene type. The latter course is followed in Release 3 software, with the introduction of several different “scenes”, including partly and mostly cloudy conditions over some of the geographical scene types as identified by Inversion, based on known surface features and cloud discrimination algorithms. Implementation of this or any other approach rests on the derivation of appropriate bidirectional (for Inversion) and directional models from existing data bases. Table A-1 shows the format for the directional albedo models file required for MTSA. These

are tabulated for our purposes for each scene type, in ten even increments of μ,centered at .95,.85,...,.05, as shown in Table A-1. Parameterization of this part of the software allows for easy access to the model values, and even for changes of the number of models, but retains as an essential feature the linear combination of scene fractions, however "scene" is defined, along with their albedos (or "normalized albedos" in the case of nonscanner measurements, see Section 6.2.3.5).

Albedo is modeled in the following way. Given the albedo for overhead sun ($\mu = 1$), the albedo for scene type i is:

$$a_i(\mu) = a_i(1)\delta_i(\mu) \tag{A-2}$$

where $\delta_i(\mu)$ is the directional model for scene type i as a function of cosine of the solar zenith angle. Then, the albedo at some other zenith angle, represented by μ' is

$$a_i(\mu') = a_i(1)\delta_i(\mu') \tag{A-3}$$

Substituting for $a_i(1)$ gives

$$a_i(\mu') = a_i(\mu)\delta_i(\mu')/\delta_i(\mu) \tag{A-4}$$

The SWRE at time (t) is given in terms of observations at time t_{obs} by

$$M_{SW}(t) = E\mu(t)\sum_{i=1}^{N} a_i(\mu(t))f_i(t) \tag{A-5}$$

Let us assume constant meteorology between t_{obs} and t, i.e., $f_i(t) = f_i(t_{obs})$. Then, substituting for albedo at t_{obs},

$$M_{SW}(t) = E\mu(t)\sum_{i=1}^{N} a_i(\mu(t_{obs}))\frac{\delta_i(\mu(t))f_i(t_{obs})}{\delta_i(\mu(t_{obs}))} \tag{A-6}$$

The constant meteorology assumption is a critical one and represents the largest potential error source in MTSA. Its implementation within the sparse measurements of the MTSA Data Matrix is discussed in the main text. A detailed discussion of the algorithms used can be found in Reviews of Geophysics (Reference 5).

Table A-1. Normalized Directional Models

		COS (SUN ZENITH ANGLE)											
Scanner Index		0.95	0.85	0.75	0.65	0.55	0.43	0.35	0.25	0.15	0.05	Nonscanner Index	
(Clear)	1	1.00000	1.07895	1.19737	1.32895	1.51316	1.75000	2.11842	2.67105	3.52632	4.39474	1	(Ocean)
	2	1.00000	.97813	1.01875	1.04375	1.09375	1.16438	1.28125	1.44375	1.68750	2.03750	2	(Land)
	3	1.00000	1.00450	1.00899	1.01289	1.01588	1.01738	1.01514	1.00525	.97437	.92747	3	(Snow)
	4	1.00000	1.02000	1.04800	1.08300	1.12600	1.17600	1.23400	1.30000	1.37200	1.45300	4	(Desert)
	5+	1.00000	1.01059	1.07627	1.13559	1.22881	1.35297	1.55085	1.83898	2.27966	2.79661		Clear
(Partly Cloudy)	6	1.00000	1.12000	1.20000	1.36000	1.48000	1.72000	2.00000	2.40000	2.92000	3.56000	5	(Ocean)
	7*	1.00000	1.03756	1.07981	1.13146	1.19249	1.29108	1.41315	1.59624	1.77465	2.01174	6	(Land/
	8*	1.00000	1.03756	1.07981	1.13146	1.19249	1.29108	1.41315	1.59624	1.77465	2.01174		Desert)++
	9*	1.00000	1.03756	1.07981	1.13146	1.19249	1.29108	1.41315	1.59624	1.77465	2.01174		Partly
	10+	1.00000	1.06805	1.12426	1.21598	1.29882	1.44970	1.63018	1.89349	2.19822	2.58432		Cloudy
(Mostly Cloudy)	11	1.00000	1.07843	1.13725	1.23529	1.29412	1.43137	1.56863	1.75686	1.96078	2.19608	7	(Ocean)
	12*	1.00000	1.04700	1.10300	1.17000	1.24400	1.33200	1.42800	1.53400	1.65000	1.77500	8	(Land/
	13*	1.00000	1.04700	1.10300	1.17000	1.24400	1.33200	1.42800	1.53400	1.65000	1.77500		Desert)++
	14*	1.00000	1.04700	1.10300	1.17000	1.24400	1.33200	1.42800	1.53400	1.65000	1.77500		Mostly
	15+	1.00000	1.08468	1.16216	1.25586	1.35135	1.46613	1.61171	1.77658	1.94685	2.14775		Cloudy
(Over-Cast)	16	1.00000	1.02353	1.07059	1.12941	1.17647	1.24706	1.31765	1.38824	1.45882	1.51765	9	Overcast

Directional Model Index Selection for Scanner Measurements

Geotype(G) = 1 (Ocean)
2 (Land)
3 (Snow)
4 (Desert)
5 (Land/Ocean)+

and f_i = 1 (Clear)
2 (Partly cloudy)
3 (Mostly cloudy
4 (Overcast)

Then if f_i = 1, INDEX = G
2, INDEX = G + 5
3, INDEX = G + 10
4, INDEX = 16

*Storing separate but identical models for land, snow, desert, and land/desert mix makes easier the generation of a scanner model index from cloud and geotype information.

+These are linear composite models (50-50 for each constituent), not independent models, which function as separate scene types for scanner processing.

++Snow geotypes must be either clear or overcast.

APPENDIX B

A Diurnal Model for Longwave Radiant Exitance

Many land areas of the Earth exhibit regular diurnal variations in longwave radiation due to surface temperature fluctuations as described in Reference 7. Such behavior can easily be seen over cloud-free land, and is especially prominent over desert areas, where the day-night variation of LW radiation can be on the order of 100 w/m^2.

In ERBE processing, all regions are first modeled with the linear interpolation (LI) discussed in the text. Then, data taken over land regions are searched for points which straddle night-day boundaries. If there are one or more daylight points surrounded by nighttime data on both sides, then the model may be applied. If any of the daytime points are less than or equal to either nighttime point or if there is only one daytime measurement in the hour following sunrise or preceding sunset, then the LI model is retained. If the model appears applicable to the observed data, a half-sine curve is calculated to fill in all the daylight hours. It is constrained to be equal to the average of the surrounding nighttime points at the half-day time for the region and day, and is fit to the available daytime points with a standard least squares technique. Specifically, for the midpoint latitude λ of the region, and solar declination Δ, the half day length in hours is given by

$$h = \left|\cos^{-1}(-\tan\Delta\tan\lambda)/\theta\right| \qquad \text{(B-1)}$$

where $\theta = 0.26179938$ is the rotational rate of the earth in radians/hour. The model for a day is then of the form

$$y(t) = LWRE(t) - \overline{LWRE}(night) = a\sin(90^o t/h) \qquad \text{(B-2)}$$

where a is a constant to be determined from the daytime data, t is the time in hours from the start of daylight, and $\overline{LWRE}(night)$ is the average of the preceding and following nighttime values. For a set of N daytime measurements, the least squares value of a is given by

$$a = \frac{\sum_{i=1}^{N} y_i \sin(90^o t_i / h)}{\sum_{i=1}^{N} \sin_i^2(90^o t_i / h)} \qquad \text{(B-3)}$$

The model is applied at the local half hour to generate LWRE within the T/S Data Matrix, replacing the LI values that were there before. If the projected amplitude of the modeled value of LWRE exceeds 400 $Wm.^2$, the model is not applied. The implementation of equation B-1, found in Subroutine COSZEN is as follows:

```
CS= -SIN(SODEC) * SIN(CLAT) / COS(SODEC) * COS(CLAT)
IF(CS>LE>-1.0) THEN SUNHR = PI
ELSE IF (CS.GE.1.0) THEN SUNHR = 0.0
ELSE SUNHR = ACOS(CS)
ENDIF
HAFDAY(DAY) = SUNHR/EROTRT
```

Equations B-2 and B-3 are implemented in Subroutine LWMOD. The pseudo code for obtaining the least square coefficient follows.

Do for all real daytime data between the two night points:

```
TIME  = (IXL - 0.5 - (12.0-HAFDAY(IN))) where IXL is the local hour box
SINI  = SIN(TIME/2.0/HAFDAY(IN) * PI)
COEF1 = COEF1 + (RADLW(IHOUR,IDAY) - AVGRAD) * SINI
COEF2 = COEF2 + (SINI * SINI)
```

then

```
COEF  = COEF1/COEF2
```

Fill in all daytime hours with the following trigonometric function:

$$RADLW(IXL,IYL) = AVGRAD + COEF*SINI$$

The flow of Subroutine LWMOD is found in Figure B-1.

Within the specific framework of the ERBE scene fraction definitions (see Appendix A and Table A-1), the LW model is applied to scanner measurements when the geotype indicator is 2(land), 4(desert), or 5(a 50/50 mix of the land and ocean models). For nonscanner, where different geotypes may occur in the same scene, the model is applied subject to the criterion that the 5.0° or 10.0° cloud free land plus desert geotype fraction (position 30 on the input data record) is greater than 0.5. This is an admittedly arbitrary choice which guarantees that at least half of the underlying geotype is land or desert. The presence of substantial cloudy or non-land contributions to the LW radiant exitance means only that application of the LW diurnal model will have no effect on the linear interpolation results, analogously to cloudy scenes in the scanner processing.

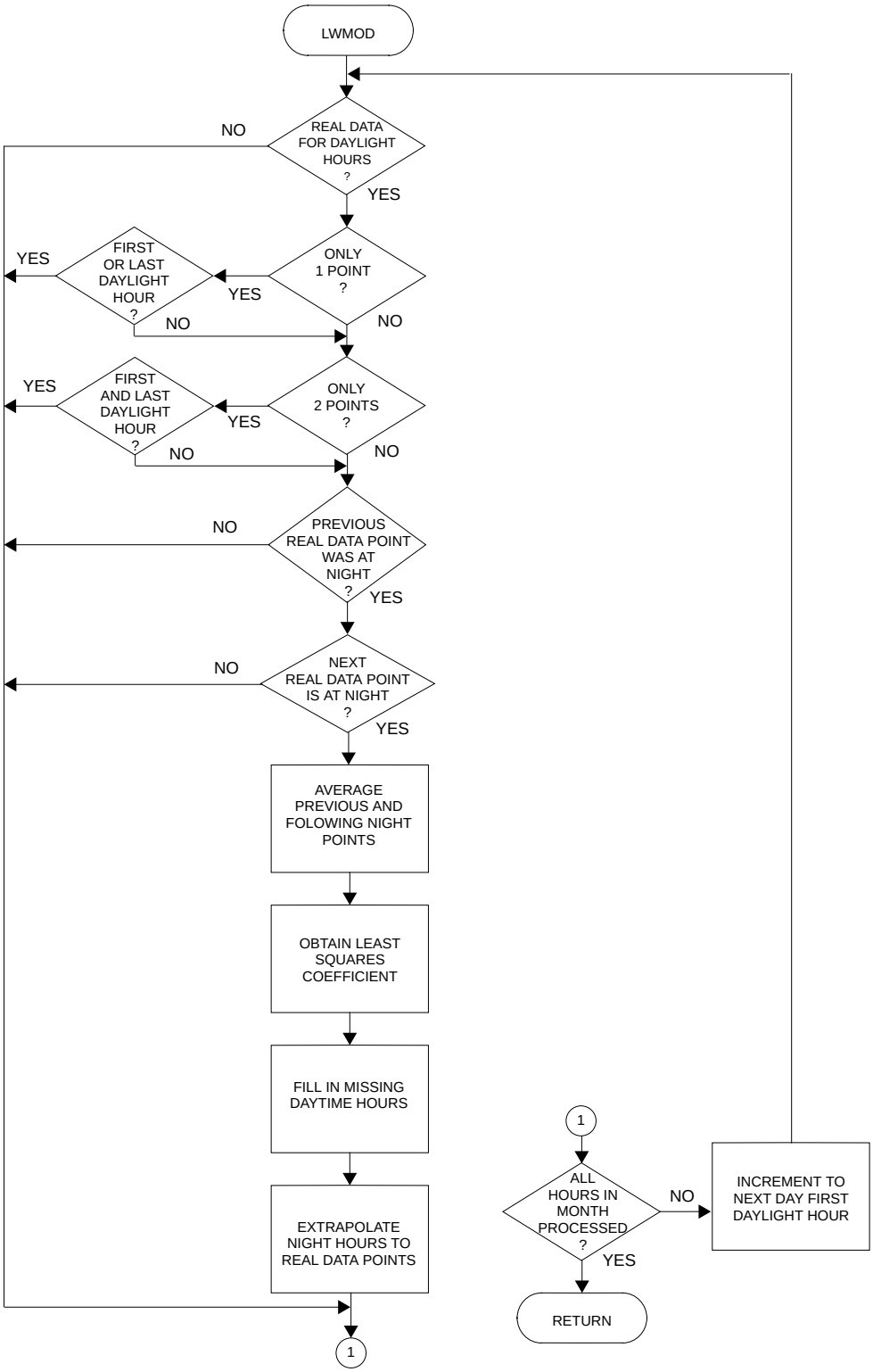


Figure B-1. Flow of Module LWMOD

APPENDIX C

The ERBE Grid System

The basic spatial reference used by ERBE is the 2.5° x 2.5° grid system described in Reference 8. To simplify data handling this grid system will be translated into a 72 x 144 (colatitude, longitude) matrix where colatitude is defined from north to south as a number between 0° to 180° and longitude is defined west to east as a number between 0° to 360°. Given a set of colatitude and longitude values the corresponding matrix index may be calculated using the following equations.

$$
\begin{aligned}
\text{LATIN} &= \text{INT}((\text{COLATITUDE}/S) + 1), \text{ when colatitude} \neq 180^\circ \\
&= n/2 \quad , \text{ when colatitude} = 180^\circ \\
\text{LONGIN} &= \text{INT}((\text{LONGITUDE}/S) + 1), \text{ when longitude} \neq 360^\circ \\
&= n \quad , \text{ when longitude} = 360^\circ
\end{aligned}
$$

where

S = grid size in degrees (2.5 for 2.5° grid)
n = number of longitude boxes at any latitude (144 for 2.5° grid)
INT = integer function of FORTRAN

The tests at colatitude = 180° and longitude = 360° are given to prevent computation of a wrong index value. For example, the 2.5° indices computed for these values using the main equations are LATIN = 73, LONGIN = 145. In this grid system the colatitude boxes are arranged from north to south and the longitude boxes from west to east as illustrated in Figure C-1.

The region number will be generated using a consecutively numbered box system starting at the north pole and Greenwich Meridian, and winding eastward around the globe. This number can be calculated using the following:

$$\text{IREG} = ((\text{LATIN} - 1)*n) + \text{LONGIN}$$

NOTE: Scanner latitude band one, consisting of regions 1 - 144, and latitude band 72, consisting of regions 10225 - 10368, are treated as one region.

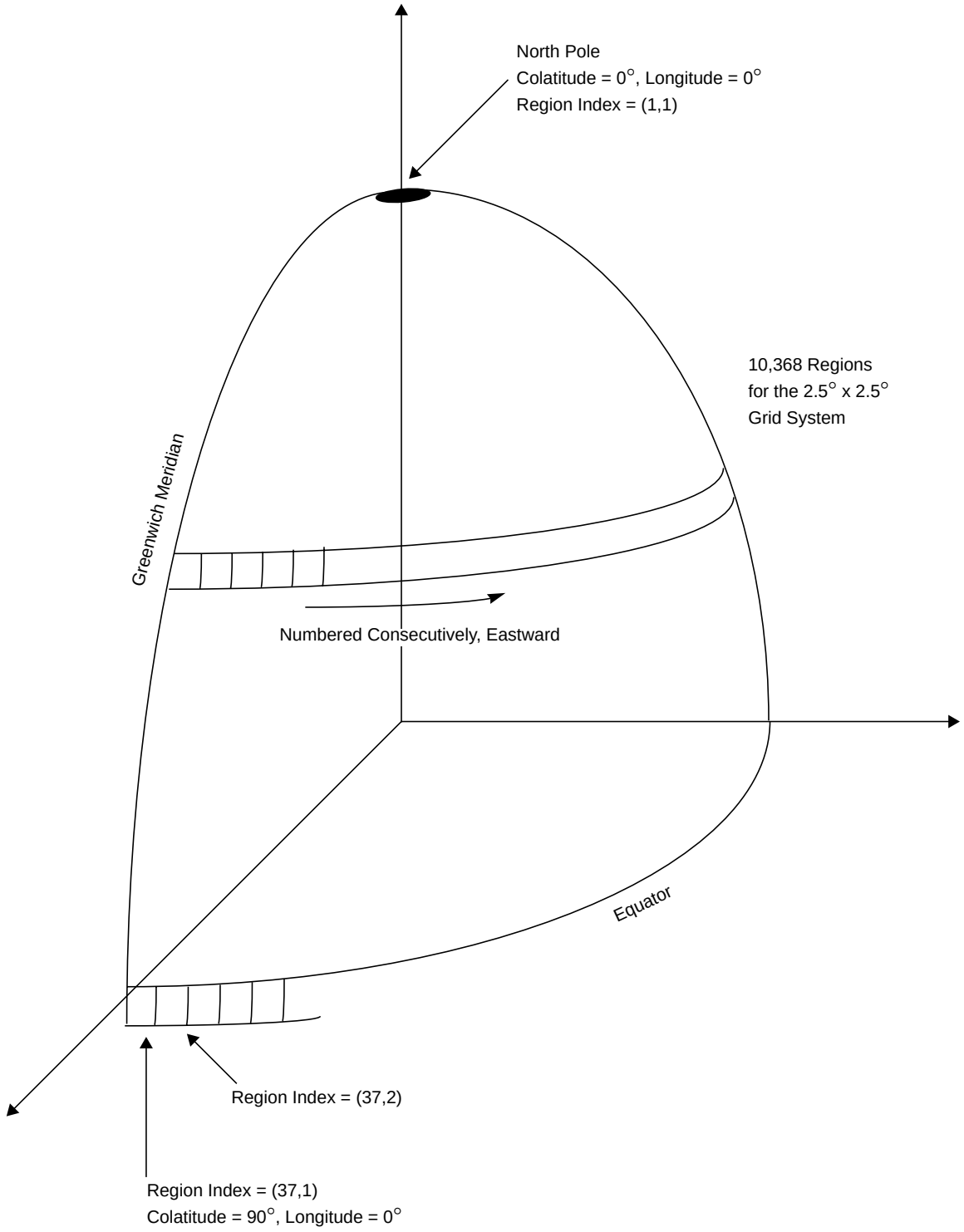


Figure C-1. The ERBE Grid System

APPENDIX D

Calculation of Tables for Solar Declination and Distance Corrected Solar Constant

The Monthly Time Space Averaging Subsystem uses tabulated values of solar declination and solar constant, and Output Products uses solar declination. For both Subsystems the values are required for each day and are always referenced to $0^h0^m0^s$ UT. A FORTRAN V program for generating these values from an analytic Earth ephemeris is given in Table D-1. Sample output is given in Table D-2. Such analytic calculations are sufficiently accurate for the intended purpose.

Given the position vector of the Sum (km) on day d, the distance correction for the solar constant on day d is

$$D(d) = A^2/R_S^2 \qquad \text{(D-1)}$$

where A is 1 Astronomical Unit (km), and R_s is the Earth-Sun distance (km, center-to-center)

$$R_S^2 = X_S^2 + Y_S^2 + Z_S^2 \qquad \text{(D-2)}$$

The solar declination D(d) is

$$D(d) = \sin^{-1}(Z_S/R_S) \qquad \text{(D-3)}$$

The table covers one calendar year and is generated according to

```
DO 100 I = 1,12
•
•
WRITE(unit no.) IYR[last 2 digits],I,MONTH(I),(DEC(J),DC(J),J=1,MONTH(I))
•
•
100 CONTINUE
```

To generate the distance corrected solar constant, E(d), for day “d,” the value D(d) is multiplied by the solar constant at 1 AU. The solar constant value is stored as an ERBE global constant.

Table D-1. FORTRAN V Program for Generating Tabulated Values of Solar Declination and Solar Constant (1 of 6)

Table D-1. FORTRAN V Program for Generating Tabulated Values of Solar Declination and Solar Constant (2 of 6)

Table D-1. FORTRAN V Program for Generating Tabulated Values of Solar Declination and Solar Constant (3 of 6)

Table D-1. FORTRAN V Program for Generating Tabulated Values of Solar Declination and Solar Constant (4 of 6)

Table D-1. FORTRAN V Program for Generating Tabulated Values of Solar Declination and Solar Constant (5 of 6)

Table D-1. FORTRAN V Program for Generating Tabulated Values of Solar Declination and Solar Constant (6 of 6)

Table D-2. Output from ERBEDEC (1 of 4)

Table D-2. Output from ERBEDEC (2 of 4)

Table D-2. Output from ERBEDEC (3 of 4)

Table D-2. Output from ERBEDEC (4 of 4)