2.2. D1 DATA (3-HOURLY, 280 KM EQUAL-AREA GRID)

2.2.1. ARCHIVE TAPE LAYOUT

Each D1 archive tape has 4 header files, followed by a variable number of data files depending on how many days are in the month. Each month of data is archived on two tapes chronologically as follows:

Tape 1: Days 1 through 16
Tape 2: Days 17 through the end of the month

Each file represents one time sample at 3 hr intervals (from UTC 00 to UTC 21 each day); actual samples are within ± 1.5 hours of the nominal time. Thus, there are 16 × 8 = 128 files on the first tape for each month and from 96 to 120 files on the second tape for each month.

Table 2.2.1. D1 Archive Tape Layout

FILE	CONTENTS	FORMAT	RECORD LENGTH (BYTES)
1	README file	ASCII	80
2	Table of Contents	ASCII	80
3	Read Software	ASCII	80
4	Ancillary Data Table	ASCII	80
5-end	D1 Cloud Data	Binary	20200

Note: *The GPC produces archive tapes using IBM standard label format which means that there are label records written before and after each file on the tape. On IBM systems, these labels provide information to the operating system about the name and format of the file and will appear transparent to the user. On non-IBM systems these label records will appear as extra short files surrounding each file listed above and should be skipped by the user. The presence or absence of these files depends on which archive supplies tape copies to the user, as they may either provide an exact copy (labels present) or a modified copy (labels absent).*

2.2.2. HEADER FILE CONTENTS

File 1 is the **README** file that contains ASCII text providing descriptive information about the tape format and contents, similar to what is written in this section. The first line of text (80 bytes) gives the ISCCP tape designator code that identifies the contents (Table 2.5.12).

File 2 is the **Table of Contents** that lists the date and spatial coverage of each data file on the tape in ASCII columns defined in Table 2.2.2. See Table 2.5.1 for Satellite ID code definitions and Table 2.5.2 for Satellite position definitions.

Table 2.2.2. Table of Contents Layout.

COLUMN	DESCRIPTION
1	File number
2	Year (83 - 99)
3	Month (1 - 12)
4	Day (1 - 31)
5	Time UTC (00, 03, 06...21)
6	Fraction (%) of good data
7	Fraction (%) of empty map grid cells
8	Satellite ID for Western Pacific/Australia position
9	Satellite ID for Europe/Africa position
10	Satellite ID for Eastern Pacific position
11	Satellite ID for North/South American position
12	Satellite ID for Indian Ocean/Asia position
13	Satellite ID for Afternoon polar orbit
14	Satellite ID for Morning polar orbit

File 3 contains a sample **FORTRAN program** and subroutines for reading, decoding and using D1 data (see Section 2.2.4).

Program SAMPLE:	Example of how to use these subroutines
Subroutine D1OPEN:	Open a D1 file and initialize
Subroutine D1READ:	Unpack D1 data for one latitude band into integer count values
Subroutine D1REC:	Used by D1READ to unpack a logical record
Subroutine D1PHYS:	Convert integer counts in latitude band to physical values
Subroutine MIDPRS:	Calculate mid-layer pressures for map grid cell
Subroutine RDANC:	Read ancillary data file
Subroutine PRINTI:	Print count values for one map grid cell
Subroutine PRINTR:	Print physical values for one map grid cell
Subroutine CENTER:	Calculate center longitude/latitude of map grid cell
Subroutine TOTIR:	Calculate total IR radiance
Subroutine TOTVIS:	Calculate total VIS radiance
Subroutine CLDHGT:	Calculate cloud top height in meters
Subroutine EQ2SQ:	Convert equal-area map to equal-angle map
BLOCK DATA:	Conversion tables and equal-area grid information

The programs should work as written on most UNIX systems. For DOS, MacIntosh or VAX systems, the OPEN statement in subroutine D1OPEN may need to be modified.

File 4 contains the **Ancillary Data Table** that lists characteristics of each map grid cell (see Section 3.1.1) in ASCII columns defined in Table 2.2.3.

Table 2.2.3. Ancillary Data Table Layout.

COLUMN	DESCRIPTION
1	ISCCP map grid cell number (1 - 6596)
2	Equal-area latitude index (south-to-north = 1 - 72)
3	Equal-area longitude index (west-to-east, variable up to 144)
4	Western-most equal-angle longitude index (1 - 144)
5	Eastern-most equal-angle longitude index (1 - 144)
6	Map grid cell center latitude in degrees
7	Map grid cell center longitude in degrees
8	Map grid cell area (km•)
9	Land cover fraction (%)
10	Mean topographic altitude (m)
11	Vegetation type (see Table 2.5.3)
12	Preferred Satellite Position Code (see Table 2.5.1)
13	Second Choice
14	Third Choice
15	Fourth Choice

2.2.3. DATA FILE CONTENTS

Each D1 data file (Figure 2.2) reports 202 variables for each of the 6596 map grid cells in the ISCCP Equal-Area map grid (see Section 3.1.1). Each variable is reported in a single byte representing a coded value from 0-255 (see Sections 2.4 and 3.1.2), so there are 202 bytes in each map grid cell. Each physical record is 20200 bytes in length, consisting of a 202 byte record prefix, followed by up to 99 map grid cells of 202 bytes each. All map grid cells and variables are present, even when data are missing. Missing data are indicated by code values of 255. Contents of the prefix are given in Table 2.2.4 and of each map grid cell in Table 2.2.5.

Each D1 data file represents the merging of analysis results from all available satellites within a 3-hour time period into the global map grid; however, in any one map grid cell, all values reported are from a single satellite. Each map grid cell location has a pre-defined hierarchy of satellite preference, given in the Ancillary Data Table (Header File 4).

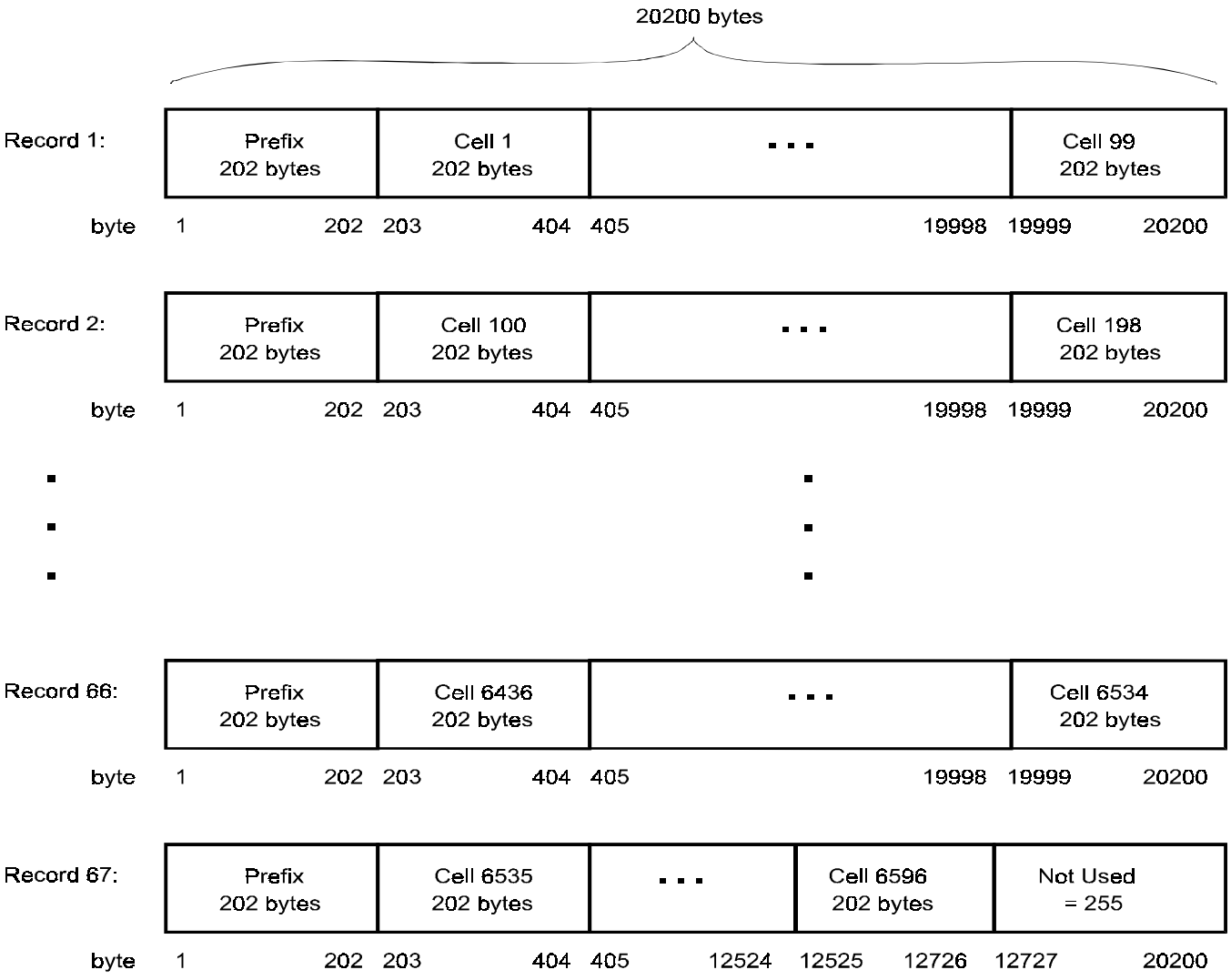

Figure 2.2. D1 Data File Layout.

Table 2.2.4. D1 Data Record Prefix Layout.

BYTE No.	DESCRIPTION
1	Record number in file (1 - 67)
2	File number on archive tape (5 - 132)
3	Year (83 - 99)
4	Month (1 - 12)
5	Day (1 - 31)
6	Time UTC (00, 03, 06....21)
7	Beginning equal-area latitude index in record
8	Beginning equal-area longitude index in record
9	Ending equal-area latitude index in record
10	Ending equal-area longitude index in record
11 - 202	Filled with 255

Table 2.2.5. D1 Data Map Grid Cell Layout. (see Table 2.5.4 for definitions of abbreviations and units, Table 2.5.5 for definitions of radiance threshold categories and Table 2.5.7 for cloud type definitions). ***Notes:*** *Variables labeled with "d" are defined only for local daytime and are undefined at night (undefined = 255). "VIS-adjusted" indicates that the pixel data include adjustments dependent on VIS data, whereas "unadjusted" means only IR data are used (see Section 3.1.7).*

BYTE No.	DESCRIPTION
	MAP GRID CELL IDENTIFICATION
1	Latitude index (equal-area and equal-angle)
2	Longitude index (equal-area)
3	Western-most longitude index (equal-angle)
4	Eastern-most longitude index (equal-angle)
5	Satellite ID code (see Table 2.5.1)
6	Day/night/land/water/coast code (see Table 2.5.6)
7	Ice/snow cover
8	MUE = cosine of satellite zenith angle * 100 (0-100)
9d	MU0 = cosine of solar zenith angle * 100 (0-100)
10d	PHI = relative azimuth angle (0-180 degrees)
	PIXEL COUNTERS
11	Total number of pixels
12	Number of cloudy pixels
13	Number of IR-cloudy pixels
14d	Number of IR-only-cloudy pixels
15	Number of NIR-cloudy pixels
16	Number of NIR-only-cloudy pixels
17	Number of IR-marginally-cloudy pixels
18d	Number of VIS/IR-marginally-cloudy pixels
19	Number of NIR-only-marginally-cloudy pixels

Continued.

Table 2.2.5. (continued).

BYTE No.	DESCRIPTION
	CLOUD DETECTION STATISTICS
20	Number of pixels with IR long-term statistics
21	Ratio number of IR-clear pixels < clear IR to number > clear IR
22d	Ratio number of VIS/IR-clear pixels > clear VIS to number < clear VIS
	CLOUD TOP PRESSURE (PC) DISTRIBUTION (UNADJUSTED)
23	Number of IR-cloudy pixels $10 \le PC \le 180$ mb
24	Number of IR-cloudy pixels $180 < PC \le 310$ mb
25	Number of IR-cloudy pixels $310 < PC \le 440$ mb
26	Number of IR-cloudy pixels $440 < PC \le 560$ mb
27	Number of IR-cloudy pixels $560 < PC \le 680$ mb
28	Number of IR-cloudy pixels $680 < PC \le 800$ mb
29	Number of IR-cloudy pixels $800 < PC \le 1000$ mb
	CLOUD TOP PRESSURE-OPTICAL THICKNESS (TAU) DISTRIBUTION (VIS-ADJUSTED)
30d	Number of cloudy pixels $10 \le PC \le 180$ mb, $0.02 \le TAU \le 1.27$
31d	Number of cloudy pixels $10 \le PC \le 180$ mb, $1.27 < TAU \le 3.55$
32d	Number of cloudy pixels $10 \le PC \le 180$ mb, $3.55 < TAU \le 9.38$
33d	Number of cloudy pixels $10 \le PC \le 180$ mb, $9.38 < TAU \le 22.63$
34d	Number of cloudy pixels $10 \le PC \le 180$ mb, $22.63 < TAU \le 60.36$
35d	Number of cloudy pixels $10 \le PC \le 180$ mb, $60.36 < TAU \le 378.65$
36d	Number of cloudy pixels $180 < PC \le 310$ mb, $0.02 \le TAU \le 1.27$
37d	Number of cloudy pixels $180 < PC \le 310$ mb, $1.27 < TAU \le 3.55$
38d	Number of cloudy pixels $180 < PC \le 310$ mb, $3.55 < TAU \le 9.38$
39d	Number of cloudy pixels $180 < PC \le 310$ mb, $9.38 < TAU \le 22.63$
40d	Number of cloudy pixels $180 < PC \le 310$ mb, $22.63 < TAU \le 60.36$
41d	Number of cloudy pixels $180 < PC \le 310$ mb, $60.36 < TAU \le 378.65$
42d	Number of cloudy pixels $310 < PC \le 440$ mb, $0.02 \le TAU \le 1.27$
43d	Number of cloudy pixels $310 < PC \le 440$ mb, $1.27 < TAU \le 3.55$
44d	Number of cloudy pixels $310 < PC \le 440$ mb, $3.55 < TAU \le 9.38$
45d	Number of cloudy pixels $310 < PC \le 440$ mb, $9.38 < TAU \le 22.63$
46d	Number of cloudy pixels $310 < PC \le 440$ mb, $22.63 < TAU \le 60.36$
47d	Number of cloudy pixels $310 < PC \le 440$ mb, $60.36 < TAU \le 378.65$
48d	Number of cloudy pixels $440 < PC \le 560$ mb, $0.02 \le TAU \le 1.27$
49d	Number of cloudy pixels $440 < PC \le 560$ mb, $1.27 < TAU \le 3.55$
50d	Number of cloudy pixels $440 < PC \le 560$ mb, $3.55 < TAU \le 9.38$
51d	Number of cloudy pixels $440 < PC \le 560$ mb, $9.38 < TAU \le 22.63$
52d	Number of cloudy pixels $440 < PC \le 560$ mb, $22.63 < TAU \le 60.36$
53d	Number of cloudy pixels $440 < PC \le 560$ mb, $60.36 < TAU \le 378.65$

Continued.

Table 2.2.5. (continued).

BYTE No.	DESCRIPTION
54d	Number of cloudy pixels 560 < PC ≤ 680 mb, 0.02 ≤ TAU ≤ 1.27
55d	Number of cloudy pixels 560 < PC ≤ 680 mb, 1.27 < TAU ≤ 3.55
56d	Number of cloudy pixels 560 < PC ≤ 680 mb, 3.55 < TAU ≤ 9.38
57d	Number of cloudy pixels 560 < PC ≤ 680 mb, 9.38 < TAU ≤ 22.63
58d	Number of cloudy pixels 560 < PC ≤ 680 mb, 22.63 < TAU ≤ 60.36
59d	Number of cloudy pixels 560 < PC ≤ 680 mb, 60.36 < TAU ≤ 378.65
60d	Number of cloudy pixels 680 < PC ≤ 800 mb, 0.02 ≤ TAU ≤ 1.27
61d	Number of cloudy pixels 680 < PC ≤ 800 mb, 1.27 < TAU ≤ 3.55
62d	Number of cloudy pixels 680 < PC ≤ 800 mb, 3.55 < TAU ≤ 9.38
63d	Number of cloudy pixels 680 < PC ≤ 800 mb, 9.38 < TAU ≤ 22.63
64d	Number of cloudy pixels 680 < PC ≤ 800 mb, 22.63 < TAU ≤ 60.36
65d	Number of cloudy pixels 680 < PC ≤ 800 mb, 60.36 < TAU ≤ 378.65
66d	Number of cloudy pixels 800 < PC ≤ 1000 mb, 0.02 ≤ TAU ≤ 1.27
67d	Number of cloudy pixels 800 < PC ≤ 1000 mb, 1.27 < TAU ≤ 3.55
68d	Number of cloudy pixels 800 < PC ≤ 1000 mb, 3.55 < TAU ≤ 9.38
69d	Number of cloudy pixels 800 < PC ≤ 1000 mb, 9.38 < TAU ≤ 22.63
70d	Number of cloudy pixels 800 < PC ≤ 1000 mb, 22.63 < TAU ≤ 60.36
71d	Number of cloudy pixels 800 < PC ≤ 1000 mb, 60.36 < TAU ≤ 378.65
72d	Number of cloudy pixels for cloud type 4 = Cumulus, ice
73d	Number of cloudy pixels for cloud type 5 = Stratocumulus, ice
74d	Number of cloudy pixels for cloud type 6 = Stratus, ice
75d	Number of cloudy pixels for cloud type 10 = Altocumulus, ice
76d	Number of cloudy pixels for cloud type 11 = Altostratus, ice
77d	Number of cloudy pixels for cloud type 12 = Nimbostratus, ice
	CLOUD TOP PRESSURES (PC)
78	Mean PC for cloudy pixels (VIS-adjusted day, unadjusted night)
79	Mean PC for IR-cloudy pixels (unadjusted)
80d	Mean PC for IR-only-cloudy pixels (VIS-adjusted)
81	Mean PC for NIR-only-cloudy pixels (unadjusted)
82	Mean PC for IR-marginally-cloudy pixels (unadjusted)
83d	Mean PC for VIS/IR-marginally-cloudy pixels (VIS-adjusted)
84	Sigma-PC for IR-cloudy pixels (unadjusted)

Continued.

Table 2.2.5. (continued).

BYTE No.	DESCRIPTION
	CLOUD TOP TEMPERATURES (TC)
85	Mean TC for cloudy pixels (VIS-adjusted day, unadjusted night)
86	Mean TC for IR-cloudy pixels (unadjusted)
87d	Mean TC for IR-only-cloudy pixels (VIS-adjusted)
88	Mean TC for NIR-only-cloudy pixels (unadjusted)
89	Mean TC for IR-marginally-cloudy pixels (unadjusted)
90d	Mean TC for VIS/IR-marginally-cloudy pixels (VIS-adjusted)
91	Sigma-TC for IR-cloudy pixels (unadjusted)
	CLOUD OPTICAL THICKNESSES (TAU)
92d	Mean TAU for cloudy pixels
93d	Mean TAU for IR-cloudy pixels
94d	Mean TAU for IR-only-cloudy pixels
95d	Mean TAU for NIR-only-cloudy pixels
96d	Mean TAU for IR-marginally-cloudy pixels
97d	Mean TAU for VIS/IR-marginally-cloudy pixels
98d	Sigma-TAU for IR-cloudy pixels
	CLOUD WATER PATHS (WP)
99d	Mean WP for cloudy pixels
100d	Mean WP for IR-cloudy pixels
101d	Mean WP for IR-only-cloudy pixels
102d	Mean WP for NIR-only-cloudy pixels
103d	Mean WP for IR-marginally-cloudy pixels
104d	Mean WP for VIS/IR-marginally-cloudy pixels
105d	Sigma-WP for IR-cloudy pixels
	CLOUD TOP TEMPERATURE (TC) DISTRIBUTION (UNADJUSTED)
106	Mean TC for IR-cloudy pixels $10 \leq PC \leq 180$ mb
107	Mean TC for IR-cloudy pixels $180 < PC \leq 310$ mb
108	Mean TC for IR-cloudy pixels $310 < PC \leq 440$ mb
109	Mean TC for IR-cloudy pixels $440 < PC \leq 560$ mb
110	Mean TC for IR-cloudy pixels $560 < PC \leq 680$ mb
111	Mean TC for IR-cloudy pixels $680 < PC \leq 800$ mb
112	Mean TC for IR-cloudy pixels $800 < PC \leq 1000$ mb
	PROPERTIES OF LOW-LEVEL CLOUD TYPES (VIS-ADJUSTED)
113d	Mean TC for cloud type 1 = Cumulus, liquid
114d	Mean TAU for cloud type 1
115d	Mean WP for cloud type 1
116d	Mean TC for cloud type 2 = Stratocumulus, liquid
117d	Mean TAU for cloud type 2
118d	Mean WP for cloud type 2

Continued.

Table 2.2.5. (continued).

BYTE No.	DESCRIPTION
119d	Mean TC for cloud type 3 = Stratus, liquid
120d	Mean TAU for cloud type 3
121d	Mean WP for cloud type 3
122d	Mean TC for cloud type 4 = Cumulus, ice
123d	Mean TAU for cloud type 4
124d	Mean WP for cloud type 4
125d	Mean TC for cloud type 5 = Stratocumulus, ice
126d	Mean TAU for cloud type 5
127d	Mean WP for cloud type 5
128d	Mean TC for cloud type 6 = Stratus, ice
129d	Mean TAU for cloud type 6
130d	Mean WP for cloud type 6
	PROPERTIES OF MIDDLE-LEVEL CLOUD TYPES (VIS-ADJUSTED)
131d	Mean TC for cloud type 7 = Altocumulus, liquid
132d	Mean TAU for cloud type 7
133d	Mean WP for cloud type 7
134d	Mean TC for cloud type 8 = Altostratus, liquid
135d	Mean TAU for cloud type 8
136d	Mean WP for cloud type 8
137d	Mean TC for cloud type 9 = Nimbostratus, liquid
138d	Mean TAU for cloud type 9
139d	Mean WP for cloud type 9
140d	Mean TC for cloud type 10 = Altocumulus, ice
141d	Mean TAU for cloud type 10
142d	Mean WP for cloud type 10
143d	Mean TC for cloud type 11 = Altostratus, ice
144d	Mean TAU for cloud type 11
145d	Mean WP for cloud type 11
146d	Mean TC for cloud type 12 = Nimbostratus, ice
147d	Mean TAU for cloud type 12
148d	Mean WP for cloud type 12

Continued.

Table 2.2.5. (continued).

BYTE No.	DESCRIPTION
	PROPERTIES OF HIGH-LEVEL CLOUD TYPES (VIS-ADJUSTED)
149d	Mean TC for cloud type 13 = Cirrus
150d	Mean TAU for cloud type 13
151d	Mean WP for cloud type 13
152d	Mean TC for cloud type 14 = Cirrostratus
153d	Mean TAU for cloud type 14
154d	Mean WP for cloud type 14
155d	Mean TC for cloud type 15 = Deep convective
156d	Mean TAU for cloud type 15
157d	Mean WP for cloud type 15
	SURFACE SKIN TEMPERATURES (TS)
158	Mean TS from clear sky composite
159	Mean TS for clear pixels
160	Mean TS for IR-clear pixels
161d	Mean TS for VIS/IR-clear pixels
162	Sigma-TS for IR-clear pixels
	SURFACE VISIBLE REFLECTANCES (RS)
163d	Mean RS from clear sky composite
164d	Mean RS for clear pixels
165d	Mean RS for IR-clear pixels
166d	Mean RS for VIS/IR-clear pixels
167d	Sigma-RS for IR-clear pixels
	NEAR-IR REFLECTANCE
168d	Mean NIR reflectance from clear sky composite
	IR RADIANCES
169	Mean IR radiance for IR-cloudy pixels
170	Sigma-IR radiance for IR-cloudy pixels
171d	Mean IR radiance for VIS/IR-cloudy pixels
172	Mean IR radiance for IR-clear pixels
173	Sigma-IR radiance for IR-clear pixels
174d	Mean IR radiance for VIS/IR-clear pixels
175	Mean IR radiance from clear sky composite

Continued.

Table 2.2.5. (continued).

BYTE No.	DESCRIPTION
	VIS RADIANCES
176d	Mean VIS radiance for VIS/IR-cloudy pixels
177d	Sigma-VIS radiance for VIS/IR-cloudy pixels
178d	Mean VIS radiance for IR-cloudy pixels
179d	Mean VIS radiance for VIS/IR-clear pixels
180d	Sigma-VIS radiance for VIS/IR-clear pixels
181d	Mean VIS radiance for IR-clear pixels
182d	Mean VIS radiance from clear sky composite
	TOVS ATMOSPHERIC INFORMATION
183	Atmospheric data origin code (see Table 2.5.8)
184	Surface pressure (PS) (based on topography)
185	Near-surface air temperature (TSA)
186	Temperature at 900 mb (T)
187	Temperature at 740 mb (T)
188	Temperature at 620 mb (T)
189	Temperature at 500 mb (T)
190	Temperature at 375 mb (T)
191	Temperature at 245 mb (T)
192	Temperature at 115 mb (T)
193	Tropopause pressure (PT)
194	Tropopause temperature (TT)
195	Stratosphere temperature at 50 mb (T)
196	Stratosphere temperature at 15 mb (T)
197	Precipitable water for 1000-800 mb (PW)
198	Precipitable water for 800-680 mb (PW)
199	Precipitable water for 680-560 mb (PW)
200	Precipitable water for 560-440 mb (PW)
201	Precipitable water for 440-310 mb (PW)
202	Ozone column abundance (O3)

Note: *Additional variables are calculated in the D1READ program provided: cloud amounts (%), cloud top height in meters, total IR radiance, total VIS radiance, and layer mid-point pressures. Cloud amounts are not explicitly reported in D1 data; rather they are calculated by dividing the number of cloudy pixels in each category by the total number of pixels in each map grid cell.*