2.3. DX DATA (3-HOURLY, 30 KM SAMPLED IMAGE PIXELS)

2.3.1. ARCHIVE TAPE LAYOUT

Each DX archive tape has 1 header file, followed by a variable number of data files. Data files vary in length and are written to tape until the tape is full. Data are arranged chronologically on the tape. Typically, there are from 50 to 100 files on each tape.

Table 2.3.1. DX Archive Tape Layout.

FILE	CONTENTS	FORMAT	RECORD LENGTH (BYTES)
1 2-end	Table of Contents DX Cloud Data	EBCDIC Binary	80 30720

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).*

2.3.2. HEADER FILE CONTENTS

File 1 is the **Table of Contents** file that lists the date and time of each file on the tape in ASCII columns defined in Table 2.3.2.

Table 2.3.2. Table of Contents Layout.

COLUMN	DESCRIPTION
1	Satellite ID name (Table 2.5.1 and Table 2.5.9)
2	Date/Time (YYMMDDHH = Year, Month, Day, Hour UTC)
3	Record Format (F = fixed length records)
4	Record Length
5	Number of Records in file
6	Internal use only
7	Production date
8	Production time

2.3.3. DATA FILE CONTENTS

Each DX data file (Figure 2.3) reports up to 45 variables for each pixel in the field of view of a particular satellite or in a particular satellite sector (see Table 2.5.9) for a particular 3-hour time slot (image). Latitude and Longitude for each pixel are given, as well as X,Y coordinates for a fixed map projection (see Section 3.2.2). Missing images and pixels with no data are not reported. The number of

variables reported for a particular pixel depends on whether it is a daytime or nighttime pixel and whether there are additional wavelength measurements available. Daytime variables are not present for nighttime pixels and additional wavelength measurements and corresponding analysis results are only reported when available from that particular satellite.

Data are packed into fixed length records of 30720 bytes each. The first physical record in the file is the image header record. The remaining records contain the pixel-level data. Each data record consists of a prefix area containing location information followed by a data area containing the packed pixel data, followed by padding to the end of the record (pad value = 255). A data record contains a variable number of whole pixels. All pixel data are reported as single byte values from 0 to 255, with 255 reserved to represent missing data. Contents of the header record are given in Table 2.3.3 and of the data record in Table 2.3.4.

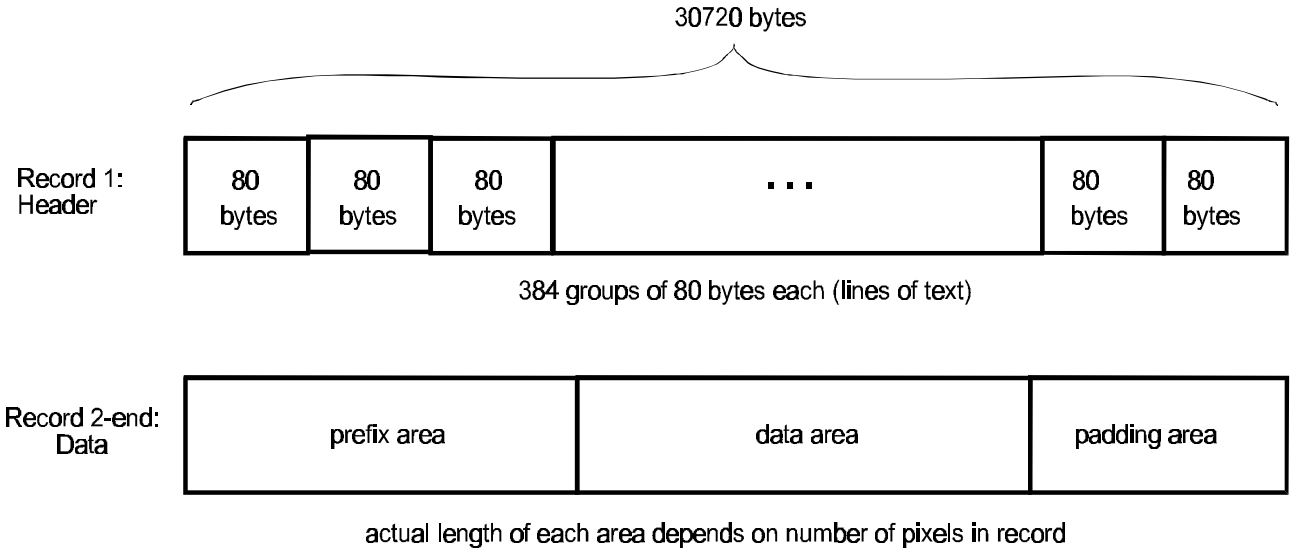

Figure 2.3. DX Data File Layout.

Table 2.3.3. DX Data Header Record Layout. See Table 2.5.1 for satellite ID codes and Table 2.5.9 for satellite type codes.

LINE (80 BYTES EACH)	DESCRIPTION (ASCII)
1	Year, Month, Day, UTC (1-8), Satellite ID code, Satellite Type Code (SATTYP), Number of channels present (NCHANS), Night Image flag
2	Production date
3	Production time
4	Input data identifier (internal use only)
5-100	Blank
101-135	Title, units, format for selected DX variables (for conversion to HDF format)
136-384	Blank

Table 2.3.4. DX Data Record Layout. Second column gives the FORTRAN variable name used in the DXREAD program.

No. BYTES	NAME	DESCRIPTION
	PREFIX AREA	
4	IWEST	Western-most longitude (0-3600 degrees*10)
4	IEAST	Eastern-most longitude (0-3600 degrees*10)
4	INORTH	Northern-most latitude (0-1800 degrees*10)
4	ISOUTH	Southern-most latitude (0-1800 degrees*10)
4	NPIX	Number of pixels reported in data area
4	IOUT	Number of bytes in packed data BUFFER
2*NPIX	LONBUF(NPIX)	Longitudes for NPIX pixels (0-3600 degrees*10)
2*NPIX	LATBUF(NPIX)	Latitudes for NPIX pixels (0-1800 degrees*10)
2*NPIX	XBUF(NPIX)	X-positions for NPIX pixels (1-480)
2*NPIX	YBUF(NPIX)	Y-positions for NPIX pixels (1-550)
	DATA AREA	
1*IOUT	BUFFER(IOUT)	Packed pixel data for NPIX pixels

Note: *When a pixel's data will not fit entirely in the remaining bytes of a record, that remainder is unused (filled with byte values = 255).*

BUFFER contains the data for each of NPIX pixels. Pixel data are divided into six sections (Figure 2.4); not all sections are present for all pixels. Daytime sections (S2, S4) are present only for daytime pixels and the extra wavelength sections (Add1, Add3) are present only for satellites that actually report such information (Figure 2.4). The DXREAD program (see Section 2.3.4) unpacks BUFFER one pixel at a time, putting the unpacked variables into a COMMON block.

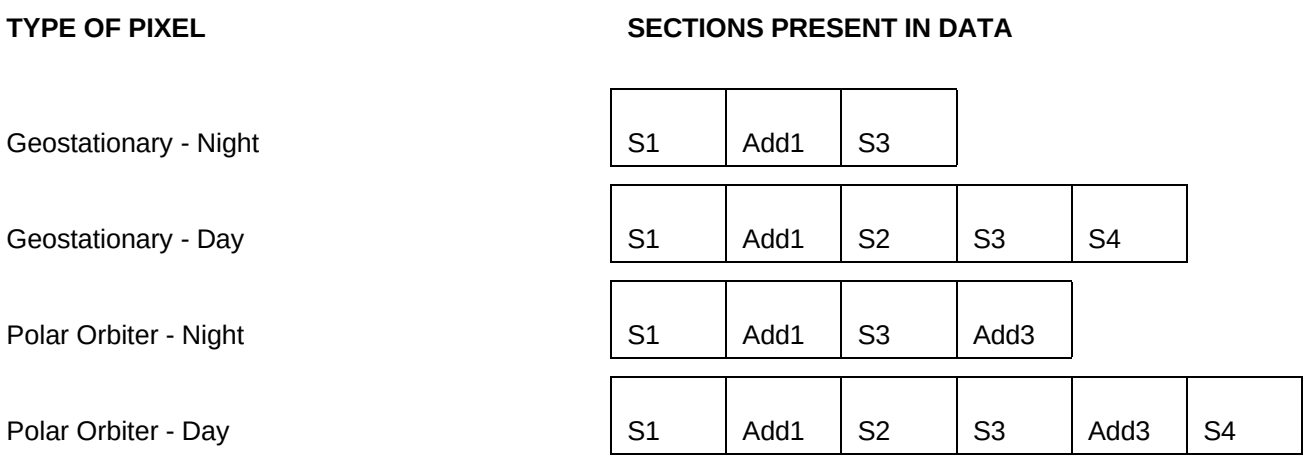

Figure 2.4. DX data packed pixel layout.

Table 2.3.5. DX Data Section Layouts. See Table 2.5.4 for definitions of abbreviations and units and Table 2.5.5 for definitions of radiance threshold categories. The NAME column gives the FORTRAN variable names as defined in the DXREAD program. ***Note:*** *Variables marked with '*' are for internal use only.*

Section S1: 5 bytes = 40 bits, always present

BIT No.	No. BITS	NAME	DESCRIPTION
1	1	NODAY*	BX night flag (0-1), 1 = Sections S2,S4 not present
2	1	BXSHOR*	BX shore flag (0-1)
3	1	LNDWTR	Land/water flag (0-1), 1 = water pixel
4	1	HITOPO	Topography flag (0-1), 1 = high topography pixel
5-6	2	SNOICE	Snow/ice code (0-3) (See Table 2.5.10)
7-8	2	TIMSPA*	Time/space test result (0-3)
9-13	5	ICSLOG*	IR clear sky composite logic code (0-24)
14-16	3	BXITHR*	First IR threshold result (0-5)
17-24	8	MUE	Cosine of satellite zenith angle * 100 (0-100)
25-32	8	IRAD	IR radiance (0-254 counts)
33-40	8	BXICSR*	First IR clear sky radiance (0-254 counts)

Section Add1: 0-3 bytes = 0-24 bits, actual number of bytes present = NCHANS – 2 (from image header)

BIT No.	No. BITS	NAME	DESCRIPTION
1-8	8	ARAD(1)	First extra wavelength radiance (0-254 counts) (present only when NCHANS > 2)
9-16	8	ARAD(2)	Second extra wavelength radiance (0-254 counts) (present only when NCHANS > 3)
17-24	8	ARAD(3)	Third extra wavelength radiance (0-254 counts) (present only when NCHANS > 4)

Section S2: 5 bytes = 40 bits, present only when NODAY = 0 (from section S1)

BIT No.	No. BITS	NAME	DESCRIPTION
1	1	GLINT	Glint flag (0-1), 1 = glint condition exists
2-5	4	VCSLOG*	VIS clear sky composite logic code (0-14)
6-8	3	BXVTHR*	First VIS threshold result (0-5)
9-16	8	MU0	Cosine of solar zenith angle * 100 (0-100)
17-24	8	PHI	Relative azimuth angle (0-180 degrees)
25-32	8	VRAD	VIS radiance (0-254 counts)
33-40	8	BXVCSR*	First VIS clear sky radiance (0-254 counts)

Table 2.3.5. (continued).

Section S3: 7 bytes = 56 bits, always present.

BIT No.	No. BITS	NAME	DESCRIPTION
1	1	DAYNIT	Day/Night flag (0-1), 1 = night pixel (no VIS)
2-4	3	ITHR	Final IR threshold result (0-5), 4,5 = cloudy
5-7	3	VTHR	Final VIS threshold result (0-5), 4,5 = cloudy
8	1	SHORE	Shore flag (0-1), 1 = near-coastal pixel
9-12	4	IRET*	IR retrieval code (0-12)
13-16	4	ICSRET*	IR clear sky composite retrieval code (0-12)
17-24	8	ICSRAD	IR clear sky composite radiance (0-254 counts)
25-32	8	ITMP	IR-retrieved cloud top or surface temperature (0-254 counts)
33-40	8	IPRS	IR-retrieved cloud top or surface pressure (0-254 counts)
41-48	8	ICSTMP	IR-retrieved clear sky composite temperature (0-254 counts)
49-56	8	ICSPRS	IR-retrieved clear sky composite pressure (0-254 counts)

Section Add3: 3 bytes = 24 bits, present only when SATTYP = 1 OR 2 OR -3

BIT No.	No. BITS	NAME	DESCRIPTION
1-8	8	NREF	NIR reflectivity (0-254 counts)
9-16	8	NTHR	NIR threshold result (1-13), > 8 = cloudy
17-24	8	NCSREF	NIR clear sky composite reflectance (0-254 counts)

Section S4: 9 bytes = 72 bits, present only when NODAY = 0 (from Section S1).

BIT No.	No. BITS	NAME	DESCRIPTION
1-4	4	VRET*	VIS retrieval code (0-14)
5-8	4	VCSRET*	VIS clear sky composite retrieval code (0-14)
9-16	8	VCSRAD	VIS clear sky composite radiance (0-254 counts)
17-24	8	VALBTA	VIS-retrieved liquid cloud tau or surface reflectance (0-254 counts)
25-32	8	VCSALB	VIS-retrieved clear sky composite reflectance (0-254 counts)
33-40	8	VTMP	VIS-adjusted cloud top temperature (0-254 counts)
41-48	8	VPRS	VIS-adjusted cloud top pressure (0-254 counts)
49-56	8	VTAUIC	VIS-retrieved ice cloud tau (0-254 counts)
57-64	8	VTMPIC	VIS-adjusted ice cloud top temperature (0-254 counts)
64-72	8	VPRSIC	VIS-adjusted ice cloud top pressure (0-254 counts)

2.3.4. READ SOFTWARE

The DXREAD FORTRAN software may be downloaded from the ISCCP WWW Home Page at URL **http://isccp.giss.nasa.gov** or from NASA Langley Research Center DAAC. The program gives an example of how to use the subroutines. Subroutine DXTABS is called first to initialize tables required for unpacking bits. Subroutine DXOPEN is called once per data file to open and initialize variables. Then Subroutine DXREAD is called repeatedly until end of file to unpack one pixel at a time into a COMMON block as integer count values.

The actual cloudy/clear decision for each pixel is calculated in the DXREAD program by testing the various threshold result codes (see Table 2.5.5) as follows:

```
If ( ITHR > 3 OR VTHR > 3 OR NTHR > 8 )
then CLOUD=1   /* pixel is cloudy */
else CLOUD=0   /* pixel is clear */
```

The actual water cloud - ice cloud decision may be calculated by the user as follows:

```
If ( VTMPIC = 255 OR ( VTMP > 74 AND VTMPIC > 74 ) )
then WATER CLOUD
else ICE CLOUD
```

To convert count values to physical units the user must apply the look-up tables provided in BLOCK DATA:

Temperatures or IR radiances (K)	=	TMPTAB(count)
Pressures (millibars)	=	PRETAB(count)
Reflectances or VIS radiances	=	RFLTAB(count)
Optical thicknesses	=	TAUTAB(count)