NIMBUS 7 NFOV MLCE Readme

1.0 Introduction

This file contains information about the NIMBUS 7 Narrow Field of View Maximum Likelihood Cloud Estimation (NIMBUS7_NFOV_MLCE) sample read software and data files. The table below lists for NIMBUS 7 Earth Radiation Budget mission the data sets available through the Langley DAAC, the format of the data sets and if sample read software is also available. The data sets appear in the order as they became available to the user community. These are the data sets that are available through the Langley DAAC:

TABLE 1. Lists all NIMBUS 7 data sets available from the Langley DAAC as well availability of Sample Read Software

Data Set Name	Sample Read Software Availability	Data Format
NIMBUS7_NFOV_MLCE	Yes	Native

This “readme” file includes the following five other sections:

- Section 2.0 - describes all sample C programs (source files).
- Section 3.0 - discusses how to create the executables from the C programs.
- Section 4.0 - demonstrates how to invoke the run-time executables.
- Section 5.0 - provides general information on the data sets.
- Section 6.0 - provides more detailed implementation notes.

If users have questions while using the NIMBUS7_NFOV_MLCE sample read software, please contact the Langley User and Data Services (UDS) office. The UDS may be reached by E-Mail: larc@eos.nasa.gov, by telephone at (757)864-8656, or by FAX at (757)864-8807. The UDS mailing address is:

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Mail Stop 157D
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Hampton, VA 23681-0001
USA

2.0 Read Software Files

The sample read program for the NIMBUS7_NFOV_MLCE data set is written in the C language. This C program has been tested on the ‘Sun4 (OS 4.1.3)’ and ‘HP’ UNIX-based workstations. There are no library routines that need to be loaded or linked. A ‘Makefile’ (called Makefile.mlce) is included for the convenience of creating the executable files from the C source file. These files and their purposes are listed as follows:

- **Makefile.mlce** - contains a set of commands to build the run-time executable.

- **nimbus7_mlce.c** - reads the NIMBUS7_NFOV_MLCE data.

3.0 Creating C Executable Files

The user can build the sample read program from the C source file in two ways. One is applying the 'make' command to the file 'Makefile.mlce,' which defines the C source file listed in Section 2.0. The other is using the C compiler 'cc' (or 'acc' for Sparc ANSI C compiler). Section 3.1 illustrates the first method, and Section 3.2 illustrates the second method. The first method is simpler to use than the second one. The symbol '**%**' in this section stands for UNIX command line prompt.

3.1 Create with 'make' command

To build the executable read program for the NIMBUS7_NFOV_MLCE data set type:

% **make -f Makefile.mlce nimbus7mlce**

3.2 Create with C compiler 'cc'

To use the command line to compile the program, type:

% cc -o nimbus7mlce nimbus7_mlce.c

4.0 Invoking Read Software

This section illustrates the invocation of the executable files. Section 4.1 describes how to run the read program for the NIMBUS7_NFOV_MLCE data set.

4.1 Running the Read Program for the NIMBUS7_NFOV_MLCE Data Set

When this program is executed, it requests an input filename.The program will next prompt for the name of the output file. If the output already exists the program will notify the user and ask if it should overwrite the file. The program will then display a menu such as the following:

```
LOGICAL RECORDS MENU
---------------------
1) DAILY
2) MONTHLY
3) ALL LOGICAL RECORDS
Enter 'h' for help about this menu
Enter 'x' to exit or terminate process
```

The user will select an option from this menu for further processing. Options one and two have submenus from which a more narrow selection can be made. Option three will dump all the logical record headers on the file. For example if option 1 is selected the following submenu is displayed:

DAILY MENU
----
1) DAILY STA
2) DAILY TA
3) DAILY ZONAL
4) DAILY ZONAL ANGULAR BIN
Enter 'h' to receive help with this menu
Enter 'x' to exit or terminate

Selecting options one, two, three, or four will process all the Data Type data on the file for that selected option. Each of the four sub-menus has a list of all the valid "PARAMETERS" that describe this particular data type. The user can select some of the parameters from this list to be printed out or select all the parameters and have them printed by inputing -1 when prompted. This processing scheme is carriedthrough for all the other menu selections.

A sample of the interactive program execution is provided in Section 6.0.

5.0 Data Set Information

Nimbus 7 Narrow Field of View Earth radiation budget products have been produced by the MLCE algorithm at several spatial and temporal scales and separately for all sky and clear sky conditions by combining parameter estimates from individual observations into lower resolution time and space average. Daily and monthly averages are available at Sub-Target Area (STA) resolution (166 km)^2 and at Target Area (TA) resolution (500 km)^2. Daily averages are also given for 40 4.5 deg. latitude zones. In a second averaging procedure, ERB products are subdivided not only by spatial and temporal scale, but also as a function of satellite viewing angle bin. Daily parameter values are provided for this method for the 40 latitude zones.

The data set's information was obtained from the data files, documents, or directly from the data producer/provider. The high-level data set description, the data files, the variables in the data files, and the contacts for data production are given for this data set. Some information that may be useful to the scientist working wiht this data that is not contained in the high level description is collected under the "NOTES ON DATA" section.

LONG NAME FOR THIS DATA SET:

NIMBUS 7 Narrow Field of View (NFOV) Maximum Likelihood Cloud Estimation (MLCE) data in native format (NIMBUS7_NFOV_MLCE)

FILE NAMING CONVENTION:

The file naming convention is:

MLCE_D_mmddyr

MLCE_M_mmddyr

Where D indicates a daily data file, M indicates a monthly data file, mm = month, dd = day and yr = year. Here are examples:

MLCE_D_080179

MLCE_M_100079 : all monthly files have "00" for their day number.

VARIABLES:

This data set nominally contains albedo, net radiation and cloud amount data. Following is a list of all parameters that contained in a data file.

The variable names are:

#	Variable	Units	Time and Spatial Coverage
1	AN Longwave Flux	W/(m^2)	STA&TA-D&M; ZN&ZNBN-D
2	DN Longwave Flux	W/(m^2)	STA&TA-D&M; ZN&ZNBN-D
3	Avg. Longwave Flux	W/(m^2)	STA&TA-D&M; ZN&ZNBN-D
4	AN Shortwave Flux	W/(m^2)	STA&TA-D&M; ZN&ZNBN-D
5	Net Radiation	W/(m^2)	STA&TA-D&M; ZN&ZNBN-D
6	Observed Albedo	Percent	STA&TA-D&M; ZN&ZNBN-D
7	Corrected Albedo	Percent	STA&TA-D&M; ZN&ZNBN-D
8	Standard Deviation of AN Longwave Flux	W/(m^2)	STA-D&M; ZNBN-D
9	Standard Deviation of DN Longwave Flux	W/(m^2)	STA-D&M; ZNBN-D
10	Standard Deviation of AN Shortwave Flux	W/(m^2)	STA-D&M; ZNBN-D
11	AN LW Population	#/day	STA-D; ZNBN-D
12	DN LW Population	#/day	STA-D; ZNBN-D
13	AN SW Population	#/day	STA-D; ZNBN-D
14	No. Days of Month Observed-AN LW		STA&TA-M
15	No. Days of Month Observed-DN LW		STA&TA-M
16	No. Days of Month Observed-AN SW		STA&TA-M
17	Avg. No. Days of Month Observed/STA Within Each TA-AN LW		TA-M
18	Avg. No. Days of Month Observed/STA Within Each TA-DN LW		TA-M
19	Avg. No. Days of Month Observed/STA Within Each TA-AN SW		TA-M
20-38	Same Sequence as Above but Data for Clear Skies Only		
39	Solar Insolation	W/(m^2)	ZN-D
40	AN % Obs. Clear Sky	Percent	TA-D&M; ZNBN-D
41	AN % Obs. Partly Cloudy	Percent	TA-D&M; ZNBN-D
42	AN % Obs. Mostly Cloudy	Percent	TA-D&M; ZNBN-D
43	AN % Obs. Overcast	Percent	TA-D&M; ZNBN-D
44	DN % Obs. Clear Sky	Percent	TA-D&M; ZNBN-D
45	DN % Obs. Partly Cloudy	Percent	TA-D&M; ZNBN-D

#	Variable	Units	Time and Spatial Coverage
46	DN % Obs. Mostly Cloudy	Percent	TA-D&M; ZNBN-D
47	DN % Obs. Overcast	Percent	TA-D&M; ZNBN-D
48	AN Ersatz Clear Sky Longwave Flux	W/(m^2)	TA-D
49	DN Ersatz Clear Sky Longwave Flux	W/(m^2)	TA-D
50	AN Ersatz Clear Sky Obs. Albedo	Percent	TA-D

The abbreviations used in the table:
AN=Ascending Node; DN=Descending Node; STA=Sub-Target Area Average; TA=Target Area Average; ZN=Zonal Average; ZNBN=Zonal and Angular-Bin Average; D=Daily Average; M=Monthly Average.

NOTES ON DATA:

The Average Longwave Flux parameter is computed from the Ascending Node and Descending Node values when both are available. A fill value is used if they are not available.

The Net Radiation is computed from the Average Longwave Flux, the Ascending Node diurnally Corrected Albedo, and the daily average Solar Insolation. If the Ascending Node diurnally Corrected Albedo or the daily average Solar Insolation are unavailable in or near the polar night, then the Net Radiation becomes the negative of the Average Longwave Flux.

The Ersatz Clear-Sky parameters are a secondary method of obtaining daily average TA clear-sky estimates of ascending- and descending-node longwave fluxes and ascending-node observed albedos.

The NIMBUS 7 ERB World Grid is an equal area grid consisting of 2070 approximately equal size Target Areas (TAs) which are numbered consectively from the South Pole. In each zone, the numbers increase westward from the Greenwich Meridian. Each TA consists of 9 Sub-Target Areas (STAs). These form a 3 by 3 grid in the TA and are coded with an index ranging from 1 to 9, starting in the SE corner and ending in the NW corner.

FIRST RECORD OF DATA FROM FIRST DATA GRANULE:

```
(1) time_scale      1
(2) data_type       11
(3) parameter_name  1
(4) sta_number      1
(5) scale_factor    10
(6) cal_day_of_mon  1
(7) month           5
(8) year            1979


AN Longwave Flux (STA & TA - D&M ZN & ZNBN - D)

The units of Flux are : W/m**2

--------------------------------------------------

(  9 ) -10000 -10000 -10000 -10000 -10000 -10000 -10000 -10000 -10000
( 18 ) -10000 -10000 -10000   1386   1628   1741   1694   1456   1690
( 27 )   1593   1530   1519   1506   1258    997   1007    961    965
( 36 )   1249   1354   1724   1781   1744   1633   1647   1702   1618
( 45 )   1858 -10000 -10000   1663   1528   1100   1018   1216   1408
( 54 )   1052   1011   1067   1466   1823   1956   1703   1874   1607
```

(63)	1808	-10000	1787	1927	1638	1725	2009	2018	-10000
(72)	-10000	-10000	-10000	1661	1383	1288	1195	1255	1393
(81)	-10000	1171	1334	1542	1722	1641	1666	1818	1962
(90)	2064	-10000	1726	1663	2024	1918	-10000	1989	1743
(99)	-10000	2127	1291	1823	1869	-10000	-10000	-10000	-10000
(108)	-10000	-10000	1738	-10000	1867	1777	-10000	1891	1680

Lines (117) to (1746) deleted for space

(1755)	-10000	-10000	3062	-10000	-10000	-10000	2665	2805	-10000
(1764)	-10000	2245	2534	-10000	-10000	-10000	2408	-10000	-10000
(1773)	-10000	2405	2378	-10000	-10000	-10000	2159	-10000	-10000
(1782)	-10000	2082	1854	-10000	-10000	1546	1941	-10000	-10000
(1791)	-10000	2582	-10000	-10000	-10000	1697	2160	-10000	-10000
(1800)	2221	1538	-10000	-10000	-10000	2120	-10000	-10000	-10000
(1809)	-10000	-10000	-10000	-10000	-10000	-10000	-10000	-10000	3209
(1818)	3105	-10000	-10000	1622	1742	-10000	-10000	-10000	2566
(1827)	-10000	-10000	-10000	2051	2064	-10000	-10000	2394	2401
(1836)	-10000	-10000	2289	-10000	-10000	1976	1971	-10000	-10000
(1845)	2244	-10000	-10000	2454	2304	-10000	-10000	2358	-10000
(1854)	-10000	2048	-10000	-10000	1822	1911	-10000	-10000	-10000
(1863)	-10000	-10000	-10000	-10000	-10000	1778	2842	-10000	-10000
(1872)	2385	-10000	-10000	2831	2476	-10000	-10000	2010	2176
(1881)	-10000	2292	2385	-10000	-10000	2246	-10000	-10000	2220
(1890)	-10000	-10000	1987	1988	-10000	2303	2300	-10000	-10000
(1899)	2411	-10000	-10000	2059	-10000	-10000	1398	2001	-10000
(1908)	-10000	-10000	-10000	-10000	-10000	-10000	1609	2381	-10000
(1917)	-10000	2350	-10000	-10000	2439	-10000	-10000	2166	2196
(1926)	-10000	2073	2274	-10000	2266	2340	-10000	2081	2027
(1935)	-10000	2108	2043	-10000	2478	-10000	-10000	2007	-10000
(1944)	-10000	2139	-10000	-10000	2223	-10000	-10000	-10000	-10000
(1953)	-10000	-10000	-10000	1976	-10000	-10000	2026	-10000	-10000
(1962)	2110	-10000	2065	2132	-10000	2215	2242	-10000	2040
(1971)	2252	-10000	2037	-10000	1916	1962	-10000	2335	-10000
(1980)	2484	1608	-10000	2089	2101	-10000	2164	-10000	-10000
(1989)	-10000	-10000	-10000	-10000	2082	2213	-10000	2336	-10000
(1998)	1971	2173	-10000	1930	1936	2138	1847	2092	1942
(2007)	-10000	1987	-10000	1963	2008	2419	2380	2291	2066
(2016)	2018	2041	2203	1924	-10000	-10000	-10000	-10000	-10000
(2025)	2009	-10000	2168	2110	2120	2160	2031	1871	1563
(2034)	1966	1932	1969	1966	2077	2171	1990	1911	1974
(2043)	1985	1769	-10000	-10000	1907	1701	1916	1861	2015
(2052)	1791	1555	2027	1891	1943	2099	1953	1928	1841
(2061)	1838	1780	-10000	2019	1943	1966	1893	1764	1870
(2070)	2085	1931	1874	1868	1941	1885	-10000	-10000	-10000

INSTRUMENTATION:

The Nimbus-7 Earth Radiation Budget (ERB) scanner instrument took measurements from November 16,1978 through June 20, 1980. It normally operated on a 3-day-on/1-day-0ff cycle; however, prior to May 1979, this schedule was frequently interrupted because of priority requirements of the other experiments on the Nimbus-7. It was found that the ERB scanner interfered with teh short-lived Limb Infrared Monitor of teh Stratosphere (LIMS) Experiment. Thus, prior to May 1979, there were extended periods when the scanner measurements were too sparse for accurate results to be obtained from the SAB algorithm. In late December 1978, one of the four shortwave sensors in the scanner became too noisy for accurate measurments. Thus, durint daylight there are only 75% as many shortwave measurements as there are longwave ones. This compounds the data-sampling problem. As a result, only 13 months (May 1979 through May 1980) were reprocessed using the SAB and MLCE algorithms.

The first stage in the reprocessing was to take the scanner meeasurments from the ERB Master Archive Tapes (MATs), optimize the calibration of the radiances, sort and average them geographicallyy into 18,630 subtarget areas (STAs), each approximately (166 km)^2, and 49 angular bins. This is done for each half orbit so that noon and midnight measurements can be treated sparately. The upward hemisphere covering an STA is divided into 85 bins, but symmetry is assumed about the principle (zenithe line-Sun) plane reducing the number to 49. These bins were chosen as an empirical compromise. They are small enough in number to allow collection of radiances for monthly integrations on individual target areas (TA) but numerous enough to allow reasonable representation of complex bidirectional reflectance patterns. They also correspond to the angular bins used in the ERBE bidirectional reflectance models. These sorted, calibrated radiances are stored on scene radiance tapes (SRTs) that are used as input in producing both the SAB and MLCE products.

CONTACT FOR DATA PRODUCT INFORMATION:

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6.0 Implementation Notes

This interactive read program first expects to read information from an input data file. Because there is so much data on a single data file, a series of menus and submenus were implemented to facilitate processing data. The submenus break the data down into six distinct data types. Each submenu has a "PARAMETER" options list menu for selecting which data is to be processed. When a particular data type is selected from the submenu all of that type of data found on the input file is then written to the output file. If the user wants to find out what data is on a particular data file they can select the "3) ALL LOGICAL RECORDS" option from the "LOGICAL RECORDS MENU" this option will list all the header records it finds to the output file.Section 6.0 gives the user a brief explanation on how to run the sample read software.

6.1 NIMBUS7_NFOV_MLCE Read Program

There is only one version of the read program available for this data set.

The following represents a sample execution of the C program, nimbus7_mlce.c. User inputs are in "**bold**:"

sorcerer% **nimbus7mlce**

`Please enter the name of the INPUT file you wish to read:` **MLCE_D_101679**

`Please enter the name of the OUTPUT file you wish to write OUTPUT to` **: mlce.output**

```
LOGICAL RECORDS MENU
---------------------
 1) DAILY
 2) MONTHLY
 3) DUMP ALL LOGICAL RECORDS
Enter 'h' for help about this menu
Enter 'x' to exit or terminate process
```
1

```
DAILY MENU
------------
 1) DAILY STA
 2) DAILY TA
 3) DAILY ZONAL
 4) DAILY ZONAL ANGULAR BIN
Enter 'h' to receive help with this menu.
Enter 'x' to exit or terminate
```
4

```
zonal_angular_bin_name Avg. Longwave Flux
The following is the list of PARAMETERS which are available for daily TA

Coded Parameter Number.
All            Clear              Description
Sky            Sky
---------------------------------------------------------------------
 1             20              AN Longwave Flux
 2             21              DN Longwave Flux
 3             22              Avg. Longwave Flux
 4             23              AN Shortwave Flux
 5             24              Net Radiation
 6             25              AN observed Albedo
 7             26              AN diurnally corrected Albedo
40             -               AN percent observations clear
41             -               AN percent observations partly cloudy
42             -               AN percent observations mostly cloudy
43             -               AN percent observations overcast
44             -               DN percent observations clear
45             -               DN percent observations partly cloudy
46             -               DN percent observations mostly cloudy
47             -               DN percent observations overcast

Please make a selection for processing. Enter the number(s)
of the PARAMETERS you wish printed. A [-1] entered will print all
of the PARAMETERS. To quit selecting and to begin processing enter
[quit](without the []).
Enter 'x' to exit or terminate
```
20

```
You have selected: 20  AN longwave flux
```

quit

```
Finshed selection of PARAMETER indexs.

   Job Completed
```

APPENDIX

A-1: Output from running ‘make all’ on HP workstation

The following is the output from running makefile to build NIMBUS7_NFOV_MLCE read programs on a HP9000:

HP% make -f Makefile.mlce nimbus7mlce

cc -g -Aa -DHPUX -DNO_HAVE_PROTOTYPES -DNO_STDARG -o nimbus7mlce nimbus7_mlce.c

A-2: Output from running ‘make all’ on SUN4 workstation:

The following is the output from running makefile to build NIMBUS7_NFOV_MLCE read programs on a SUN:

SUNOS% make -f Makefile.mlce nimbus7mlce nimbus7_mlce.c

cc -g -DSUNOS -sun4 -DNO_HAVE_PROTOTYPES -DNO_STDARG -o nimbus7mlce nimbus7_mlce.c