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Earth Sc

NIMBUS 7

SUB-TARGET RADIANCE TAPES

78-098A-07G ESRB-00017

NIMBUS 7

SUB-TARGET RADIANCE TAPES (REVISED)

78-098A-07V ESRB-00018

Table of Contents

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1. INTRODUCTION:

The documentation for this data set was originally on paper, kept in NSSDC's Data Set Catalogs (DSCs). The paper documentation in the Data Set Catalogs have been made into digital images, and then collected into a single PDF file for each Data Set Catalog. The inventory information in these DSCs is current as of July 1, 2004. This inventory information is now no longer maintained in the DSCs, but is now managed in the inventory part of the NSSDC information system. The information existing in the DSCs is now not needed for locating the data files, but we did not remove that inventory information.

The offline tape datasets have now been migrated from the original magnetic tape to Archival Information Packages (AIP's).

A prior restoration may have been done on data sets, if a requestor of this data set has questions; they should send an inquiry to the request office to see if additional information exists.

2. ERRATA/CHANGE LOG:

NOTE: Changes are made in a text box, and will show up that way when displayed on screen with a PDF reader.

When printing, special settings may be required to make the text box appear on the printed output.

Version	Date	Person	Page	Description of Change
01				
02				

3 LINKS TO RELEVANT INFORMATION IN THE ONLINE NSSDC INFORMATION SYSTEM:

http://nssdc.gsfc.nasa.gov/nmc/

[NOTE: This link will take you to the main page of the NSSDC Master Catalog. There you will be able to perform searches to find additional information]

4. CATALOG MATERIALS:

a. Associated Documents — To find associated documents you will need to know the document ID number and then click here.
http://nssdcftp.gsfc.nasa.gov/miscellaneous/documents/

b. Core Catalog Materials

NIMBUS 7

SUB-TARGET RADIANCE TAPE (STRT)

78-098A-07G ESRB-00017

THIS DATA SET HAS BEEN RESTORED. ORIGINALLY THERE WERE 47 TAPES, 46 OF THESE WERE 9-TRACK, 6250 BPI WRITTEN IN BINARY. ONE OF THESE WAS 9-TRACK, 1600 BPI WRITTEN IN EBCDIC AND IS A SOFTWARE TAPE. THERE ARE 47 RESTORED TAPES, ALL OF WHICH ARE BIANRY EXCEPT THE SOFTWARE TAPE WHICH IS ASCII. THE DR TAPES ARE 3480 CARTRIDGES AND THE DS TAPES ARE 9-TRACK, 6250 BPI. THE ORIGINAL TAPES WERE CREATED ON AN IBM 360 COMPUTER AND THEY WERE RESTORED ON THE MRS SYSTEM. THE DR AND DS NUMBERS ALONG WITH THE CORRESPONDING D NUMBERS AND THE TIME SPANS ARE AS FOLLOWS:

DR#	DS#	D#	FILES	TIME SPAN
DR004502	DS004502	D059897	6	11/16/78 - 11/22/78
DR004503	DS004503	D059896	6	11/24/78 - 11/30/78
DR004504	DS004504	D049895	6	12/02/78 - 12/08/78
DR004505	DS004505	D059473	6	12/12/78 - 12/23/78
DR004506	DS004506	D059474	6	12/24/78 - 01/04/79
DR004507	DS004507	D059894	6	01/05/79 - 01/16/79
DR004508	DS004508	D059475	6	01/17/79 - 01/31/79
DR004509	DS004509	D059476	6	02/02/79 - 02/14/79
DR004510	DS004510	D059477	6	02/17/79 - 03/05/79
DR004511	DS004511	D059478	6	03/06/79 - 03/18/79
DR004512	DS004512	D059481	2	03/13/79 - 03/19/79
DR004513	DS004513	D059479	6	03/21/79 - 03/30/79
DR004514	DS004514	D059494	6	04/14/79 - 04/19/79
DR004515	DS004515	D059495	6	04/22/79 - 04/29/79
DR004516	DS004516	D059496	6	05/03/79 - 05/13/79
DR004517	DS004517	D059467	6	05/14/79 - 05/23/79
DR004518	DS004518	D059468	6	05/24/79 - 05/31/79

78-098A-07G

DR#	DS#	D#	FILES	TIME SPAN
DR004519	DS004519	D059469	6	06/01/79 - 06/08/79
DR004520	DS004520	D059892	6	06/09/79 - 06/16/79
DR004521	DS004521	D059893	6	06/17/79 - 06/25/79
DR004522	DS004522	D059470	6	06/25/79 - 07/02/79
DR004523	DS004523	D059471	6	07/03/79 - 07/10/79
DR004524	DS004524	D059472	6	07/11/79 - 07/18/79
DR004525	DS004525	D059484	6	07/19/79 - 07/26/79
DR004526	DS004526	D059483	6	07/27/79 - 08/03/79
DR004527	DS004527	D059485	6	08/04/79 - 08/11/79
DR004528	DS004528	D059486	6	08/12/79 - 08/19/79
DR004529	DS004529	D059487	6	08/20/79 - 08/28/79
DR004530	DS004530	D059488	6	08/28/79 - 09/04/79
DR004531	DS004531	D059489	6	09/05/79 - 09/12/79
DR004532	DS004532	D059490	6	09/13/79 - 09/20/79
DR004533	DS004533	D059491	6	09/21/79 - 09/28/79
DR004534	DS004534	D059492	6	09/30/79 - 10/08/79
DR004535	DS004535	D059493	6	10/10/79 - 10/16/79
DR004536	DS004536	D059482	6	10/18/79 - 10/25/79
DR004537	DS004537	D059466	6	10/26/79 - 11/04/79
DR004538	DS004538	D059480	6	11/05/79 - 05/19/80
DR004539	DS004539	D059465	6	11/07/79 - 11/13/79
DR004540	DS004540	D059464	6	11/15/79 - 11/21/79
DR004541	DS004541	D059463	6	11/23/79 - 11/29/79
DR004542	DS004542	D059462	6	12/01/79 - 12/09/79
DR004543	DS004543	D059461	6	12/10/79 - 12/19/79
DR004544	DS004544	D059460	6	12/23/79 - 01/02/80
DR004545	DS004545	D059459	6	01/06/80 - 01/12/80
DR004546	DS004546	D059458	6	01/15/80 - 01/23/80
DR004547	DS004547	D059457	6	01/23/80 - 01/30/80
DR004548	DS004548	D059497	6	SOFTWARE TAPE

REQ. AGENT	RAND NO.	ACQ. AGENT
DAD	V0209	RWP

NIMBUS 7

ERB SUB-TARGET RADIANCE TAPE (STRT)

78-098A-07G

THIS DATA SET CATALOG CONSISTS OF 47 TAPES. ONE OF THEM IS AN (STRT) SOFTWARE TAPE, WHICH IS 9-TRACK, 1600 BPI, EBCDIC AND CONTAINS 6 FILES. THE OTHER 46 TAPES ARE 9-TRACK, 6250 BPI, BINARY AND WERE CREATED ON AN IBM 360/195 COMPUTER. ALL OF THE TAPES CONTAIN 6 FILES OF DATA EXCEPT D-59481 WHICH CONTAINS 2 FILES. ~~DOCUMENTATION FOR THIS DATA SET CAN BE FOUND IN ROOM 123, IN THE FILING CABINET.~~ THE D AND C NUMBERS ALONG WITH THE TIME SPANS WILL FOLLOW BELOW. ON THE FOLLOWING PAGES OF THIS CATALOG, YOU WILL FIND A LISTING WHICH CONTAINS THE START DATE OF EACH FILE ON THE TAPE. SOME OF THE TAPES HAVE VARIOUS TIME PERIODS ON THEM.

D#	C#	TIME SPAN
D-59897	C-23543	11/16/87 - 11/22/78
D-59896	C-23544	11/24/78 - 11/30/78
D-59895	C-23545	12/02/78 - 12/08/78
D-59473	C-23418	12/12/78 - 12/23/78
D-59474	C-23419	12/24/78 - 01/04/79
D-59894	C-23546	01/05/79 - 01/16/79
D-59475	C-23420	01/17/79 - 01/31/79
D-59476	C-23421	02/02/79 - 02/14/79
D-59477	C-23422	02/17/79 - 03/05/79
D-59478	C-23423	03/06/79 - 03/18/79
D-59481	C-23426	03/13/79 - 03/19/79
D-59479	C-23424	03/31/79 - 04/03/79
D-59494	C-23439	04/04/79 - 04/19/79
D-59495	C-23440	04/22/79 - 04/29/79
D-59496	C-23441	05/03/79 - 05/13/79
D-59467	C-23547	05/14/79 - 05/23/79
D-59468	C-23413	05/24/79 - 05/31/79
D-59469	C-23414	06/01/79 - 06/08/79
D-59892	C-23548	06/09/79 - 06/16/79
D-59893	C-23549	06/17/79 - 06/25/79
D-59470	C-23415	06/25/79 - 07/02/79
D-59471	C-23416	07/03/79 - 07/10/79
D-59472	C-23417	07/11/79 - 07/18/79
D-59484	C-23429	07/19/79 - 07/26/79
D-59483	C-23428	07/27/79 - 08/03/79
D-59485	C-23430	08/04/79 - 08/11/79
D-59486	C-23431	08/12/79 - 08/19/79
D-59487	C-23432	08/20/79 - 08/28/79

78-098A-07G

D#	C#	TIME SPAN
D-59488	C-23433	08/28/79 - 09/04/79
D-59489	C-23434	09/05/79 - 09/12/79
D-59490	C-23435	09/13/79 - 09/20/79
D-59491	C-23436	09/21/79 - 09/28/79
D-59492	C-23437	09/30/79 - 10/08/79
D-59493	C-23438	10/10/79 - 10/16/79
D-59482	C-23427	10/18/79 - 10/25/79
D-59466	C-23412	10/26/79 - 11/04/79
D-59480	C-23425	11/05/79 - 05/19/80
D-59465	C-23411	11/07/79 - 11/13/79
D-59464	C-23410	11/15/79 - 11/21/79
D-59463	C-23409	11/23/79 - 11/29/79
D-59462	C-23408	12/01/79 - 12/09/79
D-59461	C-23407	12/10/79 - 12/19/79
D-59460	C-23406	12/23/79 - 01/02/80
D-59459	C-23405	01/06/80 - 01/12/80
D-59458	C-23404	01/15/80 - 01/22/80
D-59457	C-23403	01/23/80 - 01/30/80
** D-59497	C-23442	STRT SOFTWARE TAPE

NOAA Technical Memorandum NESDIS 3

NIMBUS-7 ERB SUB-TARGET RADIANCE TAPE (STRT) DATA BASE

L. L. Stowe and
M. D. Fromm

Washington, D.C.
December 1983

UNITED STATES
DEPARTMENT OF COMMERCE
Malcolm Baldrige, Secretary

National Oceanic and
Atmospheric Administration
John V. Byrne, Administrator

National Environmental Satellite,
Data, and Information Service
John H. McElroy,
Assistant Administrator

78-098A-07G

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Washington, D.C.
February 6, 1984

- ERRATA -

NOAA Technical Memorandum NESDIS 3
NIMBUS-7 ERB SUB-TARGET RADIANCE TAPE (STRT) DATA BASE
L. L. Stowe and M. D. Fromm

PAGE	CORRECTION
Title	M. D. Fromm is employed by Research and Data Systems, Inc., Lanham, MD 20706
ii	3.5.1 The Identification Block
16	Second sentence of 2.3.1: The 11.5 and co-located 6.7 micrometer ....
19	Second paragraph, second line: radiances, and the adjusted boundary radiances, as well as pertinent ....
25	Ninth line from the top: average climatology product ....
31	Second sentence of second paragraph of section 3.3 should be replaced by: The size of the bin in the azimuth direction ranges between 6° and 30°.
34	Four of the azimuth angles in parentheses in Figure 12 should be changed as follows: (18) should be (19.5); (162) should be (160.5); (198) should be (199.5); and (342) should be (340.5).
51	Last line bottom of Table 11: into bin 1226, 5 and 6 into bin 1303 and so on.
C1	Third line of first paragraph: percent land in each STA, the ....

Nimbus-7 ERB Sub-Target Radiance Tape (STRT) Data Base

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PREFACE

One of the objectives of the Earth Radiation Budget (ERB) experiment, flown on the Nimbus-6 and 7 satellites, was to observe the bi-directional properties of reflection and emission from Earth and cloud surfaces. Prior to the launch of Nimbus-6, in June of 1975, it became clear to scientists at NOAA that a special data set devoted to the scanning channels of ERB would be advantageous in meeting this objective. NOAA assumed the responsibility for this data processing and research effort, funded through reimbursible contracts with NASA. Preliminary design of a scanning channel data set began in 1975 and evolved into the current Sub-Target Radiance Tape (STRT) data base concept in 1978. During this period, the scanner on Nimbus-6 failed after three months of operation. Also, emphasis at NOAA had shifted to preparing for Nimbus-7 ERB data, which became available on Nov. 16, 1978. In addition, a method to extract cloud cover information, concurrent and co-located with the ERB data, had been developed using Nimbus-7 Temperature Humidity Infrared Radiometer (THIR) data. Global snow and ice cover information was also available from the Air Force archives for the Nimbus-7 period. As a consequence of these various developments, the STRT data base does not contain any Nimbus-6 ERB data.

Delays in generating the STRT data base were caused by the necessity to perform studies related to instrument calibration and to production and validation of Nimbus-7 ERB Master Archive Tapes (MAT) and THIR Clouds-ERB Tapes (CLE). Because of these delays, final production did not commence until June of 1981. NASA funding constraints caused production to cease in May 1983 after completing 272 days out of 388 days possible. About 90 min. of CPU time is required for processing one day's worth of data on an IBM 360-195 computer. The remaining 116 days may be processed into the STRT data base eventually, if and when funding becomes available. Until then, the 272 day data set should be adequate to answer many questions related to climate, Earth's radiation budget, and reflection and emission processes. Improved cloud cover information is expected from Nimbus-7 data in 1984 and it would be highly desirable to incorporate it into the STRT data base.

A word about the format of the STRT tapes is in order. The STRTs were produced using the PL/1 language on the IBM 360-195 computer. This language is ideal for efficient manipulation of large amounts of mixed data types (e.g.

numerical, character strings, bit strings, etc.). However, the resulting tape structure may make it difficult to process these tapes with some language other than PL/1, e.g., FORTRAN. It is highly recommended that the user read and unpack the data on the tapes with PL/1 software, but if not available, FORTRAN can be used. Programs which dump the data records in both PL/1 and FORTRAN are available on magnetic tape from the NASA archive center.

Finally, this document is published as a NOAA Technical Memorandum to inform the scientific community of the existance of this data base and to explain how it was created. It is also written to serve as a USER'S GUIDE. A user of the STRT data base should find all that is needed to extract the information contained on these tapes.

ACKNOWLEDGEMENTS

This project could not have been completed without the expert scientific and computational efforts of the following individuals: H. Jacobowitz, E. Baldwin, V.R. Taylor, P. Pellegrino, I. Ruff, M. Chen, J. Wydick, M. Varnadore, R. Ryan, F. Van Cleef, D. Brown, M. Hill, D. Coleman, I. Burden and B. Mengel; and the following Research and Data Systems, Inc. employees: M. Hopkins, J. Weissenbach, J. Rea, R. Parr, M. Vilardo, R. Paul, and supported under NASA contract number NAS 5-25123. Charges for use of the NOAA 360-195 computer were paid with NASA contracts S-54635-A, S-40170-B and S-54640-A. The manuscript was typed by Linda Oliver, of RDS, Inc.

LIST OF ACRONYMS

AFGWC	Air Force Global Weather Central
BPI	Bits Per Inch
CLDT	Calibrated-Located Data Tape
(N)CLE	(New) ERB-Clouds Tape
EBCDIC	Extended Binary Coded Decimal Interchange Code
ERB(E)	Earth Radiation Budget (Experiment)
GOES	Geostationary Operational Environmental Satellite
(I)FOV	(Instantaneous) Field-Of-View
JCL	Job Control Language
LWSC	Long-Wave Scanning Channel
MAT	Master Archival Tape
MGG	Merge-Geography Tape
MCL	Merge-Cloud Tape
MRA	Merge-Radiance Tape
NASA/GSFC	National Aeronautics and Space Administration/ Goddard Space Flight Center
NCAR	National Center for Atmospheric Research
NESDIS	National Environmental Satellite, Data and Information Service
NFOV	Narrow Field-Of-View
NMC	National Meteorological Center
NOAA	National Oceanic and Atmospheric Administation
NSSDC	National Space Science Data Center
QC	Quality Control
RDS	Research and Data Systems, Inc.
RMS	Root-Mean-Square
(S)TA	(Sub-) Target Area
STAGS	Sub-Target Area Geographical Season Tape
STR(T)	Sub-Target Radiance (Tape)
THIR	Temperature-Humidity Infrared Radiometer
TOMS	Total Ozone Monitoring System

1.0 Introduction

There is an increasing interest in the study of the angular dependence of reflected solar and emitted terrestrial radiation. Also of concern is the role of the Earth's surface characteristics and cloudiness in the angular variation of radiation. To this end, a data base has been compiled that makes available from one source, detailed information describing the Earth's surface configuration and vegetation, snow and ice cover, cloud cover and type, and long-and short-wave radiance at the top of the atmosphere. The data is archived on magnetic tape, which will be referred to as the sub-target radiance tape (STRT). This data base is global in coverage and offers daily resolution for 272 days (16 November 1978 to 19 May 1980). The dates available are shown in Table 1.

The information describing surface configuration and vegetation, which will be referred to as the topography record, derives from subjective interpretations of atlas maps of these fields. Further definition of the surface condition is included in the geography record which identifies areas of snow and ice cover, land and water. These data come from analyses that support the Air Force 3-D Nephanalysis objective.

Cloud cover and type are estimated from histograms of window radiances measured by the Temperature Humidity Infrared Radiometer (THIR) aboard the Nimbus-7 satellite. The radiance data also derive from Nimbus-7; the Earth Radiation Budget (ERB) short- and long-wave Narrow Field-of-View (NFOV) scanning channels.

The ERB scanning channel radiances and associated information are sorted into 2070 approximately equal areas on the Earth (500km x 500km) referred to as ERB target areas (TA), depicted in Figures 1-3. Each TA is further divided into a 3x3 array of sub-target areas (STA). A detailed description of the TA and STA is provided in Section 3.2.

The data for each day are contained on the tape with the following space/time resolution:

1. topography - one per TA (constant)
2. geography - one per STA per day
3. radiance/cloud - one per STA per orbital sighting

This document describes the STRT physical product, the methods used to create each component of the data base, and provides statements of quality of the data base. Each component data set is described in section 2. Section 3 is a description of the STRT product itself.

Table 1. Dates when STRT data exist (XXX). The data base may be expanded to include the dates flagged with '000'. Dates when no data can be produced are left blank.

	1978		1979												1980					
Day	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
01			XXX		XXX			XXX		XXX	XXX		XXX	XXX		000		000	000	
02		XXX		XXX	000			XXX	XXX		XXX	XXX		XXX	XXX		000		000	000
03		XXX					XXX		XXX	XXX			XXX	XXX	000	000	000	000	000	000
04		XXX	XXX				XXX	XXX	XXX	XXX	XXX	XXX	XXX		000	000	000			000
05			XXX		XXX		XXX	XXX		XXX	XXX		XXX	XXX		XXX		000	000	
06		XXX		XXX	XXX			XXX	XXX		XXX	XXX			XXX		000		000	000
07		XXX							XXX	XXX		XXX	XXX	XXX	XXX	XXX	000	000	000	000
08		XXX	XXX				XXX	XXX	XXX	XXX	XXX	XXX	XXX		XXX	000	000	000		000
09			XXX	XXX	XXX			XXX		XXX	XXX		XXX	XXX		000		000	000	
10				XXX	XXX			XXX	XXX		XXX	XXX		XXX	XXX		000		000	000
11		000					XXX		XXX	XXX		XXX	XXX	XXX	XXX	000	000	000	000	000
12		XXX	XXX					XXX	XXX	XXX	XXX	XXX	XXX		XXX	000	000	000		000
13			XXX	XXX	XXX		XXX	XXX		XXX	XXX		XXX	XXX		000		000	000	
14				XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX		XXX	000		000		000	000
15		XXX				XXX	XXX		XXX	XXX		XXX	XXX	XXX	XXX	000	000	000	000	000
16	XXX	XXX	XXX			XXX		XXX	XXX	XXX	XXX	XXX	XXX		XXX	000	000	000		000
17	XXX		XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX		XXX	000		000		000	000	
18	XXX			XXX	XXX	XXX		XXX	XXX		XXX	XXX			XXX		000		000	000
19		XXX				XXX	XXX		XXX	XXX		XXX	XXX	XXX	XXX	XXX	000	000	XXX	000
20	XXX	XXX	XXX				XXX	XXX	XXX	XXX	XXX	XXX	XXX		XXX	000	000	000		000
21	XXX		XXX	XXX	XXX		XXX	XXX		XXX	XXX		XXX	000		000		000	000	
22	XXX			XXX	XXX	XXX		XXX	XXX		XXX	XXX		000	XXX		000		000	000
23		XXX				XXX	XXX		XXX	XXX		XXX	XXX	XXX	XXX	000	000	000	000	
24	XXX	XXXX					XXX	XXX	XXX	XXX	XXX	XXX	XXX		XXX	000	000	000		
25	XXX		XXX		XXX		XXX	XXX		XXX	XXX		XXX	XXX		000		000	000	
26	XXX				XXX	XXX		XXX	XXX		XXX	XXX		000	XXX		000		000	
27		XXX	XXX			XXX	XXX		XXX	XXX			XXX	XXX	XXX	000	000	000	000	
28	XXX	XXX				XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		XXX	000	000	000		
29	XXX		000		XXX	XXX	XXX	XXX		XXX			XXX	XXX		000		000	000	
30	XXX				XXX			XXX	XXX		XXX	XXX		XXX	XXX		000		000	
31		XXX	XXX				XXX		XXX	XXX				000	XXX		000		000	

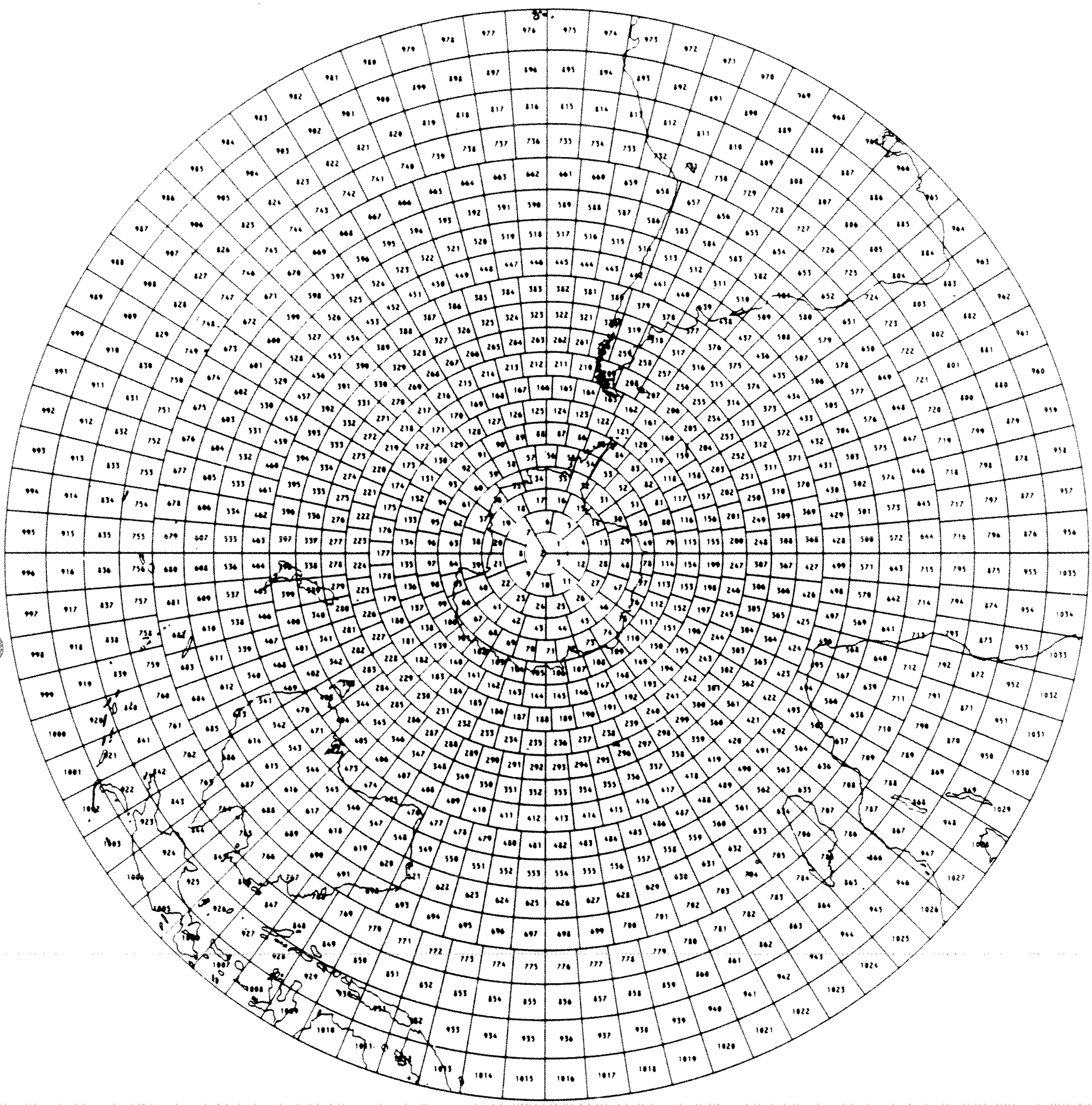


Figure 1. ERB target areas, numbered sequentially from the South Pole, overlain on a polar sterographic map of the Southern Hemisphere. Numbers range from 1 at the pole to 1035 at the Equator.

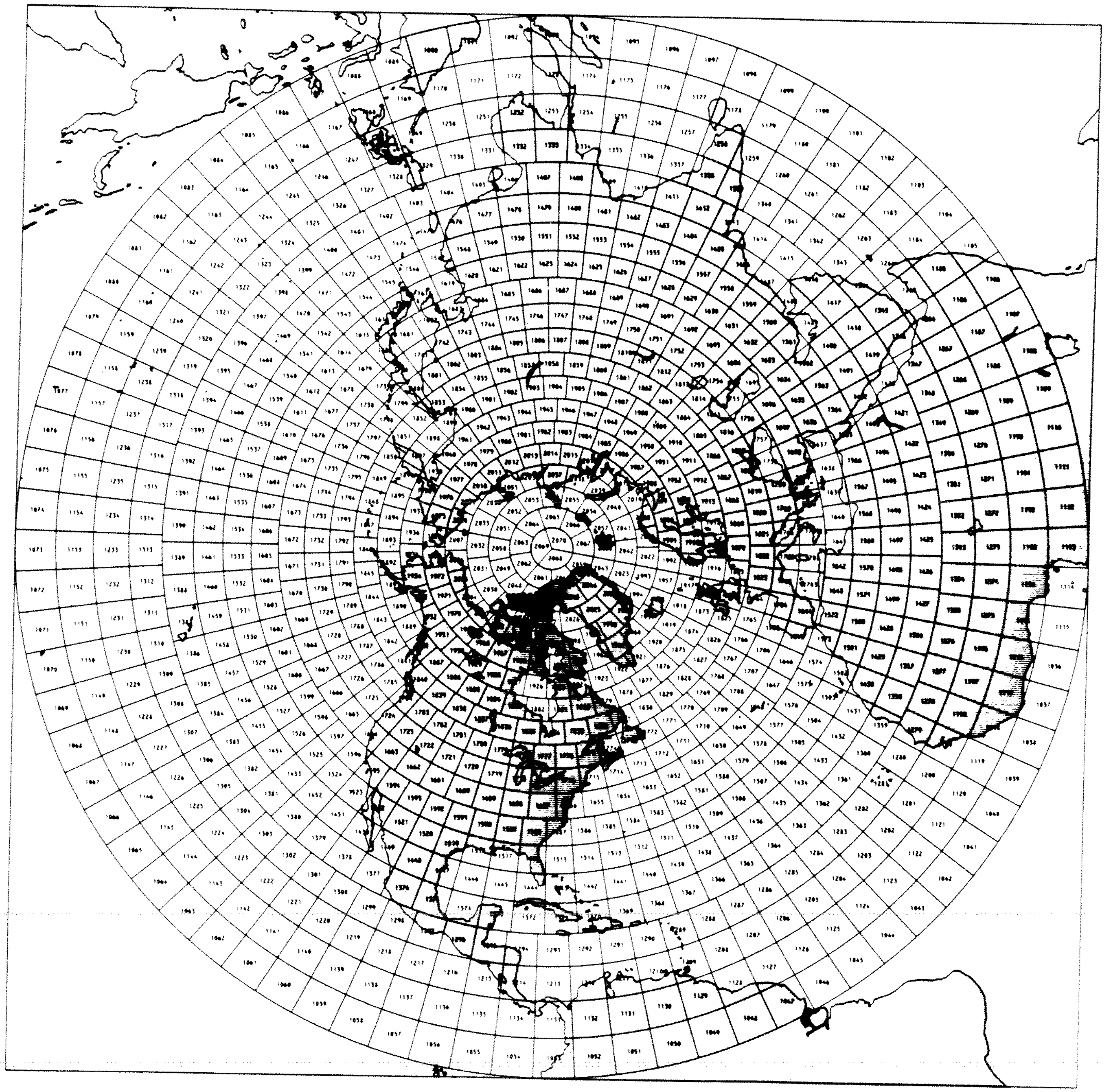


Figure 2. Same as Figure 1 for the Northern Hemisphere. Numbers range from 1036 at the Equator to 2070 at the pole.

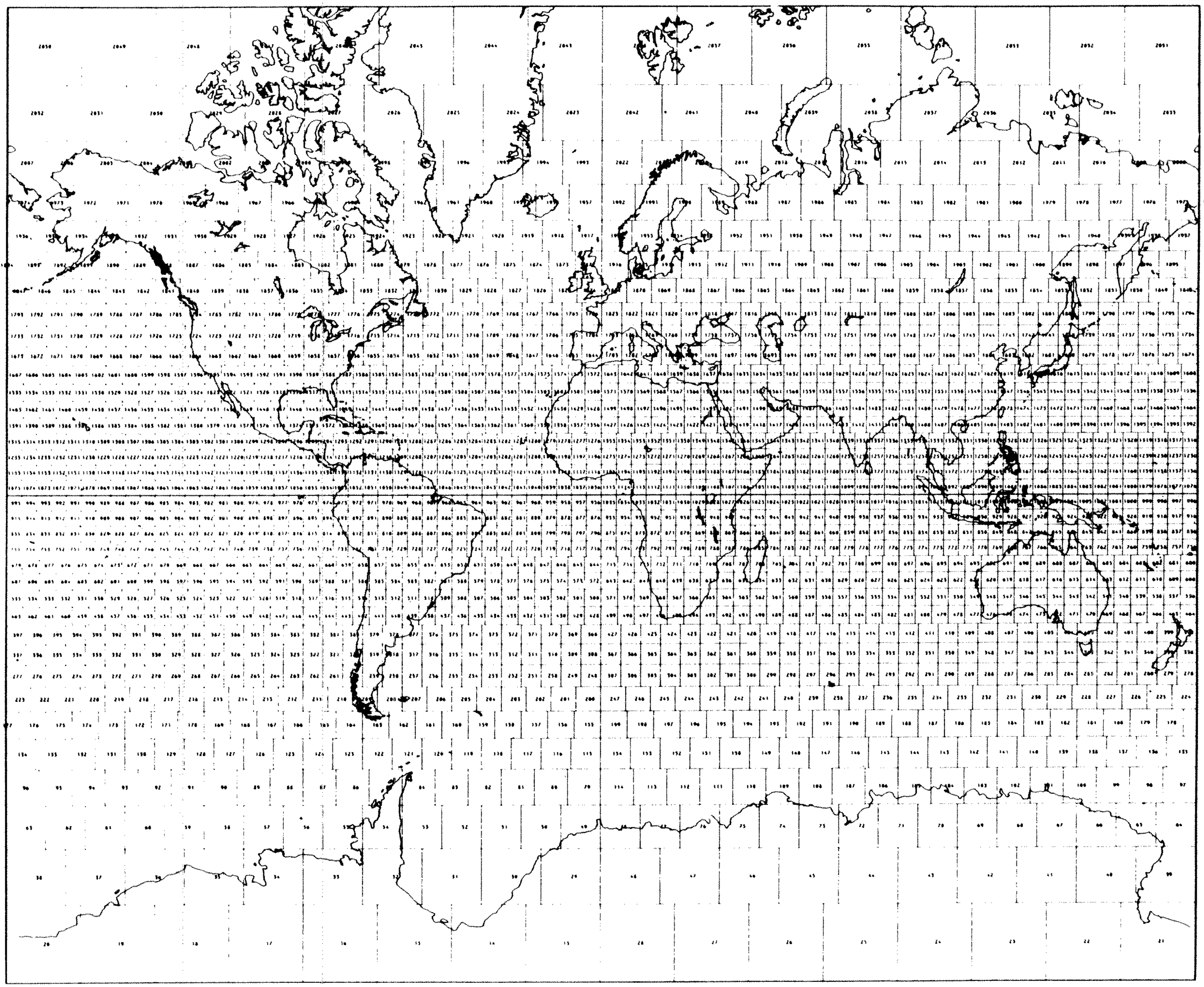


Figure 3. ERB target areas displayed on a Mercator projection.

2.0 Components of the STRT Data Base

2.1 The Topography Record

The STRT has one topography data record per target area. The topography record consists of information describing the configuration of the Earth's surface and its vegetation types.

2.1.1 Source of the Data

The source for this data is A Geography of Man by P. E. James (1). James classifies the surface configuration into 6 types: plain, hilly upland and plateau, mountain, hamada, erg, and mountain-bolson desert. In regions where ice cover is possible, a seasonal variation in the fractional amount of ice is included in the record (Oceanographic Atlas of the Polar Seas (2)). Winter in the Northern Hemisphere (summer in the Southern Hemisphere) is considered the three-month period from January to March; spring (autumn) is from April to June; summer (winter) is from July to September; and autumn (spring) from October to December.

2.1.2 Description of the Data

Figures 4 a and b were constructed from the STRT topography record showing the predominant surface types for the Southern and Northern Hemisphere, respectively.

The types are defined as follows:

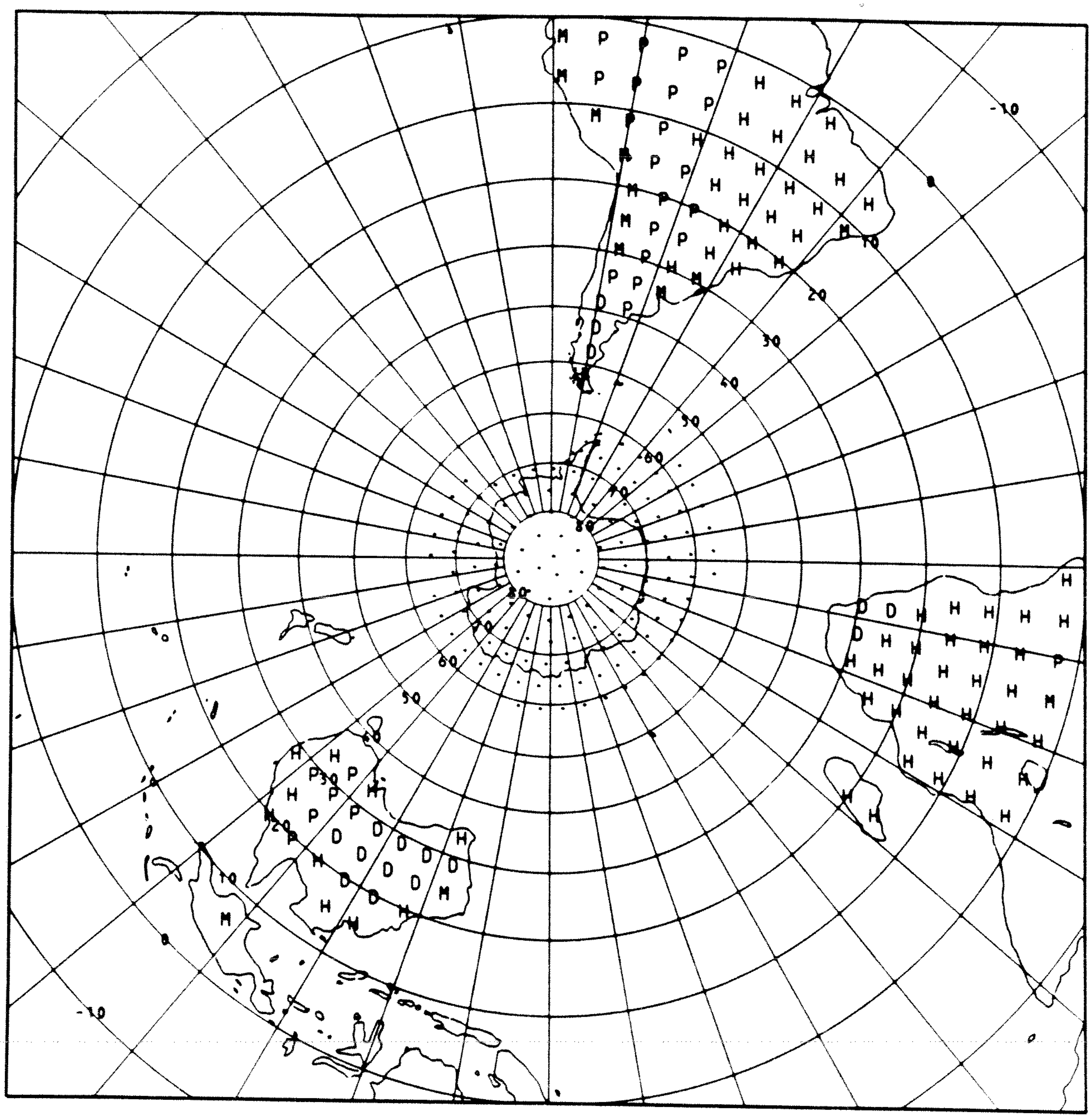
Plain: An area of low relief (generally less than five hundred feet).

Hilly upland and plateau: A hilly upland has more than five hundred feet of local relief and has a relatively small proportion of its surface at or near the summit level. A plateau stands distinctly above bordering areas, at least on one side; and it has a large part of its total surface at or near the summit level.

High and low mountains: Low mountains have more than a thousand feet of local relief. High mountains generally have a local relief in excess of three thousand feet.

Hamada: The surface is covered with a thin mantle of angular rock fragments with an underlying solid rock layer.

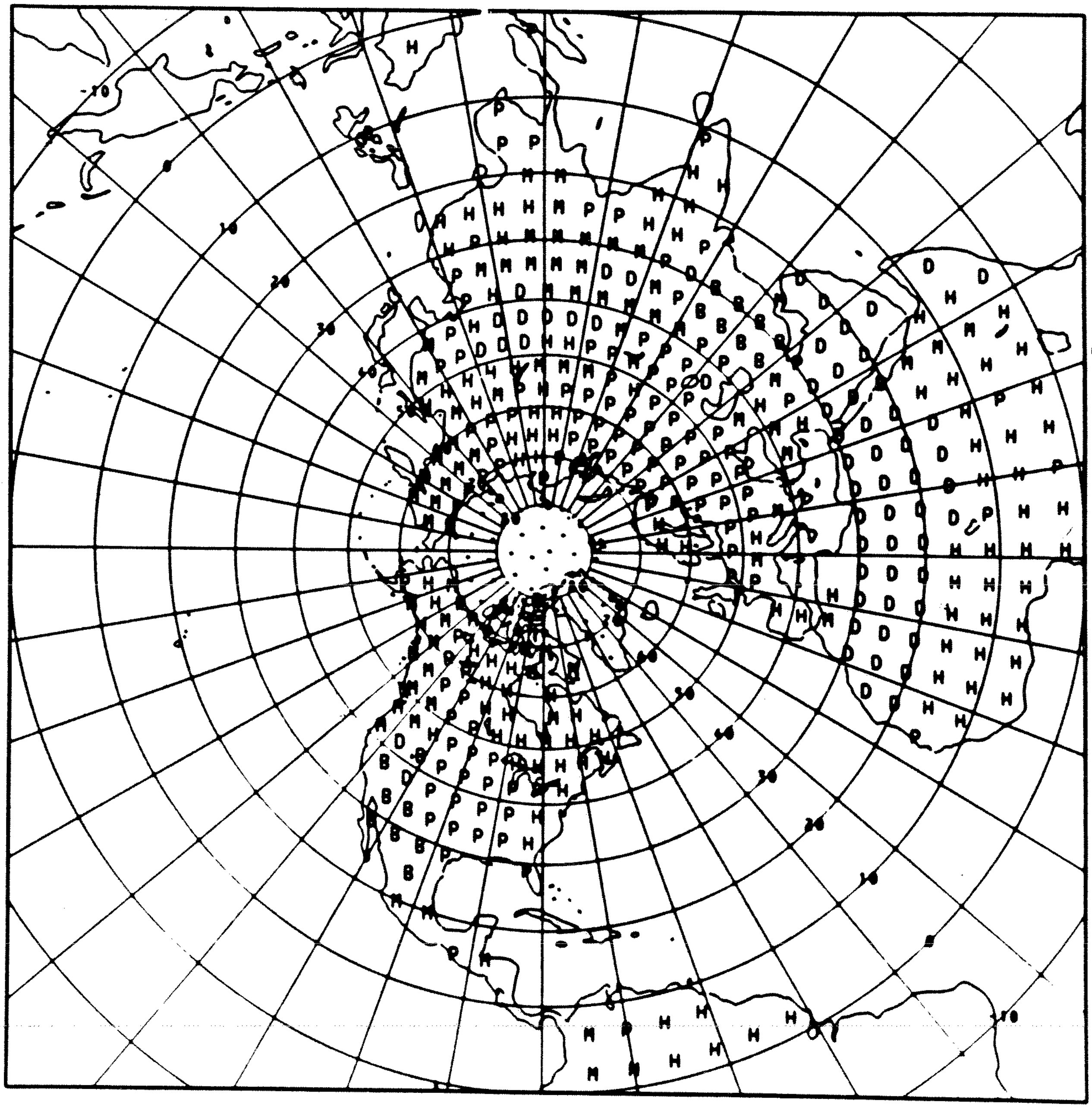
TOPOGRAPHY



SOUTHERN HEMISPHERE

Figure 4a. From the topography record, the predominant terrain type in each target area in the Southern Hemisphere. Symbols for each type are as follows: water-blank; ice '.'; plain 'P'; hilly '**H**'; mountain 'M'; hamada 'H'; erg 'D'; bolson 'B'.

TOPOGRAPHY



NORTHERN HEMISPHERE

Figure 4b. Same as 4a for Northern Hemisphere.

Erg: The erg is a sandy desert.

Bolson: Alternatively referred to as a basin and range desert, the bolson is characterized by scattered ranges of barren hills or low mountains separated by more or less extensive basins.

Vegetation can fall into any of nine categories: mountain, selva, scrub and semideciduous forest, taiga, mixed midlatitude forest, savanna, prairie/steppe, tundra, desert. Figures 5 a and b show the geographic distribution of the predominant vegetation types for Southern and Northern Hemispheres, respectively. These types are defined as follows:

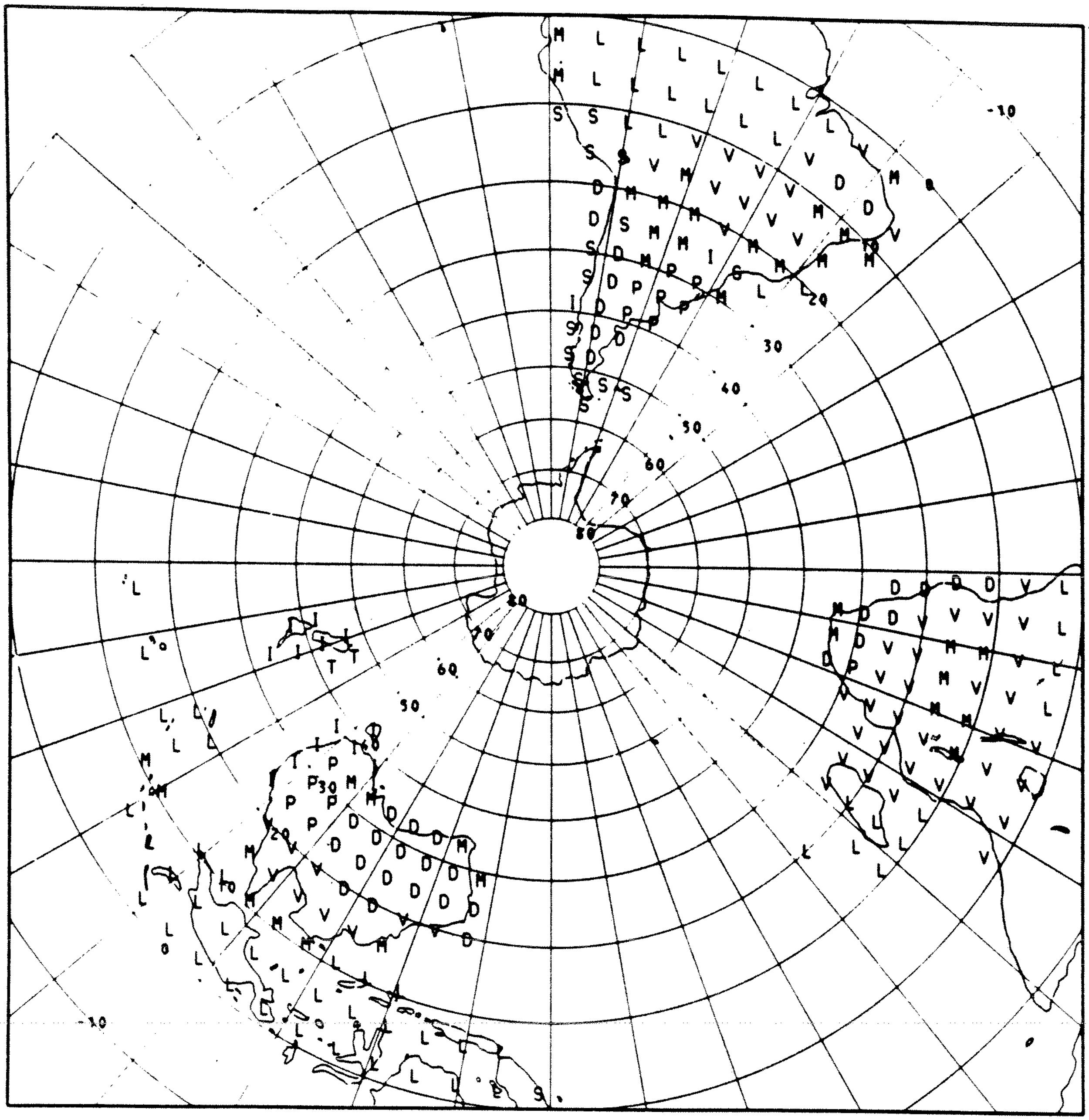
Mountain, undifferentiated: Because of its extensive relief, high mountainous terrain may consist of a broad range of vegetation types; shrubs and grasses to forests, and deciduous to evergreen, as well as barren rock and snow cover. Thus, for size scales on the order of the TA, this vegetation type is referred to as undifferentiated.

Selva (tropical rain forest): Consists of a dense deep coverage of tree growth.

Scrub and Semideciduous, tropical: This type is composed of shorter, less densely packed tree growth. Unlike the selva, this region experiences a seasonal variation in the coverage of foliage; in the dry season, many of the trees loose their leaves and the landscape takes on a brownish or grayish tinge.

Savanna: A tropical regime that responds to a seasonal variation of precipitation that ranges from over-abundant to deficient. The savanna is characterized by a combination of scrub woodland and grassland that becomes brown and barren in the dry season and vegetatively active in the wet season.

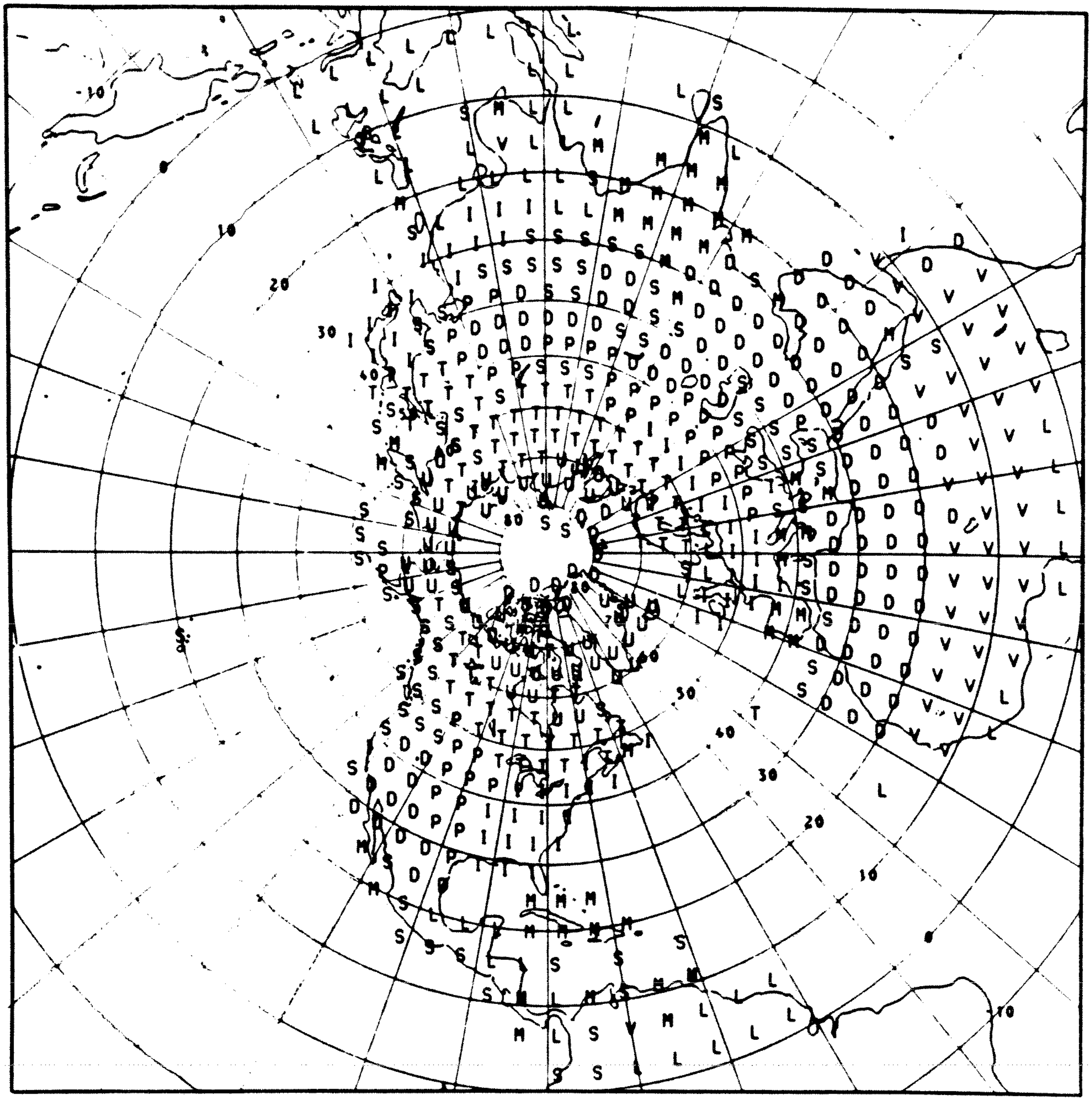
VEGETATION



SOUTHERN HEMISPHERE

Figure 5a. From the topography record, the predominant vegetation type in each target area in the Southern Hemisphere. Symbols for each type are as follows: mountain 'M'; selva 'L'; taiga 'T'; scrub 'S'; mixed 'I'; savanna 'V'; prairie 'P'; tundra 'U'; desert 'D'.

VEGETATION



NORTHERN HEMISPHERE

Figure 5b. Same as Figure 5a for Northern Hemisphere.

Prairie/Steppe: This type occupies the transition zone between midlatitude deserts and forests. The steppe is characterized by a continuous coverage of short (generally less than one foot in height) grasses. The prairie is also a grassland, the general height of which is in excess of three feet. Tree growth, while supportable, is sparse in these regions.

Desert: A typical desert scene includes a non-continuous cover of low xerophytic shrubs and grasses, which after a rainfall, gives the landscape a distinctly greenish tinge.

Mixed midlatitude forest: These forests are composed of a combination of broadleaf deciduous and coniferous evergreen trees.

Taiga: The taiga consists of a relatively low density of evergreen coniferous tree coverage. These regions border the poleward extent of the midlatitude forests.

Tundra: This polar regime is characterized by dwarf trees, bushes, shrubs and grass.

The geographic distribution of the vegetation types does not vary seasonally.

The topography information is converted for use on the STRT by assigning within each target area a fractional area represented by each configuration and vegetation type comprising the TA. This assignment of fractional amounts is accomplished by a subjective, visual interpretation of maps from James' text overlain with a grid of TA boundaries. Thus, for each TA the fractional values for water and ice and surface configuration or vegetation should sum to 1.0. If the sum is less than 1.0, the difference is the fraction of the TA with missing topographic information. These results are sorted by TA and stored on disc as the "TOPO" dataset. A detailed description of the record format is given in Section 3.5.2.

2.1.3 Quality of the Data

The areal fractions are subjectively determined to within 0.05. Any uncertainty in determining these fractions will exist only when more than one topographic type exists within a TA. It should be kept in mind that these are climatological classifications and do not represent alterations caused by man, e.g. building of cities or highways, agriculture, etc.

In certain Northern Hemispheric target areas, the vegetation category, mixed latitude forest, was inadvertantly misinterpreted as selva. These target areas, identified by their coded number (see Section 3.2), are 3243, 3244, 3245, and 3301.

2.2 Geography Record

The STRT provides one Geography data record for each STA. This data record describes in percent the fraction of the STA comprised of land and water, snow and ice. In addition, the age and depth of the snow and age of ice is included in the record.

2.2.1 Source of the Data

The geography data originate from the terrain and snow/ice fields that support the Air Force Global Weather Central (AFGWC) Automated Cloud Analysis Model (3D NEPH)(Fye, 3). The Air Force supplies two data bases; a terrain analysis and a snow/ice analysis, each of which are stored on magnetic tape. Both products are global gridpoint fields, with each hemisphere represented on a 512 x 512 grid overlying a polar stereographic projection, giving a resolution of 40 km at 60° North or South latitude. The snow data are updated at 00Z every day and the ice data, once per week. Thus the snow data are current to within 24 hours of any satellite radiance observation on the STRT.

In the terrain data set, a gridpoint is defined as either land, water or coastal (both land and water). Terrain elevation information, which is on the Air Force tape, is not incorporated into the STRT data base.

In compiling its snow/ice analysis the Air Force calls on inputs from hourly conventional surface reports, weekly Navy sea ice analyses, satellite brightness observations, and climatology (Luces et. al., 4).

For the land gridpoints, snow cover is indicated by the report of a depth greater than or equal to 3mm. This value is updated every 24 hours by additional snowfall reports or decreased by calculated snow melt. In the absence of observations or other data the snow depth is adjusted so that it eventually approaches climatology. Depth cannot exceed 800mm.

Snow age is calculated for each gridpoint where snow depth is greater than 25mm. When a depth of more than 25mm is obtained, the age count is initialized to one day. The count is reinitialized when an additional accumulation of greater than 25mm is received. The age can be incremented to a maximum of 255 days. Ice age is incremented from the day of first report and is reset only when ice is no longer reported.

For gridpoints over water, sea-ice information is added from weekly bulletins received from the U.S. Navy. Where there is land, the snow analysis is allowed to proceed normally. No snow accumulation is allowed over water; ice is denoted by a snow depth of 254mm over water.

2.2.2 Data Processing

In the STRT algorithm, the Air Force terrain data base is called on first. A look-up table which relates the I, J indices of the hemispheric grid to each STA is employed. All gridpoints are grouped into appropriate STAs and land/water fractions are computed by a straight average of all gridpoints. The number of gridpoints per STA will vary between almost 50 near the equator to about 10 near the poles. Coastal grid points are considered half water, half land.

After the ratio of land to water is determined for each STA, the snow/ice data are processed. Consistent with the Air Force procedure, no snow is allowed over water and no ice is allowed over land. In each STA a separate counter is incremented when snow depth or ice is observed. When all observations in a STA are recorded, the proportions of ice, snow, land and water are computed. Additionally, an average age and depth of snow and age of ice is computed. These results are sorted by STA number and time and written to the merge-geography (MGG) tape. The MGG record format is described in detail in Section 3.5.3. Figure 6 shows the distribution of land, water, snow and ice derived from the Air Force data on the ERB/STA grid for a day in November, 1978.

2.2.3 Quality of the Data

The user of the STRT should be aware of some anomalous occurrences of snow in mountainous sub-tropical and tropical regions. The Air Force analysis procedure successfully removes snow from areas where it is physically impossible but at high elevations, such as in the Andes of South America, snow depths may be retained because of a climatological snow amount.

The Air Force has issued memoranda in which it is suggested that the use of their data set be limited to snow/no snow decisions. There were deficiencies in their algorithm for computing snow depth that impacted seriously on the end product. The snow data reverts to climatology on the first of each month. They have also determined that the snow age parameter is very inaccurate in data-sparse regions, such as the poles, and highly questionable elsewhere.

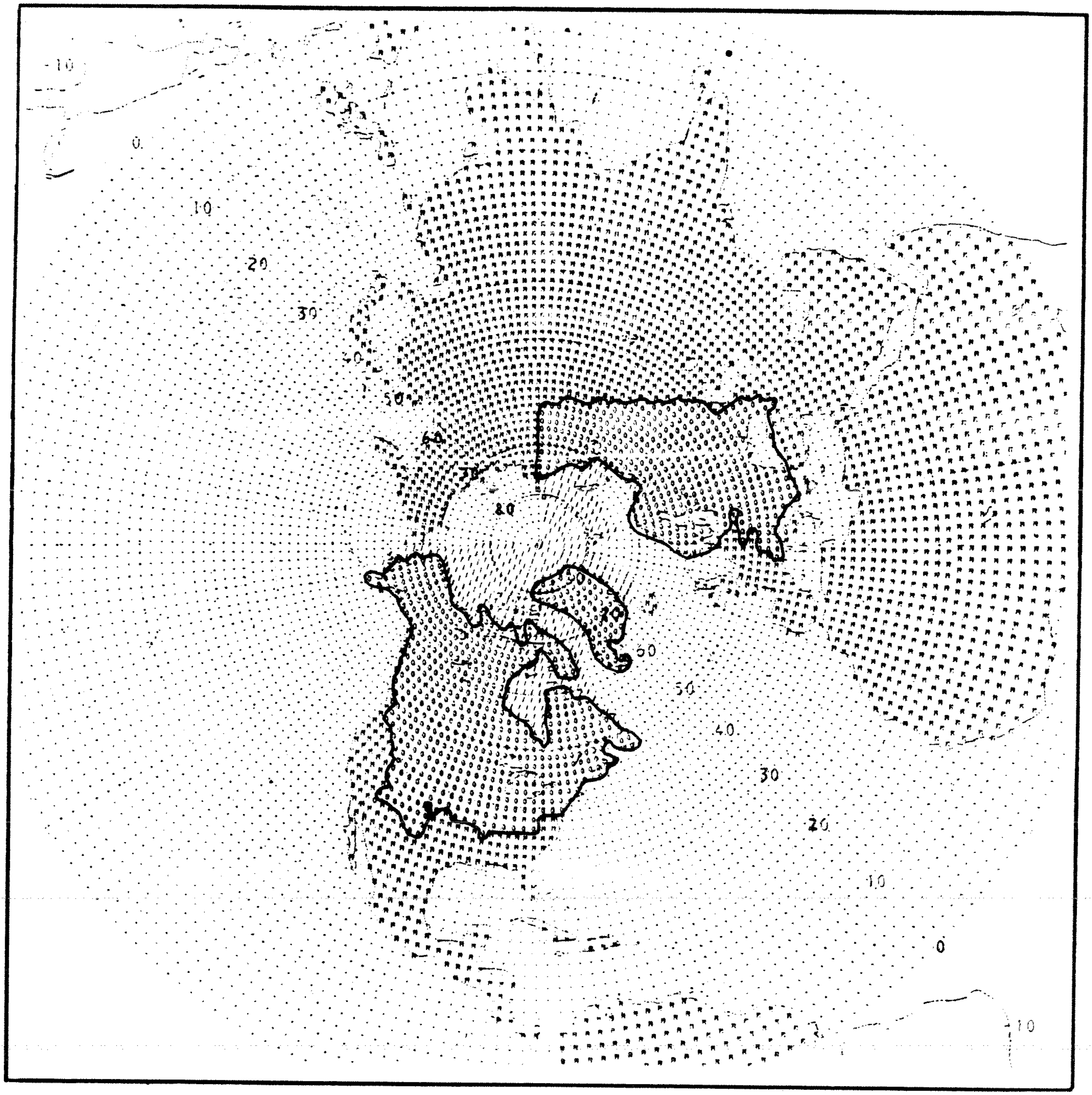


Figure 6. From the geography record, the predominant surface coverage classification for each sub-target area in the Northern Hemisphere. A sub-target area may consist predominately of land, water, snow (over land only), or ice (over water only. The symbols for each type are: land 'M'; water'.'; snow 'O'; ice '/'. A snow/no snow line is drawn for clarity.

Comparison studies of Air Force, NOAA, NMC, and NESDIS analyses of snow cover performed at NOAA show qualitative agreement in the placement of the snow/no snow line. The Air Force memo confirms that this feature of their analysis is reliable.

There was a deficiency in the NOAA algorithm that associated latitude and longitude coordinates to the data points of the Air Force grid. Each value was incorrectly located by one half of a grid space in both I, J directions. The amount of the location error is typically 25 km or less than one sixth of the size of a sub-target area. Thus, it is not believed that this error causes a serious bias, and will only affect STAs containing snow/no snow and land/water boundaries.

If one or more Air Force grid points are missing from a STA, then no geography coverage is computed.

2.3 The Radiance/Cloud Record

The STRT provides one observation record per orbital sighting of each STA. The data record contains the radiance observations (to be described in section 2.3.4-6) from the ERB scanning radiometer and cloudiness estimates derived from measurements from the Temperature Humidity Infrared Radiometer (THIR) flown aboard Nimbus-7. Consequently the cloud estimates are concurrent to within ten minutes of the ERB observations on the STRT. The cloud estimates are of percent coverage in each of four sky/cloud conditions; clear, low cloud, middle cloud, and high cloud. Additional information, further defining the cloud type and aiding interpretation is provided for each cloud classification.

2.3.1 Source of the Cloud Data

Cloudiness estimates and flags are produced for each STA by a threshold technique. Eleven and co-located 6.7 micrometer filtered radiances are sorted into bins of a histogram separated by 11.5 μm radiance boundaries which are related to cloud type. The cloud type is defined by altitude above sea-level and is adopted from the cloud-type classification described in the International Cloud Atlas (5). The derived radiance thresholds represent boundaries between clear/low cloud, low/middle, and middle/high cloud radiating surfaces.

The number of radiance samples in each histogram (clear or cloud type) level is divided by the total samples in the STA to produce a percent coverage. After an examination of other statistics such as mean and root-mean-square (RMS) deviation of the radiances in each histogram bin, flags are set which further characterize the cloud type and which warn of ambiguity of the classification.

2.3.2 Data Processing

Creation of the cloudiness data involves several steps. Figure 7 is a representation of the flow of data through the process of creating the final cloud product. First, a climatological temperature data set provided by NCAR (Jenne, et. al., 6) is used to derive the boundary temperatures for each histogram level. Altitudes of low, middle, and high clouds are specified as a function of latitude, shown in Table 2.

Table 2. Cloud Boundaries

Latitude	Low Cloud	Middle Cloud	High Cloud
0 - 30°	sfc - 2km	2 - 7km	> 7km
30 - 60°	sfc - 2km	2 - 6km	>6km
60 - 90°	sfc - 2km	2 - 4km	>4km

The data tape from NCAR consists of monthly mean temperatures computed over a 20-year span, gridded at 5° intersections of latitude and longitude. The temperatures, which are supplied at the Earth's surface and at mandatory pressure levels, are linearly interpolated to the appropriate cloud-boundary altitude and bi-linearly interpolated in latitude and longitude to the center of each STA. Also, the Air Force terrain data tape is used to compute percent land and average terrain altitude for each STA. These data are then written onto magnetic tape, referred to as an ERB Sub-Target Area Geographical-Season (STAGS) tape.

The Nimbus-7 THIR is a two-channel cross-track scanning radiometer. It measures Earth radiation from two spectral bands during the day and night. A 10.5 to 12.5μm (11.5μm) window channel measures the radiative temperatures from cloud, land, and sea surfaces. A 6.5 to 7.0μm (6.7μm) channel provides information on the moisture content of the upper troposphere. The ground resolution at the sub-satellite point is 6.7km for the 11.5 μm channel and 20km for the 6.7 μm channel (Hwang, 7). The THIR measurements are calibrated, earth-located and written on the calibrated-located data tape (CLDT) at NASA/GSFC.

Using the cloud boundary temperatures and a table of mean adjustments for atmospheric attenuation, boundary temperatures at the surface and 2km are corrected for attenuation so they correspond more correctly to the measured radiation from THIR. Attenuation at the middle/high cloud boundary is assumed to be negligible. The correction for attenuation is an empirical factor (Brower, et. al., 8) expressed as a function of temperature and local zenith angle of the radiating surface. THIR data is processed in the following manner: 1) During

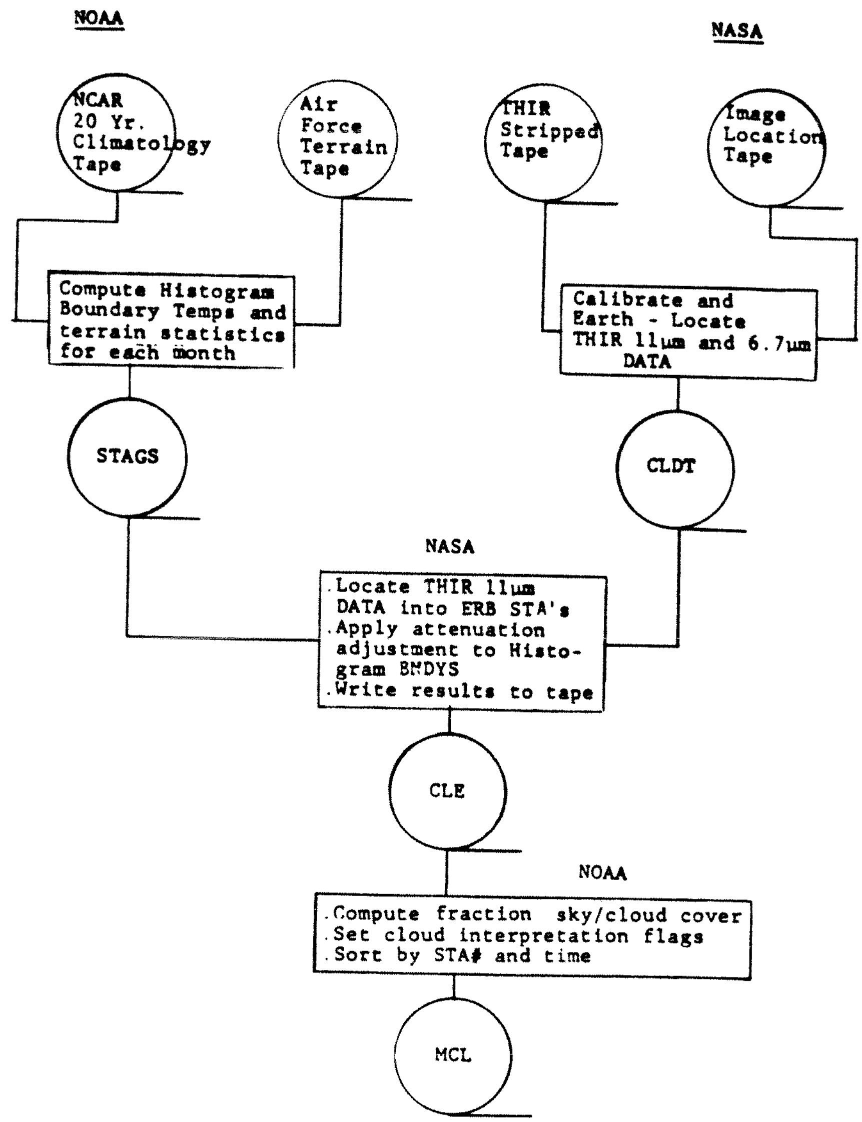


Figure 7. The flow of data in the production of the cloud component to the STRT data base.

each orbit the THIR observations are sorted by STA. As many as 600 THIR 11 μm samples may lie within a STA; 2) Three cloud boundary temperatures for that month are read from the STAGS tape for each STA viewed during that orbit; 3) A mean temperature correction for atmospheric attenuation is applied to the surface and 2km temperatures using the zenith angle of the first sample in the STA and temperatures are converted to radiance; 4) The 11.5 μm observations are sorted within histogram levels; 5) A mean and RMS deviation of radiance are computed from the 11.5 μm and the corresponding 6.7 μm samples for each histogram (i.e., cloud) level.

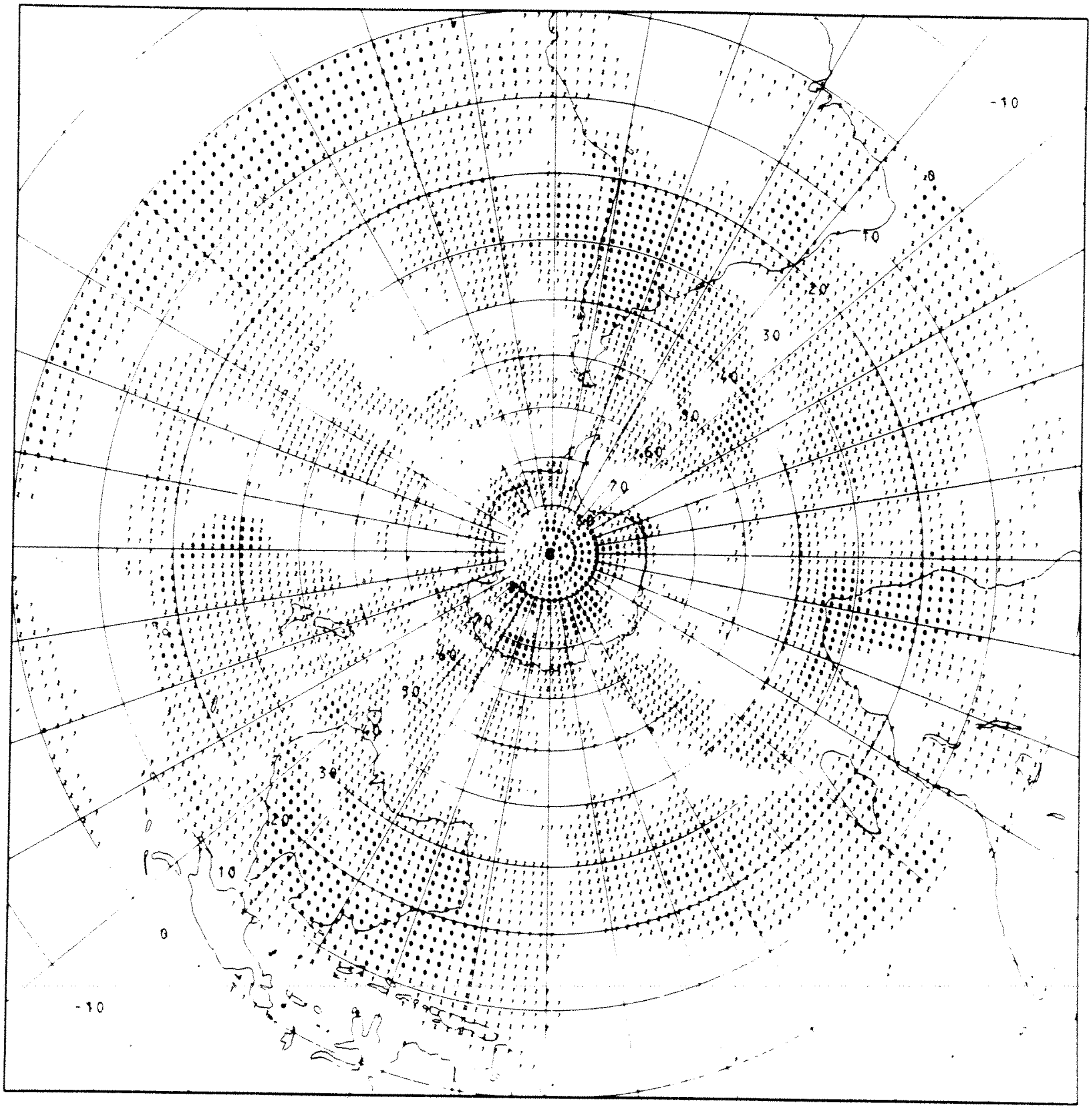
Four sample populations, four 11.5 and 6.7 μm mean and RMS temperatures, and the adjusted boundary temperatures, as well as pertinent location data, are written onto an ERB-clouds (CLE) tape. The data are written in time order for each orbit.

One final step in the creation of the cloud data to be merged on the STRT involves processing the CLE data tapes. In each STA, the 11.5 μm sample populations from each cloud bin are divided by the total population for the STA to determine a fractional coverage by low, middle, and high clouds. Figures 8 a and b show amount of total cloudiness derived from the CLE tape for 4 Sept. 1979 on the ERB/STA grid for Southern and Northern Hemisphere, respectively.

Then a series of checks are made in order to determine further the character of the cloud type and the ambiguity of the cloud estimate. The mean 11.5 μm radiance in each bin is compared with histogram boundaries to identify whether that cloud-type estimate is ambiguous. A test is made to determine if the cloud is predominantly an ice cloud (when the 11.5 μm mean temperature from the high cloud bin is less than 240K). The RMS deviations of the 11.5 and 6.7 μm samples are inspected to identify characteristics indicative of horizontal uniformity and thickness of the cloud layer or whether the cloud is convective in nature. For example, if the RMS deviation of the 11.5 μm radiance in the middle cloud bin is at least 4K in equivalent blackbody temperature, the cloud is flagged as convective. In some cases the RMS deviation of the 6.7 μm radiance is inspected in a test for nonuniformity of moisture content of the upper troposphere, such as might be introduced by a thin cirrus cloud.

Such tests are performed in each cloud bin only when the total population in the STA exceeds 100. The various test criteria were determined from a visual inspection of cloud images and an accompanying subjective identification of the cloud type with a typical RMS deviation of 11.5 and 6.7 μm observations of that cloud. Appendix C outlines the logic of the cloud-testing algorithm.

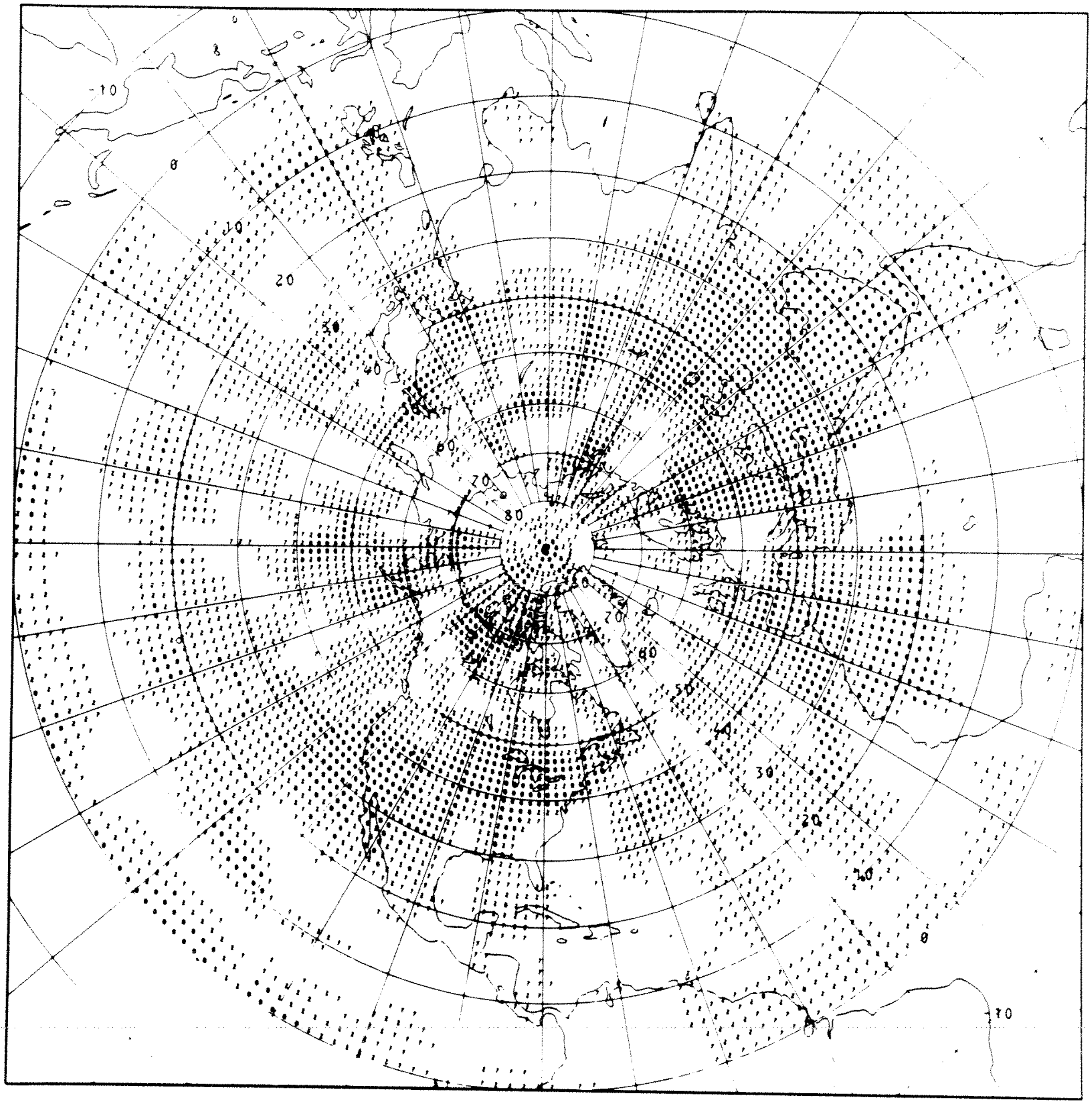
THIR DERIVED CLOUD SEPT 4, 1979



SOUTHERN HEMISPHERE

Figure 8a. From the THIR-derived cloud data, the total cover of low, middle and high cloud in each Southern Hemisphere sub-target area. The date is 4 September 1979. Symbols denoting fractional coverage are: .95-1.00 (cloudy) - 'blank'; .50 - .95 = '7'; .05 - .50 = '2'; 0 - .05 (clear) = '0'.

THIR DERIVED CLOUD SEPT 4,1979



NORTHERN HEMISPHERE

8b. Same as 8a for Northern Hemisphere.

All of these data are then sorted by STA number and time and written to a merge-cloud tape (MCL) which is used in the final merge of data onto the STRT.

2.3.3 Quality of the Data

Table 3 is an example of the THIR cloud product contained on the STRT. The THIR cloud amount

Table 3. Sample of THIR Cloud Products.

Clr Amt = 0.30	Low Cld Amt = 0.28	Mid Cld Amt = 0.29	Hi Cld Amt = 0.13
Clear Flags	**Low Cld Flags**	**Mid Cld Flags**	**Hi Cld Flags**
Ambig Low = 0	Ambig Clr = 0	Thin Cirrus = 0	Ice = 1
Low Cld = 0	Clear = 0	Convctv = 1	Brkn Stratus = 0
Thin Cirrus = 0	Thin Cirrus = 0	Ambig Clear = 0	Thk Stratus = 0
Ambigs = 1	Ambigs = 1	Ambig Low = 0	Thin Stratus = 0
		Ambig High = 0	Ambig Middle = 0
			Convctv = 1

estimates have been validated in a comparison with an independent cloud analysis (Stowe, 9). The independent analysis was performed by meteorologists experienced in using both satellite and ground-based data. The meteorological analysts employ surface synoptic reports, snow cover analyses, radiosonde observations, and visible and infrared images from the GOES-EAST satellite located near the equator and 75° W. Chosen for analysis were 185 STA observations from November and December, 1978, April and June, 1979 near local noon and 61 STA observations from November, 1978 near local midnight. The skill of the analyst is checked against a second analyst as well as the cloud analysis produced by the U. S. Air Force's 3-D nephanalysis.

Estimates of the amount of clear (100%-total cloud amount) and low, middle and high (opaque) cloud cover from one of the analysts and from Nimbus-7 THIR (CLE) have been correlated to determine the systematic and random errors of each. Tables 4 and 5 are the results of the intercomparison. To interpret the results, it was assumed that the analyst has negligibly small systematic errors and a range of possible random errors from negligibly small to

TABLE 4. Correlation statistics for the analyst and THIR estimates of cloudiness for 185 local noon cases. In the regression test the analyst is the dependent (y) variable and THIR is the independent (x) variable.

Cloud Classification	$\overline{Y}$ (%)	$\overline{X}$ (%)	Correl. Coeff.	Slope	Intcpt.	$S.E/\sqrt{2}$	RMS Diff.
Clear	33.4	32.5	.769	.675	11.4	13.6	22.1
Low	33.5	18.3	.507	.746	19.8	18.4	30.6
Middle	19.7	34.2	.566	.502	2.6	16.7	32.0
High	13.1	14.5	.950	.919	-0.2	6.1	9.0

Table 5. Correlation statistics for the analyst and THIR estimates of cloudiness for 61 local midnight cases. In the regression test the analyst is the dependent (y) variable and THIR is the independent (x) variable.

Cloud Classification	$\overline{Y}$ (%)	$\overline{X}$ (%)	Correl. Coeff.	Slope	Intcpt.	$S.E/\sqrt{2}$	RMS Diff.
Clear	44.4	20.9	.529	.700	29.8	23.1	41.3
Low	7.1	15.5	.059	.051	6.4	12.7	28.2
Middle	33.0	47.5	.364	.315	18.0	21.6	42.5
High	15.4	15.7	.848	.867	1.8	10.9	15.9

equal and uncorrelated with the other estimate. The difference in the means and the slope and intercept of the regression line relative to the anlayst are used as a measure of systematic error. The RMS and standard error of regression, divided by the square root of two, are used to give an upper and lower limit, respectively, to the range of random errors of the CLE observations. However, these results should be considered as maximum possible errors for CLE, since they include errors due to the analyst.

These analyses have produced the following results:

A. For daytime observations from Nimbus-7 THIR/CLE tapes; 1) clear amount is overestimated when mostly clear and underestimated when mostly cloudy by 10% - 20% at these extremes, but agrees to within 1% on the average; the random error is in the range of 14% - 22%; 2) low cloud amount is underestimated on the average by 15%; differences with the analyst are large when amount is small and almost nil for overcast conditions; random errors range between 18% and 31%; 3) middle clouds are overestimated by 14% on the average; differences with the analyst are small when amount is small and get larger as amount increases; random errors range between 17% and 32%; 4) low and middle clouds, when considered as one cloud type, give smaller errors (e.g., random error ranges between 14% - 24%) suggesting that the errors for low and middle separately are partially due to differences in cloud altitude interpretation; 5) high cloud amount is measured with less than a few percent systematic error and the random errors range between 6% - 9%.

B. For nighttime observations with Nimbus-7 THIR/CLE tape: 1) estimates of low, and in some cases middle cloud, are erroneous over land (due to the use of climatological monthly mean surface temperature), grossly overestimating cloud amount relative to the analyst; however, CLE estimates of clear amount over land are probably correct when the amount exceeds 90%; 2) estimates of high cloud amount over land are in good agreement with the analyst, within one percent on the average, with random errors somewhat larger than during daytime, 11% - 16%; 3) over oceans, errors in the amount of clear and different cloud types are expected to be comparable to daytime errors.

In conclusion, the Nimbus-7 THIR/CLE tape cloud amount estimates have been validated for use in scientific investigations with random errors of 6% - 30% and systematic errors less than 20%. The CLE estimates should not be used for land areas at night, except for high clouds. The most likely causes for these errors which are maximum possible because they include errors by the analyst, are: 1) use of climatological temperatures; and 2) effects of clouds which partially fill the radiometer field of view. The THIR data are being re-processed using concurrent surface temperature information from the Air Force and reflectance information from the Nimbus-7 Total Ozone Mapping Spectrometer (TOMS) to reduce these errors. New Nimbus-7 CLE tapes (NCLE) and a space/time avertage climatology product tape (CMATRIX) will be produced. They should become available in 1984. Until then, the current CLE archive, which spans three years beginning November 16, 1978, can be used for investigations into cloud related scientific issues on regional or global scales. The value of CLE tapes has already been realized through their use in developing models of bidirectional reflection and emission for the Nimbus-7 Earth Radiation Budget and NASA ERBE programs, c.f., Taylor and Stowe (10).

Intercomparison studies have shown that most of the cloud description flags do not represent the physical conditions they were expected to describe. One exception is the high-ice cloud flag which identifies cloud types with radiative properties characteristic of ice particles based on the work of Taylor and Stowe, 10. The flags for ambiguous cloud classification have been checked by comparing THIR estimates with those of the analyst after removal of ambiguous cases. The removal of ambiguous cases did not improve the agreement between THIR estimates and those of the analyst. However, the flags do convey information about the radiances and the variances of the radiance in the histogram bins (Appendix C) which may be a useful aid for users who wish to develop their own interpretation of the STRT cloud data.

2.3.4 Source of the Radiance Data

The observations of earth-emitted and reflected radiance on the STRT are supplied by the ERB-7 narrow-angle field of view (NFOV) scanner. The NFOV scanner has eight sensing channels, four of which measure shortwave radiation (0.2 μm to 4.5 μm) and four that measure emitted longwave radiation (4 μm to 50 μm). The Nimbus-7 User's Guide (11) describes the ERB instrument in detail.

The eight NFOV channels have an instantaneous, rectangular field of view (IFOV) of .25° x 5.12°. The scan head of the NFOV instrument contains four telescopes which are oriented 12 degrees apart. Each telescope is shared by one longwave and one shortwave channel. The scan head is stepped at varying rates over each ½ second measurement, integrating the signal of up to 20 IFOVs, to partially maintain an average ground resolution of about 150km as it scans from nadir (20 IFOV's integrated; resolution ≅ 90km) to the Earth's horizon (1 IFOV integrated; resolution ≅ 250km).

The scanner repeats a complete sequence of angular observations every 112 seconds, in which time it has stepped to the Earth's horizon (satellite zenith angle of 90°) in the forward and aft (along the orbital track) direction and not quite that far in one direction normal to the orbital path (satellite zenith angle of 72°). With such a scan sequence a particular point on the Earth can be viewed from several independent viewing directions as the satellite orbits overhead. A calibration is performed every 12 days.

2.3.5 Data Processing

The data base used for the radiance measurements is the ERB-7 master archival tape (MAT). This is a 1600 bpi, 9-track tape that consists of one day of earth-located, calibrated wide and narrow field of view observations. The data are recorded in chronological order and grouped by orbit. The MAT is first subjected to a quality control screen to determine if the data are useable. The data on acceptable MAT's are processed in the following manner.

Certain geometric and housekeeping data from the MAT are checked against acceptable values, such as subsatellite latitude and longitude. Major frames (16-second intervals of data) containing unacceptable data are deleted from further processing. The NFOV shortwave radiances are recalibrated to account for changes from the pre-flight calibration. The radiation data are grouped in time order for each 112-second scan sequence for each day and written to an intermediate tape (the FOV tape). The radiances are defined in terms of time, viewing geometry and earth location. Satellite and solar zenith angles and azimuth relative to the sun and solar azimuth from north are computed.

As each scan sequence of data is processed from the FOV tape, the radiances are identified with a STA. The viewing zenith and azimuth angles are placed into discrete bins, each about 6° in zenith and 15° in azimuth. The number of sub-fields-of-view (1/9 of FOV) lying within the STA and the telescope number are also specified. After all radiances within that STA for that orbital pass are processed, a mean solar zenith and azimuth (relative to north) are computed to complete the radiance record. These radiance records are ordered by STA and by time and written to the merge-radiance (MRA) tape. The format of the radiance/cloud (orbital data) record is described in Section 3.5.4.

2.3.6 Quality of the Data

The NFOV radiances observed by the ERB-7 scanner have been subjected to various validation tests. The longwave measurements are believed to be stable to within one percent over the 19-month lifetime of the scanner and accurate to about 2% (Jacobowitz, et. al., 12). The shortwave measurements are stable to within one percent also over the scanner's lifetime. Channel 18 (telescope 4) shortwave radiance measurements become quite noisy after December 27, 1978 and should not be used for scientific study.

The LWSC signals are calibrated to an accuracy of 1-2% and have a noise equivalent radiance less than 2 $W/m^2/sr$ when scanning. The SWSC signals of channels 15-18 were scaled down by factors of 0.91, 0.87, 0.92 and 0.85, respectively, to correct for an apparent change in sensitivity after launch. After adjustment the radiances are thought to be accurate to 2-3% with noise equivalent radiance less than 2 $W/m^2/sr$ when scanning.

3. THE STRT Product

3.1 Introduction

The period covered by the STRT data base extends from 16 November 1978 to 19 May 1980. Within this period, there exist 272 days of data, one day per tape file. Table 1 indicates the dates during the period for which STRT data is available. The STRT data base is archived at the National Space Science Data Center (NSSDC), located at NASA's Goddard Space Flight Center in Greenbelt, Maryland. Requests for data from the STRT data base should be directed to:

National Space Science Data Center
NASA/GSFC
Greenbelt, Maryland 20771
Phone: (301) 344-7134

The data is archived on magnetic tape. These tapes are nine-track, non-label, high density (6250 bpi), multi-file (6-day) tapes. Refer to Appendix D for programming and job control language (JCL) requirements.

The final production step in the creation of the STRT data file is a merge operation. Topography (TOPO), snow/ice (MGG), cloud (MCL) and radiance (MRA) data are read from separate devices and written onto a single tape file shown schematically in Figure 9. Each file on the tape contains one day of data. In each file, the Earth's topography and vegetation, land and water distribution, snow, ice and cloud cover, and angular radiance characteristics are described by target area and sub-target area for the whole globe as viewed near local noon and midnight from the Nimbus-7 orbit.

3.2 Target and Sub-Target Areas

The globe is divided geographically into 2070 TA's, each approximately 500 km x 500 km in area. Each TA has dimensions which are constant in latitude and variable in longitude to preserve an approximately constant area. The latitudinal dimension is 4.5° and the longitudinal dimension varies from 120° nearest the poles to 4.5° at the equator.

A coding convention, employing two-digit indices is used on the STRT to identify each target area by latitudinal strip and longitudinal position within the strip (Table 6). The strips are numbered 0 to 39 from south to north. The number of TA's on a strip varies from 3 at the poles to 80 at and near the equator. The second index is the longitudinal position of the TA with respect to the Prime

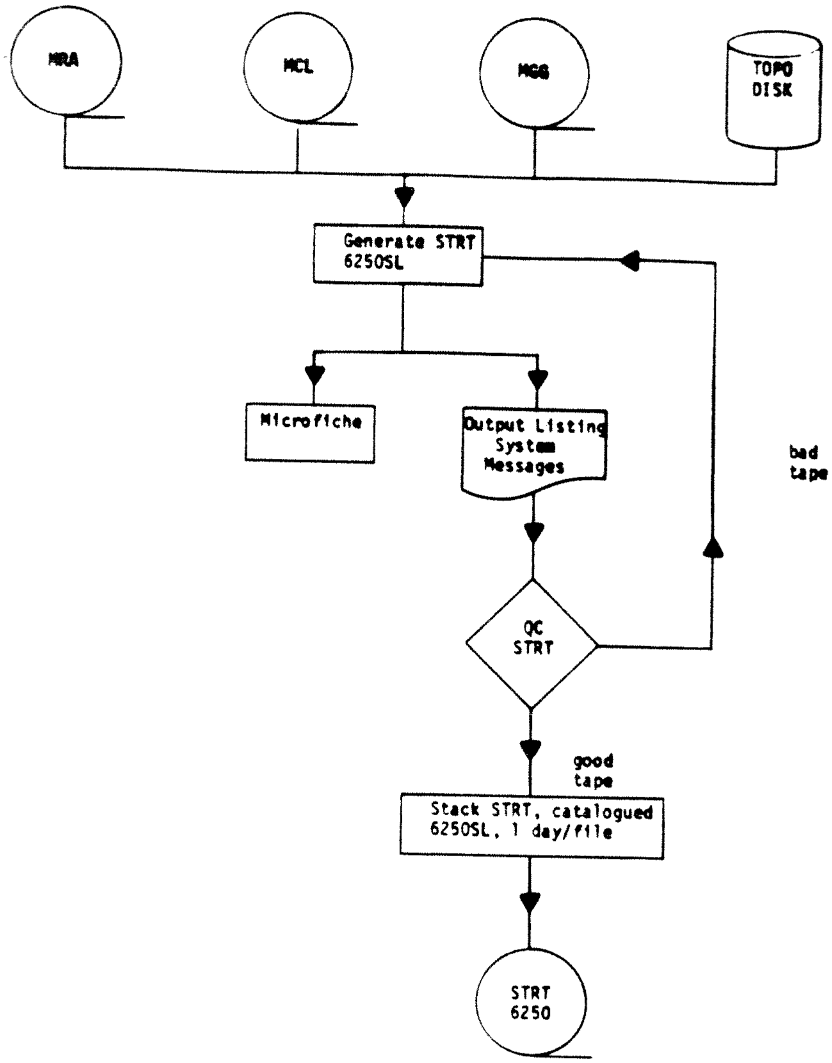


Figure 9. Schematic of the merge operation resulting in a single data file on the STRT. The four inputs are the merge-radiance (MRA), merge-cloud (MCL) merge-geography (MGG), and topography (TOPO DISK) data. The quality control (QC) checks on the STRT are discussed in 3.6. A successfully merged STRT file is subsequently stacked on a multifile, 6250 bpi tape.

Table 6. ERB SCANNING CHANNEL TARGET AREAS

CODED TARGET NO.		SEQUENTIAL TARGET NO.		LATITUDE LIMITS		LONGITUDE INTERVAL*
SOUTH HEM.	NORTH HEM.	SOUTH HEM.	NORTH HEM.	LOWER Limit	UPPER Limit	
1901-1980	2001-2080	956-1035	1036-1115	EQ. 0.0	4.5	4.5
1801-1880	2101-2180	876-955	1116-1195	4.5	9.0	4.5
1701-1780	2201-2280	796-875	1196-1275	9.0	13.5	4.5
1601-1680	2301-2380	716-795	1276-1355	13.5	18.0	4.5
1501-1572	2401-2472	644-715	1356-1427	18.0	22.5	5.0
1401-1472	2501-2572	572-643	1428-1499	22.5	27.0	5.0
1301-1372	2601-2672	500-571	1500-1571	27.0	31.5	5.0
1201-1272	2701-2772	428-499	1572-1643	31.5	36.0	5.0
1101-1160	2801-2860	368-427	1644-1703	36.0	40.5	6.0
1001-1060	2901-2960	308-367	1704-1763	40.5	45.0	6.0
0901-0960	3001-3060	248-307	1764-1823	45.0	49.5	6.0
0801-0848	3101-3148	200-247	1824-1871	49.5	54.0	7.5
0701-0745	3201-3245	155-199	1872-1916	54.0	58.5	8.0
0601-0640	3301-3340	115-154	1917-1956	58.5	63.0	9.0
0501-0536	3401-3436	79-114	1957-1992	63.0	67.5	10.0
0401-0430	3501-3530	49-78	1993-2022	67.5	72.0	12.0
0301-0320	3601-3620	29-48	2023-2042	72.0	76.5	18.0
0201-0216	3701-3716	13-28	2043-2058	76.5	81.0	22.5
0101-0109	3801-3809	4-12	2059-2067	81.0	85.5	40.0
0001-0003	3901-3903	1-3	2068-2070	85.5	Pole	120.0

* For each latitude band the longitude intervals start at the 0 degree meridian and progress West by the increments listed.

The sequential numbering system assigns a number, between 1 and 2070, to each target area starting from the South Pole. Within each latitude belt the numbers increase westward from the 0° meridian and continue to increase within the adjacent latitude belt to the North.

In each hemisphere there will be 1035 target areas and each of those areas is further subdivided into 9 subdivisions.

Meridian, increasing from east to west (Figure 10). For example, target area number 2858 is located 29 strips from the south, and 58 target areas west of the Prime Meridian. (This TA includes the island of Sicily and the 'boot' of Italy.) An algorithm is included in Appendix A for a conversion from coded TA number to latitude and longitude.

Each TA is further divided into nine equal sub-target areas. These form a 3 X 3 grid in the TA and are coded with an index ranging from 1-9, starting in the SE corner and ending in the NW corner as shown below.

TA

9	8	7
6	5	4
3	2	1

↑ N

3.3 Angular Bins for Grouping Radiances

Each STA is viewed from a number of angles by the ERB scanner as it orbits overhead. The possible viewing angles are grouped by zenith (θ) and relative solar azimuth (ϕ) into 419 discrete bins (figure 11, 12). Each radiance observation from a STA is assigned a bin code consistent with its angular characteristics.

The angular bins are 6° wide in θ except for the first and last bins which are 3° wide (these are never sampled). The size of the bin in the azimuth direction is a minimum (6°) in the principal plane of the sun (along the axis, $\phi=0^{\circ}$, 180°) and increases outward (to 15°). A coding convention is used on the STRT to number each angular bin. The bins are numbered XX YY by concentric ring (XX) increasing outward, and by position in the ring (YY) beginning at $\phi=0^{\circ}$ and increasing clockwise. The convention is similar to the TA numbering convention. The number of angular bins in a ring increases from one at the center to 30 in the outermost ring. A look-up table for converting from coded bin numbers to angular units at the center of each bin is supplied in Appendix B.

3.4 Data Organization

Topography, geography, and orbital (radiance/cloud) logical records are arranged in TA groups. Each TA group is further arranged according to STA subgroups. The TA record groups are ordered in increasing coded target number sequence; they begin at the Prime Meridian and proceed row-wise westward, then column-wise northward from the south pole to the north pole. A schematic of the logical record organization is shown in Figure 13.

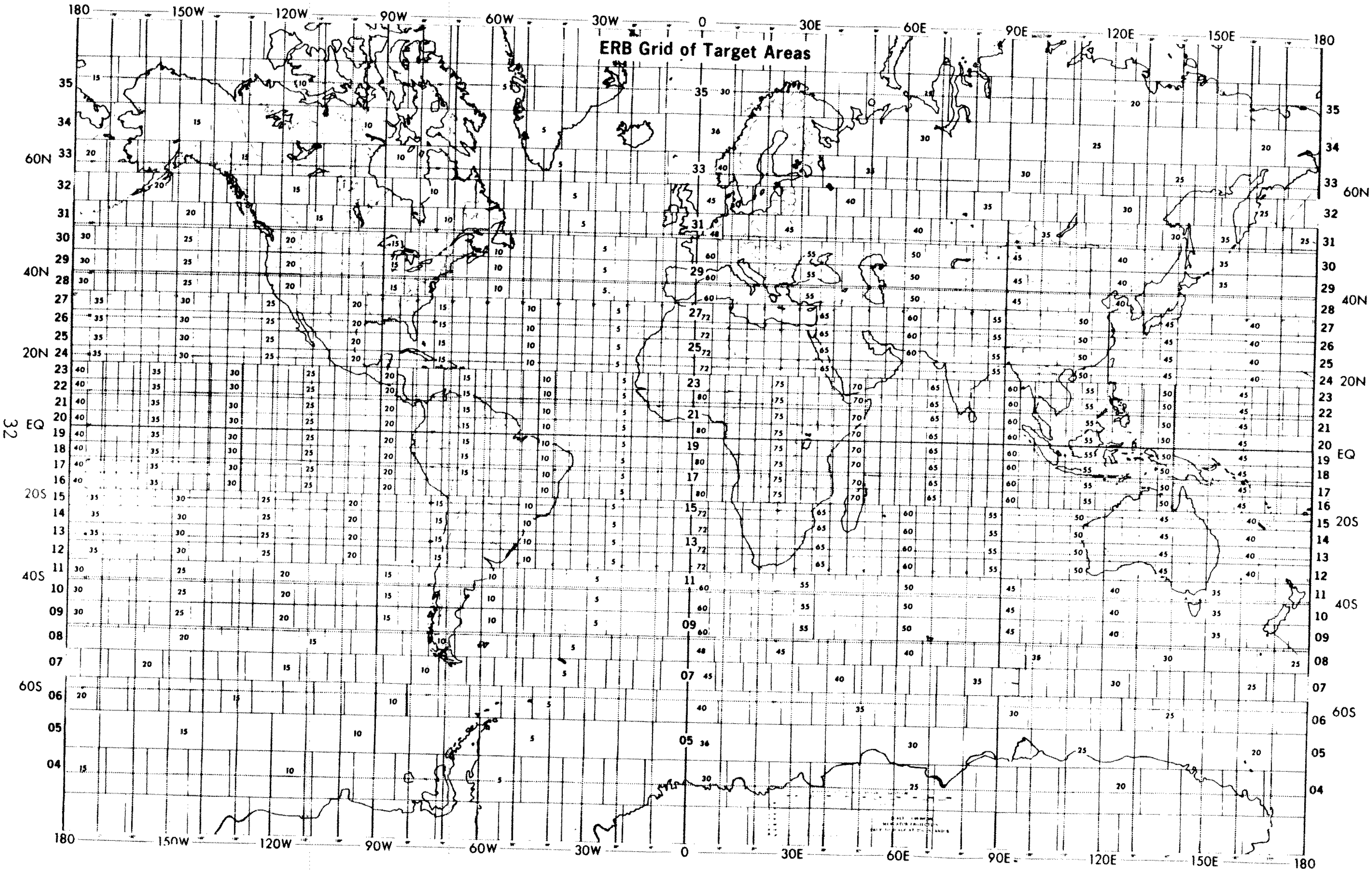


Figure 10. The ERB grid of target areas, shown with keys to the coded numbering system.

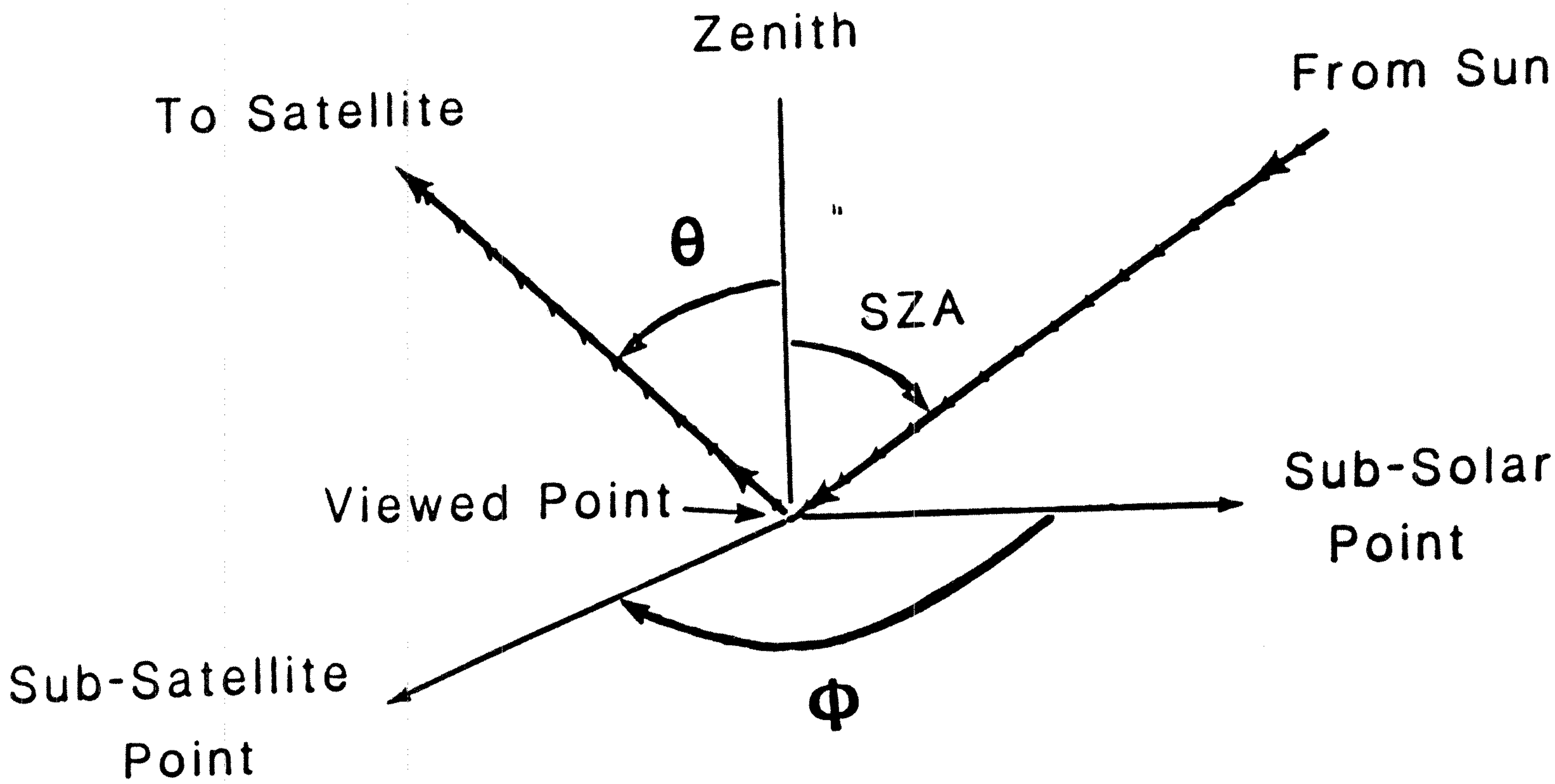


Figure 11. Schematic illustrating the geometric angles used in the STRT radiance record. The solar zenith angle (SZA) is measured from the sun to the local zenith. The satellite zenith angle (θ) is measured from the satellite viewing vector to local zenith. Relative solar azimuth (Φ) is the angle defined by the sub-solar point, viewed point and the sub-satellite point.

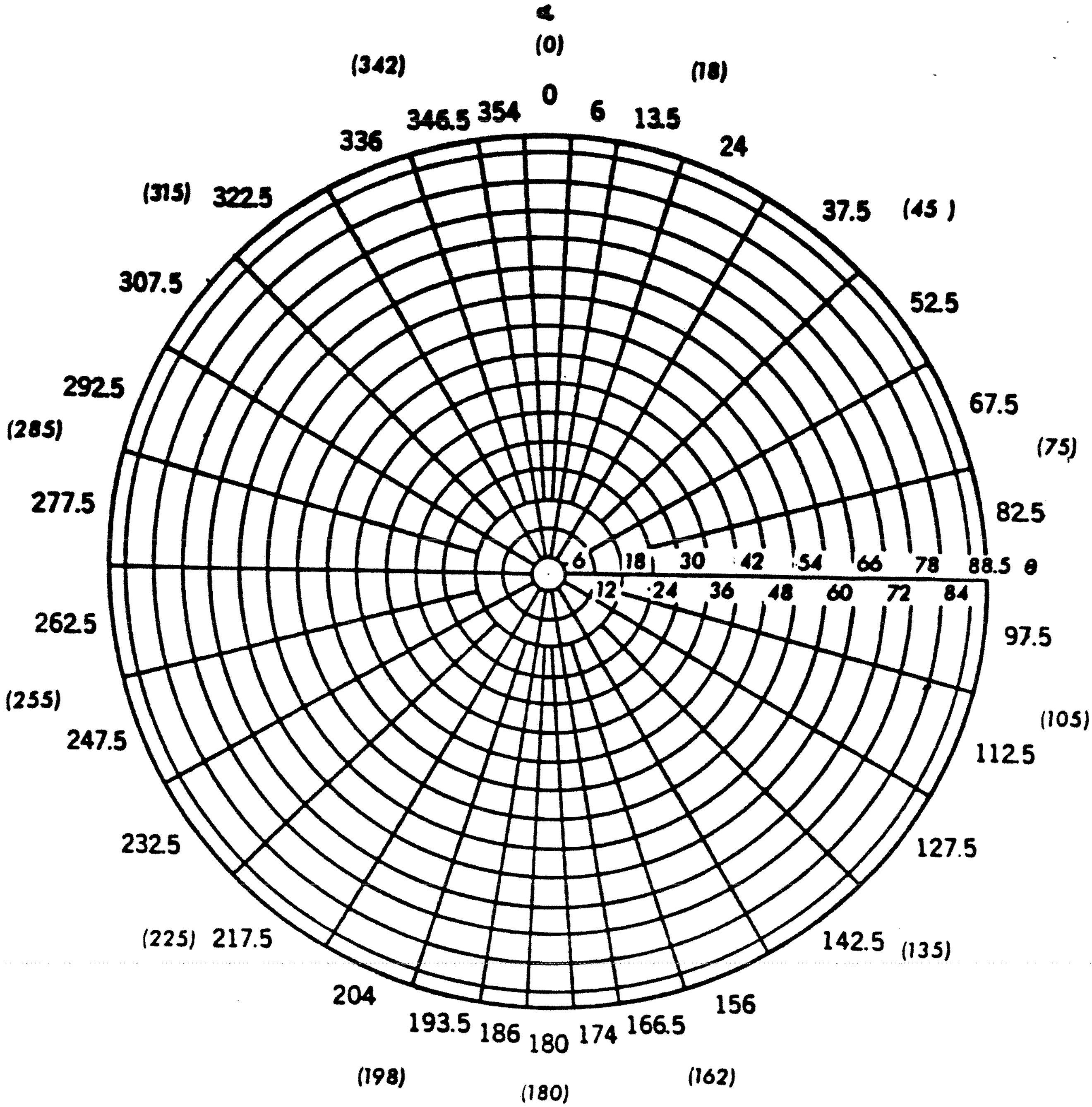


Figure 12. Bins for grouping angular characteristics of reflected and emitted radiance. A coding convention, given in Appendix B, assigns to each bin a number identifying it by ring number and position within the ring. The relative azimuth at the center of the bin is labeled around the perimeter of the circl (the labels in parentheses refer to the bins in rings 2 and 3). The satellit zenith angle at the center of the bin is labeled along the 90° azimuth line. The innermost bin has a radius of 3 degrees.

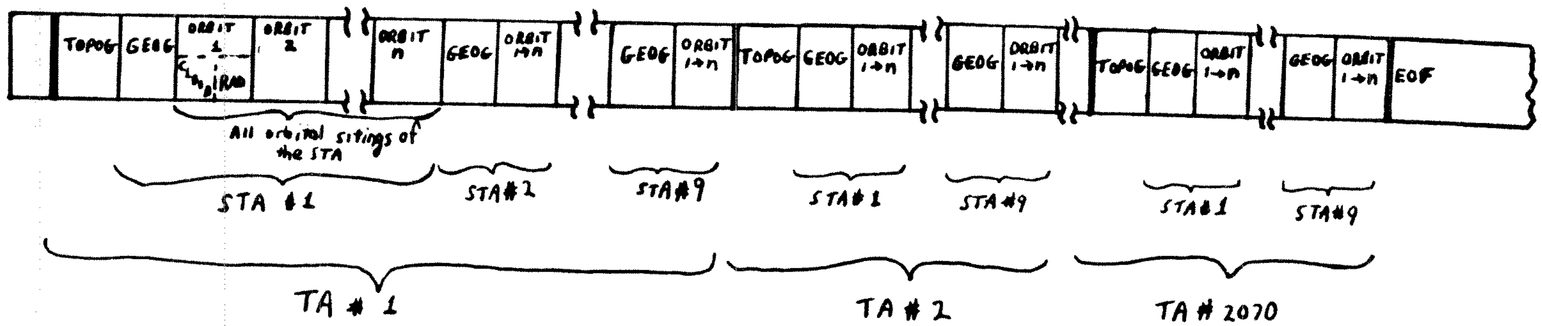


Figure 13. Order of the logical records in a STRT data file (one day of data). The three logical records are topography (one per target area), geography (one per sub-target area), and orbital (one per orbital siting per sub-target area). There are 2070 target areas covering the globe.

An orbital record includes all observations of an STA for a single orbital pass of the satellite. One orbital record is written for each satellite pass during which the STA was observed. Each orbital record contains all of the available radiance and cloud data pertaining to that STA and pass, without regard to change in Nimbus-7 orbit number, nor change of date at midnight. All data collected from the last Nimbus-7 orbit to start before midnight is included in the same STRT, even if the orbital record observations all occured after midnight. Each new STRT begins with the first Nimbus-7 orbit to start after midnight. Each orbital record is identified by the time and date of the first siting of the pass (even when that time is after midnight and the date has changed to that of the following day).

If there are no orbital records for any STA in a TA record group, then that group will contain only the 9 STA geography records for that TA, arranged in STA number sequence (1-9). Otherwise, the TA record group will consist of a TA topography record, followed by 9 STA record subgroups for that TA, arranged in STA number sequence (1-9).

Each STA record subgroup begins with the STA geography record (always present). If there are any orbital records pertaining to this STA, then they will follow the geography records, ordered by time of first STA siting.

3.5 The Logical Record

3.5.1 The Identification Block

Each logical record begins with a block of data, which will be referred to as an identification (ID) block. It consists of character (EBCDIC) and binary (integer) data defining: 1) the type of data record that follows (either topography, geography, or orbital), 2) appropriate dates and times of the data, 3) revisions to the software used to produce the record, and 4) target and sub-target code numbers. The ID block also contains some housekeeping data which is of no practical use to the scientific user. The ID block format is identical for each logical record, with one exception; the orbital record does not contain the last seven words that exist in the ID block for the topography and geography logical record.

The standard ID block format will be described word-by-word (Table 7) with special notations on the different meanings of each word for each logical record. The description of each word will begin with a name and a brief definition. The word's symbolic (binary or EBCDIC) representation will be noted. Character data are declared as LOGICAL(n) in FORTRAN and CHARACTER(n) in

PL/1, where n is the number of bytes. For those words that are of use for identification, either the prescribed value or range of values will be included in the description.

TABLE 7

Identification Block Structure for STRT Logical Records

1. ERB Target Area Data Base Tag - Two bytes (EBCDIC), initialized as 'ET' (Experiment Tape).

2. Revision - Code for updates in record formats. One byte (EBCDIC). Set to 'B' except for geography record where it is set to 'C'.

3. Record Type - Identifies the following scientific data. One byte (EBCDIC). Initialized as 'T' for the Topography record, 'G' for Geography record, 'R' for the Orbital record (which contains radiance and cloud data).

4. Source of Data - Code for primary or auxiliary data sources. Two bytes (EBCDIC). Filled with blanks in topography record; geography record uses character string 'NB' except when Air Force Snow/Ice tapes had missing byte at end of each data block when 'SB' character string is used. These latter tapes may have up to 45 STAs in each hemisphere with Geography data set to zero. A list of the 90 STAs possibly affected is given in Table 7a. The dates affected by the short byte problem range from 2/1/80 to and including 6/16/80; Orbital record uses character string 'C2', indicating a second THIR dataset corrected for fill data and wavy patterns was used for the cloud data. If no cloud data were available for a pass of the STA, then character string is filled with blanks.

5. Data Time - Not used. Two bytes (binary) set to zero.

6. Day Processed - Not used. Two bytes (binary). Set to zero except in geography record where they are not initialized (ignore!).

7. Target - Coded target and sub-target area number.
Six bytes (EBCDIC) of the form 'XXYY.Z', where

'xx' = target latitude band number; bytes one and two (see table 6)

'yy' = target longitude bin number; bytes three and four

'.' = period; byte five.

'z' = sub-target number; byte six.

Range of values: 'xx' = 00-39

'yy' = 01-80

'z' = { 1-9 Geography and Orbital records; 0 Topography records. }

*** The meaning of the first (8-14) and second (15-21) time words ***
*** depends on the type of logical record. For topography: First ***
*** Reference Seconds set to zero; Second Reference Seconds set to ***
*** (2**31 - 1); First and Second Year; Month; Day are the same and ***
*** set to date of the data; First Hour; Minute; Second is set to ***
*** 00:00:00 and Second is set to 99:99:99. For geography records: ***
*** First and Second Reference Seconds are not initialized (ignore!); ***
*** First and Second Year; Month; Day are the same and set to date of ***
*** the data; First Hour; Minute; Second are set to 00:00:00 and Second ***
*** Hour; Minute; Second are set to 23:59:59. For orbital records: only ***
*** preceded by first time block, which defines beginning of the ***
*** approximately 20-minute period during which the radiance data was ***
*** gathered for the STA.***

8. First Reference Seconds - Time, in seconds, from January 1, 1978. Four bytes (Binary).

9. First Year - Two bytes (EBCDIC)

10. First Month - Two bytes (EBCDIC)

11. First Day - Two bytes (EBCDIC)

12. First Hour - Two bytes (EBCDIC). Filled with zeroes in Topography and Geography records.

13. First Minute - Two bytes (EBCDIC). Filled with zeroes in Topography and Geography records.

14. First Second - Two bytes (EBCDIC). Filled with zeroes in Topography and Geography records.

15. Second Reference Seconds - Four bytes (Binary)

16. Second Year - Two bytes (EBCDIC)

17. Second Month - Two bytes (EBCDIC)

18. Second Day - Two bytes (EBCDIC)

19. Second Hour - Two bytes (EBCDIC)

20. Second Minute - Two bytes (EBCDIC)

21. Second Second - Two bytes (EBCDIC)

*** Note: If the I.D. record information read from STRTs is not in ***
*** agreement with this specification, an invalid STRT has possibly ***
*** been processed. Notify NSSDC. ***

*** End of Identification Block ***

Table 7a. Sub-Target Areas In Which Geography Data May Be Set To Zero (2/1/80 - 6/16/80)

S.W.		N.W.	
SEQUENTIAL	CODED	SEQUENTIAL	CODED
TGTNO= 981.1	TGTNO= 1926.1	TGTNO= 1086.7	TGTNO= 2051.7
TGTNO= 817.6	TGTNO= 1722.6	TGTNO= 1249.5	TGTNO= 2254.5
TGTNO= 733.9	TGTNO= 1618.9	TGTNO= 1333.3	TGTNO= 2358.3
TGTNO= 809.6	TGTNO= 1714.6	TGTNO= 1257.6	TGTNO= 2262.6
TGTNO= 966.1	TGTNO= 1911.1	TGTNO= 1101.7	TGTNO= 2066.7
TGTNO= 986.1	TGTNO= 1931.1	TGTNO= 1081.7	TGTNO= 2046.7
TGTNO= 743.3	TGTNO= 1628.3	TGTNO= 1323.9	TGTNO= 2348.9
TGTNO= 521.1	TGTNO= 1322.1	TGTNO= 1546.9	TGTNO= 2647.9
TGTNO= 444.1	TGTNO= 1217.1	TGTNO= 1623.9	TGTNO= 2752.9
TGTNO= 510.3	TGTNO= 1311.3	TGTNO= 1557.7	TGTNO= 2658.7
TGTNO= 651.7	TGTNO= 1508.7	TGTNO= 1416.3	TGTNO= 2461.3
TGTNO= 881.7	TGTNO= 1806.7	TGTNO= 1186.1	TGTNO= 2171.1
TGTNO= 829.5	TGTNO= 1734.5	TGTNO= 1237.6	TGTNO= 2242.6
TGTNO= 528.3	TGTNO= 1329.3	TGTNO= 1539.7	TGTNO= 2640.7
TGTNO= 216.8	TGTNO= 817.8	TGTNO= 1852.2	TGTNO= 3129.2
TGTNO= 123.6	TGTNO= 609.6	TGTNO= 1945.6	TGTNO= 3329.6
TGTNO= 204.9	TGTNO= 805.9	TGTNO= 1864.2	TGTNO= 3141.2
TGTNO= 503.2	TGTNO= 1304.2	TGTNO= 1564.8	TGTNO= 2665.8
TGTNO= 797.3	TGTNO= 1702.3	TGTNO= 1269.8	TGTNO= 2274.8
TGTNO= 753.9	TGTNO= 1638.9	TGTNO= 1313.3	TGTNO= 2338.3
TGTNO= 461.3	TGTNO= 1234.3	TGTNO= 1606.7	TGTNO= 2735.7
TGTNO= 133.6	TGTNO= 619.6	TGTNO= 1935.6	TGTNO= 3319.6
TGTNO= 2.1	TGTNO= 2.1	TGTNO= 2069.9	TGTNO= 3902.9
TGTNO= 153.6	TGTNO= 639.6	TGTNO= 1955.6	TGTNO= 3339.6
TGTNO= 498.1	TGTNO= 1271.1	TGTNO= 1641.9	TGTNO= 2770.9
TGTNO= 793.6	TGTNO= 1678.6	TGTNO= 1353.6	TGTNO= 2378.6
TGTNO= 837.6	TGTNO= 1742.6	TGTNO= 1229.6	TGTNO= 2234.6
TGTNO= 539.1	TGTNO= 1340.1	TGTNO= 1528.9	TGTNO= 2629.9
TGTNO= 228.8	TGTNO= 829.8	TGTNO= 1840.3	TGTNO= 3117.3
TGTNO= 143.6	TGTNO= 629.6	TGTNO= 1925.6	TGTNO= 3309.6
TGTNO= 240.8	TGTNO= 841.8	TGTNO= 1828.2	TGTNO= 3105.2
TGTNO= 564.3	TGTNO= 1365.3	TGTNO= 1503.7	TGTNO= 2604.7
TGTNO= 869.3	TGTNO= 1774.3	TGTNO= 1197.9	TGTNO= 2202.9
TGTNO= 1001.1	TGTNO= 1946.1	TGTNO= 1066.7	TGTNO= 2031.7
TGTNO= 686.9	TGTNO= 1543.9	TGTNO= 1381.1	TGTNO= 2426.1
TGTNO= 546.2	TGTNO= 1347.2	TGTNO= 1521.8	TGTNO= 2622.8
TGTNO= 479.3	TGTNO= 1252.3	TGTNO= 1588.7	TGTNO= 2717.7
TGTNO= 557.1	TGTNO= 1358.1	TGTNO= 1510.9	TGTNO= 2611.9
TGTNO= 704.9	TGTNO= 1561.9	TGTNO= 1362.3	TGTNO= 2407.3
TGTNO= 946.7	TGTNO= 1871.7	TGTNO= 1121.1	TGTNO= 2106.1
TGTNO= 926.7	TGTNO= 1851.7	TGTNO= 1141.1	TGTNO= 2126.1
TGTNO= 849.2	TGTNO= 1754.2	TGTNO= 1217.9	TGTNO= 2222.9
TGTNO= 773.6	TGTNO= 1658.6	TGTNO= 1293.6	TGTNO= 2318.6
TGTNO= 857.3	TGTNO= 1762.3	TGTNO= 1209.9	TGTNO= 2214.9
TGTNO= 941.7	TGTNO= 1866.7	TGTNO= 1126.1	TGTNO= 2111.1

3.5.2 Topography Logical Record

The Topography record defines the surface topography, water and ice cover, and vegetation as a fractional coverage of a TA. The TA can be composed of any of 8 types of topographic (including ice and water) and of 9 types of vegetative cover. The fractions of each should sum to 1 (100%) or 1 minus an amount assumed to be missing or unknown. The ice and water coverage can vary seasonally, but the vegetation and surface topography fractions are fixed in time. The word-by-word description of the Topography logical record resumes in Table 8 with the physical data immediately following the ID block.

TABLE 8

Topography Logical Data Record

1-21. ID block (See Table 7)

*** All items in this block are two-byte words, written as fixed point ***
*** binary. They consist of one whole bit and 8 fractional bits and are ***
*** scaled by 2**8. Declare as INTEGER *2 in FORTRAN and then ***
*** divide by 2**8 or FIXED BINARY (9,8) in PL/1.***
*** Note: Equivalent to FIXED BINARY (15,8)***

22. Fraction Water - Fraction of the Target Area covered with water.

23. Fraction Ice - Fraction of the Target Area covered with ice.

24. Fraction Plain - Fraction of the Target Area covered with plain.

25. Fraction Hilly - Fraction of the Target Area covered with hills.

26. Fraction Mountain - Fraction of the Target Area covered by mountain.

27. Fraction Hamada - Fraction of the Target Area covered by hamada.

28. Fraction Erg - Fraction of the Target Area covered by erg.

29. Fraction Bolson - Fraction of the Target Area covered by bolson.

30. Mountain Vegetation - Fraction of the Target Area covered with mountain vegetation.

31. Selva - Fraction of the Target Area covered with selva vegetation.

32. Taiga - Fraction of the Target Area covered with taiga vegetation.

33. Scrub - Fraction of the Target Area covered with scrub vegetation.

34. Mixed - Fraction of the Target Area covered with mixed vegetation.

35. Savanna - Fraction of the Target Area covered with savanna vegetation.

36. Prairie - Fraction of the Target Area covered with prairie vegetation.

37. Tundra - Fraction of Target Area covered with tundra vegetation.

38. Desert - Fraction of Target Area covered with desert vegetation.

39. Padding - To force the logical record to end on the full word (4-byte) boundary. Two bytes (EBCDIC). Filled with blanks.

*** End of Topography Logical Record ***

3.5.3 Geography Logical Record

The geography logical record describes, on the scale of a STA, the fractional coverage of ice-free water, snow-free land, snow and ice. Also given is the depth and age of the snow and age of the ice. These data were discussed fully in section 2.2. The fraction of STA with missing Air Force grid information is also given. The geography information is set to zero if A.F. grid information is missing. The geography data immediately follow the geography ID block, and are described word-by-word in Table 9.

TABLE 9

Geography Logical Record

1-21. ID Block

*** All items in this block are two-byte words, written as fixed point ***
*** binary. Words 22-24, 27, 29 have one whole number bit and 8 ***
*** fractional bits (i.e., INTEGER*2 scaled by 2**8 in FORTRAN or ***
*** FIXED BINARY (9, 8) in PL/1). Words 25, 26, 28 have 10, 8, and 8 ***
*** whole bits, respectively (i.e., INTEGER*2 in FORTRAN, ***
*** or FIXED BINARY (15) in PL/1). ***
*** Note: FIXED BINARY (9,8) is equivalent to FIXED BINARY (15,8)***

22. Land Coverage - Fractional part of the STA covered by land.

23. Water Coverage - Fractional part of the STA covered by water.

24. Snow Coverage - Fractional part of the STA covered by snow.

25. Snow Depth - Depth of snow in millimeters, to a maximum of 800.

26. Snow Age - Age of snow in days, maximum of 255.

27. Ice Coverage - Fractional part of the STA coverage by ice.

28. Ice Age - Age of ice in days, to a maximum of 255.

29. Missing - Fraction of the STA represented by missing input data. If > 0 then words 22-28 are set to zero.

*** End of Geography Logical Record ***

3.5.4 Orbital Data Record

The Orbital data record, flagged by the character 'R' in the identification block of the logical record, consists of solar geometry, cloud cover and type, and angular radiance data for a single orbital pass of the NIMBUS-7 spacecraft. If the same STA is seen on multiple orbital passes, multiple logical records are written to tape. Each logical record will have a variable length, depending on the number of sitings of the STA by the ERB scanning radiometer. The record is always padded to achieve a length divisible by four bytes, i.e. each record ends on a full-word boundary. The logical record begins with an identification block which is 14 words instead of 20 words long, as shown in Table 7. Table 10 is a detailed description of the orbital data record.

TABLE 10

Orbital Logical Record

1-14. Identification Block

*** Parameters 15-18 constitute a block of solar geometry data. All ***
*** angles are defined in degrees. Azimuths range from zero to ±180 ***
*** degrees, positive (negative) in a clockwise (counter-clockwise) ***
*** direction from North. Zenith angles range from 0 (daytime) to 180° ***
*** (nighttime). Each parameter is two bytes long; which includes a ***
*** sign bit, 8 whole number bits, and 7 fractional bits. Equivalently, ***
*** they are INTEGER *2 words scaled by 2**7 in FORTRAN or ***
*** FIXED BINARY (15,7) in PL/1. ***

15. Solar Azimuth - Mean solar azimuth from north, defined at the center of the STA.

16. Solar Zenith Minimum - Minimum solar zenith angle of those computed during an orbital siting of the STA.

17. Solar Zenith Mean - Mean solar zenith angle of those computed during an orbital siting of the STA, defined at the center of the STA.

18. Solar Zenith Maximum - Maximum solar zenith angle of those computed during an orbital siting of the STA.

19. Unused - Fifteen (15) unused binary bits set to zero. To be ignored.

*** Parameters 20 through 47 constitute a block of data describing ***
*** cloud amount and type. ***

20. Cloud Flag - Flag to indicate if valid cloud data follow. One binary bit.

'1'	-	Cloud data available
'0'	-	No cloud data

*** Parameters 21-24 describe a fraction of the STA covered by each ***
*** of four sky conditions. Each is a two byte binary number, with one ***
*** whole number bit and 8 fractional bits. Declare as INTEGER*2 ***
*** and divide by 2**8 in FORTRAN or declare as FIXED BINARY ***
*** (9,8) in PL/1. ***
*** Note: Equivalent to FIXED BINARY (15,8)***

21. Fraction Clear - Fraction of the STA with clear sky.

22. Fraction Low Clouds - Fraction of the STA containing low clouds.

23. Fraction Middle Clouds - Fraction of the STA containing middle clouds.

24. Fraction High Clouds - Fraction of the STA containing high clouds.

*** Parameters 25-47 are one-bit flags or multi-bit padding to form ***
*** 8-bit bytes. These bit flags are turned on (equal to 1) when the ***
*** described condition exists, and turned off (equal to 0) otherwise ***
*** (See Appendix C for conditions). The flag and padding bit strings are 8
*** bits long grouped by sky/cloud type (clear, low, middle, high) and ***
*** named accordingly. In FORTRAN, an INTEGER*2 word would ***
*** encompass bit flags and padding for two cloud types. In PL/1, ***
*** declare as BIT(1) for flags or BIT(n) for padding, where n = number ***
*** of padded bits. ***

25. Clear/Padding - Four bits, set to zero.

26. Clear/Ambiguous Low Cloud Flag - When the Fraction Clear may actually be low cloud instead.

27. Clear/Low Cloud Flag - Not used. One bit, set to zero.

28. Clear/Thin Cirrus Flag - When the Fraction Clear may actually be thin cirrus.

29. Clear/Ambiguous Cloud Flag - When Fraction Clear may be indistinguishable from other cloud types.

30. Low/Padding - Four bits, set to zero.

31. Low/Ambiguous Clear Flag - When the Fraction Low may actually be clear sky.

32. Low/Clear Flag - Not used. One bit, set to zero.

33. Low/Thin Cirrus Flag - When the Fraction Low may actually be cirrus cloud.

34. Low/Ambiguous Cloud Flag - When the Fraction Low may actually be of an indistinguishable type.

35. Middle/Padding - Three bits, set to zero.

36. Middle/Thin Cirrus Flag - When the Fraction Middle may actually be a thin cirrus cloud.

37. Middle/Convective Flag - When the Fraction Middle may be a convective cloud.

38. Middle/Ambiguous Clear Flag - When the Fraction Middle may be a clear area instead.

39. Middle/Ambiguous Low Flag - When the Fraction Middle may be low cloud instead.

40. Middle/Ambiguous High Flag - When the Fraction Middle may be a high cloud instead.

41. High/Padding-Two bits, set to zero.

42. High/Ice Cloud Flag - When the Fraction High consists predominantly of ice rather than water.

43. High/Broken Stratus Flag - When the Fraction High can be characterized as broken stratus cloud.

44. High/Thick Stratus Flag - When the Fraction High can be characterized as thick stratus.

45. High/Thin Stratus Flag - When the Fraction High can be characterized as thin stratus cloud.

46. High/Convective Flag - When the Fraction High may be convective in nature.

47. High/Ambiguous Middle Flag - When the Fraction High cannot be distinguished in character from middle cloud.

48. Number of bins - Number of angular bins into which satellite observations of this STA were grouped during the orbital pass. Maximum is 419. Two bytes (binary). Declare as INTEGER*2 in FORTRAN or FIXED BINARY (9) in PL/1. (Note: Equivalent to FIXED BINARY (15).)

49. Total Observations - Actual number of sitings of this STA during this orbital pass. Maximum is 999. Two byte (binary) with 10 whole number bits. In FORTRAN, declare as INTEGER*2; in PL/1, declare as FIXED BINARY (10). (Note: Equivalent to FIXED BINARY) (15).)

50. Padding Extent - Two-byte integer, FIXED BINARY (15) or INTEGER * 2. Contains the number of 2-byte padding words (parameter 58) which occur at the end of the logical record. Possible values of parameter 50 are one or two, depending upon the length of the "Bin Block" and "Observation Block" described below. (User may ignore).

*** The "Bin Block" consists of the next 8n bytes of data following ***
*** parameter 50 of the orbital logical record, where n = value of ***
*** parameter 48 (e.g. if parameter 48 is 10, then the "Bin Block" ***
*** contains 80 bytes). The "Bin Block" is organized in n sets of 8-byte ***
*** groups. One 8-byte group pertains to each angular bin for which ***
*** there are one or more radiance observations in this record. The ***
*** 8-byte groups are sequenced in increasing order by coded angular ***
*** bin number. Parameters 51-53 describe each 8-byte group. ***

51. Bin Code - Four-character identifier of the bin; of the form 'xxyy' where 'xx' is a function of satellite zenith, and 'yy' is a function of relative azimuth. In FORTRAN, declare as LOGICAL*4; in PL/1, declare as CHARACTER (4).

52. Number of Observations - The number of sitings with the respective bin code. Two byte (binary), with 10 whole number bits. Same as INTEGER*2 in FORTRAN or FIXED BINARY (10) in PL/1. (Note: Equivalent to FIXED BINARY (15).)

53. First Index - Position in the "Observation Block" of the first occurrence of the respective bin code. Two bytes (binary), with 10 whole bits. Same as INTEGER*2 and FIXED BINARY (10).

*** The "Observation Block" consists of the next 6m bytes following ***
*** the "Bin Block", where m=value of parameter 49. (e.g. if ***
*** parameter 49 is 20, then the "Observation Block" contains 120 ***
*** bytes). The "Observation Block" is subdivided into m sets of 6-byte ***
*** groups. One 6-byte group pertains to each radiance observation in ***
*** this record. The 6-byte groups are sequenced first by coded ***
*** angular bin number (in increasing order of occurance), and second ***

*** by time of siting for that angular bin. Parameters 54-57 describe ***
*** each 6-byte group. ***
*** The "Bin-Block" and "Observation Block" are closely related. ***
*** Parameter 53 in the "Bin Block" contains the index number for ***
*** the first 6-byte group in the "Observation Block" which pertains ***
*** to the respective angular bin. Parameter 52 in the "Bin Block" ***
*** contains the count of how many 6-byte groups in the "Observation ***
*** Block" pertain to the respective angular bin. Table 11 ***
*** illustrates how to interpret Bin and Observation data. The first ***
*** 3 columns contain data from a sample "Bin Block". The last 4 ***
*** columns contain data from a sample "Observation Block". ***

54. Reflected - Reflected shortwave radiance. Two bytes (binary) with one sign bit, 11 whole number bits and 4 fractional bits. Declare as INTEGER*2 and divide by 2**4 in FORTRAN or declare as FIXED BINARY (15,4) in PL/1. Units are Watts/Meter^2/ster.

55. Emitted - Emitted longwave radiance. Two bytes (binary) with one sign bit, 11 whole number bits and 4 fractional bits. Declare as INTEGER*2 and divide by 2**4 in FORTRAN or declare as FIXED BINARY (15,4) in PL/1. Units are Watts/Meter^2/ster.

56. Scope Number - There are four telescopes through which radiance measurements are taken. This word identifies each observation with its corresponding scope. One byte (binary) with only the three (3) lower order bits ever turned on. Declare as BIT (8) in PL/1 or LOGICAL*1 in FORTRAN. Maximum value = 4.

57. Number of Sub-FOVs - The measuring instrument's field of view is gridded into nine 'sub-FOVs' for weighting purposes. The number of sub-FOVs lying within the STA are recorded in this word. One byte (binary) with only the four (4) lower order bits ever turned on. Declare as BIT (8) in PL/1 or LOGICAL *1 in FORTRAN. Maximum value = 9.

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58. Padding - At the end of the "Observation Block" to force the logical record length to end on a full word boundary. Either one or two 2-byte (binary) zero-fill words. Number of 2-byte padding words given by parameter 50. Each padding word is INTEGER *2 or FIXED BINARY (15).

*** End of Orbital Logical Record ***

TABLE 11

Example of Bin and Observation Data From a Radiance Record

BIN CODE	NUMBER OF OBS	FIRST INDEX	REFLECTED	EMITTED	SCOPE NUMBER	NUMBER SUB-FOVS
1126	2	1	40.1	86.5	1	1
			45.8	84.8	1	6
1226	2	3	40.1	82.2	1	1
			45.8	81.1	1	5
1303	2	5	46.3	84.8	1	2
			50.3	83.5	1	1
1422	2	7	48.3	79.2	3	2
			55.6	81.4	3	3
1423	5	9	56.9	76.1	3	5
			63.3	75.2	3	3
			47.8	78.3	3	7
			57.2	75.2	3	7
			50.9	76.3	3	1
1523	1	14	64.9	70.1	3	1

In this case, the first two observations fall into bin 1126, observations 3 and 4 into bin 1226, 5 and 6 into bin 1422 and so on.

3.6 Quality Control

Each of the components to the STRT merge operation is subjected to a quality control check at the time of its creation. The STRT file undergoes another QC check after its creation.

The goals of the STRT QC check are two-fold:

1. To assure consistency in each component data set before and after the merge operation.

2. To assure that the radiance data is scientifically reasonable.

The quality control analyst studies computer output from the merge operation and previous production steps in performing the following QC steps:

1. Verify that the topography record on the STRT is identical to previous days.

2. Using three randomly chosen target areas, verify that the radiance data is identical to that which was input to the merge operation. This procedure is duplicated for 3 distinct TAs to verify the successful merge of the geography and cloud data to the STRT. Bit flags in the identification block are checked to verify that the most recent version of the input data were used.

3. Using three random daytime target areas, assess the physical reasonableness of the data by comparing coincident cloud, geography and radiance data with the following table of values.

Scene Type	Radiance ($W/m^2/sr$) Emitted	Reflected
Clear Ocean	$\geq$ 80	$\leq$ 50
Clear Land	$\geq$ 80	$>$ 50
Cloudy	$<$ 80	$>$ 100

Note: The shortwave (reflected) measurement from telescope 4 becomes noisy after 27 December 1978. These values, while included on the STRT, are not physically reasonable.

If the STRT failed any of the above tests, processing of the data base was halted until the problem was investigated, understood, and resolved.

REFERENCES

1. James, P.E., 1951: A Geography of Man, Ginn and Co., New York, N.Y., 631 pages.

2. U.S. Navy Hydrographic Office, 1958: Oceanographic Atlas of the Polar Seas, Part I: Antarctic, Part II: Arctic, H.O. Pub. No. 705, Washington, D.C.

3. Fye, F.K., 1978: The AFGWC Automated Cloud Analysis Model, AFGWC Technical Memorandum 78-002, HQ Air Force Global Weather Central, Offutt AFB, NE 68113.

4. Luces, S.A, S.J. Hall, and J.D. Martens, 1975: The AFGWC Snow Cover Analysis Model, AFGWC Tech. Memo. 75-1, HQ Air Force Global Weather Central, Offutt AFB, NE 68113.

5. World Meteorological Organization, 1956: International Cloud Atlas, Vol. 1, Geneva, Switzerland.

6. Jenne, R.L., H.L. Crutcher, H. Van Loon, and J.J. Taljaard, 1974: A Selected Climatology of the Southern Hemisphere: Computer Methods and Data Availability, NCAR-TN/STR-92, Boulder, CO., 91 pages.

7. Hwang, P.H.,1982: NIMBUS-7 Temperature Humidity Infrared Radiometer (THIR) Data User's Guide, NASA Goddard Space Flight Center, Greenbelt, Maryland 20770.

8. Brower, R.L., H.S. Gohrband, W.G. Pichel, T.L. Sianore, and C.C. Walton, 1976: Satellite Derived Sea-surface temperatures from NOAA Spacecraft, NOAA Technical Memorandum NESS 78, Washington, D.C., 74 pages.

9. Stowe, L.L., 1984: Evaluation of Nimbus-7 THIR/CLE and Air Force 3-D Nephanalysis Estimates of Cloud Amount, Accepted for Special Nimbus-7 Issue of Journal of Geophysical Research.

10. Taylor, V.R. and L.L. Stowe, 1984: Reflectance Characteristics of Uniform Earth and Cloud Surfaces Derived from Nimbus-7 ERB, Accepted for Special Nimbus-7 issue of Journal of Geophysical Research.

11. Jacobowitz, H., L.L. Stowe and J.R. Hickey, 1978: The Nimbus-7 User's Guide, NASA Goddard Space Flight Center, Greenbelt, Maryland, pp. 33-69.

12. Jacobowitz, H.L., H.V. Soule, H.L. Kyle, and the NIMBUS-7 ERB Experiment Team, 1984: The Earth Radiation Budget (ERB) Experiment: An Overview, Accepted for Special Nimbus-7 Issue of Journal of Geophysical Research.

APPENDIX A

Look-up table and algorithm for conversion from coded TA to Lat/Lon coordinates of the center of the TA.

Given the indices that identify the target areas by row (latitude) and position in the row (longitude), the latitude, longitude coordinates of the center of the target area can be computed with the use of the table below. The index ILAT and ILON are read from the STRT identification block. NLON is the number of TA's in a latitude strip.

ILAT	0	1	2	3	4	5	6	7	8	9
NLON (ILAT)	3	10	16	20	30	36	40	45	48	60
ILAT	10	11	12	13	14	15	16	17	18	19
NLON (ILAT)	60	60	72	72	72	72	80	80	80	80
ILAT	20	21	22	23	24	25	26	27	28	29
NLON (ILAT)	80	80	80	80	72	72	72	72	60	60
ILAT	30	31	32	33	34	35	36	37	38	39
NLON (ILAT)	60	48	45	40	36	30	20	16	10	3

- For indices ILAT (varying from 00-39) and ILON (varying from 01-80), the Lat and Lon at the middle of a TA are computed as follows:

TALAT (ILAT)	=	ILAT * 4.5 - 87.75
LONWDT	=	360/NLON (ILAT)
HLFWDT	=	LONWDT/2
TALON (ILAT, ILON)	=	LONWDT * ILON - HLFWDT

TALAT varies from -87.75 to 87.75. Around the Equator, TALON varies from 2.25 to 357.75, increasing westward. Near the poles, TALON varies from 60° to 300°, increasing westward.

APPENDIX B

Look-up table: angular bin code to sequential number, satellite zenith and relative azimuth angle.

The following look-up table allows one to go from the angular bin coding convention to a sequential (the order with which they are written on tape) system as well as to the relevant angles, defined at the center of the bin. The bin code is a four digit number; the first two prescribe the concentric ring (see Figure 12), the second two prescribe the position in the ring, relative to the principal plane of the sun.

Angular Bin Code	Sequence Number	Satellite Zenith	Relative Azimuth
0101	1	0.0	0.0
0201	2	6.0	0.0
0202	3	6.0	19.5
0203	4	6.0	45.0
0204	5	6.0	75.0
0205	6	6.0	105.0
0206	7	6.0	135.0
0207	8	6.0	160.5
0208	9	6.0	180.0
0209	10	6.0	199.5
0210	11	6.0	225.0
0211	12	6.0	255.0
0212	13	6.0	285.0
0213	14	6.0	315.0
0214	15	6.0	340.5
0301	16	12.0	0.0
0302	17	12.0	19.5
0303	18	12.0	45.0
0304	19	12.0	75.0
0305	20	12.0	105.0
0306	21	12.0	135.0
0307	22	12.0	160.5
0308	23	12.0	180.0

0309	24	12.0	199.5
0310	25	12.0	225.0
0311	26	12.0	255.5
0312	27	12.0	285.0
0313	28	12.0	315.0
0314	29	12.0	340.5
0401	30	18.0	0.0
0402	31	18.0	6.0
0403	32	18.0	13.5
0404	33	18.0	24.0
0405	34	18.0	37.5
0406	35	18.0	52.5
0407	36	18.0	67.5
0408	37	18.0	82.5
0409	38	18.0	97.5
0410	39	18.0	112.5
0411	40	18.0	127.5
0412	41	18.0	142.5
0413	42	18.0	156.0
0414	43	18.0	166.5
0415	44	18.0	174.0
0416	45	18.0	180.0
0417	46	18.0	186.0
0418	47	18.0	193.5
0419	48	18.0	204.0
0420	49	18.0	217.5
0421	50	18.0	232.5
0422	51	18.0	247.5
0423	52	18.0	262.5
0424	53	18.0	277.5
0425	54	18.0	292.5
0426	55	18.0	307.5
0427	56	18.0	322.5
0428	57	18.0	336.0
0429	58	18.0	346.5
0430	59	18.0	354.0

0501	60	24.0	0.0
0502	61	24.0	6.0
0503	62	24.0	13.5
0504	63	24.0	24.0
0505	64	24.0	37.5
0506	65	24.0	52.5
0507	66	24.0	67.5
0508	67	24.0	82.5
0509	68	24.0	97.9
0510	69	24.0	112.5
0511	70	24.0	127.5
0512	71	24.0	142.5
0513	72	24.0	156.0
0514	73	24.0	166.5
0515	74	24.0	174.0
0516	75	24.0	180.0
0517	76	24.0	186.0
0518	77	24.0	193.5
0519	78	24.0	204.0
0520	79	24.0	217.5
0521	80	24.0	232.5
0522	81	24.0	247.5
0523	82	24.0	262.5
0524	83	24.0	277.5
0525	84	24.0	292.5
0526	85	24.0	307.5
0527	86	24.0	322.5
0528	87	24.0	336.0
0529	88	24.0	346.5
0530	89	24.0	354.0
0601	90	30.0	0.0
0602	91	30.0	6.0
0603	92	30.0	13.5
0604	93	30.0	24.0
0605	94	30.0	37.5
0606	95	30.0	52.5

0607	96	30.0	61.5
0608	97	30.0	82.5
0609	98	30.0	97.5
0610	99	30.0	112.5
0611	100	30.0	127.5
0612	101	30.0	142.5
0613	102	30.0	156.0
0614	103	30.0	166.5
0615	104	30.0	174.0
0616	105	30.0	180.0
0617	106	30.0	186.0
0618	107	30.0	193.5
0619	108	30.0	204.0
0620	109	30.0	217.5
0621	110	30.0	232.5
0622	111	30.0	247.5
0623	112	30.0	262.5
0624	113	30.0	277.5
0625	114	30.0	292.5
0626	115	30.0	307.5
0627	116	30.0	322.5
0628	117	30.0	336.0
0629	118	30.0	346.5
0630	119	30.0	354.0
0701	120	36.0	0.0
0702	121	36.0	6.0
0703	122	36.0	13.5
0704	123	36.0	24.0
0705	124	36.0	37.5
0706	125	36.0	52.5
0707	126	36.0	67.5
0708	127	36.0	82.5
0709	128	36.0	97.5
0710	129	36.0	112.5
0711	130	36.0	127.5
0712	131	36.0	142.5
0713	132	36.0	156.0

0714	133	36.0	166.5
0715	134	36.0	174.0
0716	135	36.0	180.0
0717	136	36.0	186.0
0718	137	36.0	193.5
0719	138	36.0	204.0
0720	139	36.0	217.5
0721	140	36.0	232.5
0722	141	36.0	247.5
0723	142	36.0	262.5
0724	143	36.0	277.5
0725	144	36.0	292.5
0726	145	36.0	307.5
0727	146	36.0	322.5
0728	147	36.0	336.0
0729	148	36.0	346.5
0730	149	36.0	354.0
0801	150	42.0	0.0
0802	151	42.0	6.0
0803	152	42.0	13.5
0804	153	42.0	24.0
0805	154	42.0	37.5
0806	155	42.0	52.5
0807	156	42.0	67.5
0808	157	42.0	82.5
0809	158	42.0	97.5
0810	159	42.0	112.5
0811	160	42.0	127.5
0812	161	42.0	142.5
0813	162	42.0	156.0
0814	163	42.0	166.5
0815	164	42.0	174.0
0816	165	42.0	180.0
0817	166	42.0	186.0
0818	167	42.0	193.5
0819	168	42.0	204.0

0820	169	42.0	217.5
0821	170	42.0	232.5
0822	171	42.0	247.5
0823	172	42.0	262.5
0824	173	42.0	277.5
0825	174	42.0	292.5
0826	175	42.0	307.5
0827	176	42.0	322.5
0828	177	42.0	336.0
0829	178	42.0	346.5
0830	179	42.0	354.0
0901	180	48.0	0.0
0902	181	48.0	6.0
0903	182	48.0	13.5
0904	183	48.0	24.0
0905	184	48.0	37.5
0906	185	48.0	52.5
0907	186	48.0	67.5
0908	187	48.0	82.5
0909	188	48.0	97.5
0910	189	48.0	112.5
0911	190	48.0	127.5
0912	191	48.0	142.5
0913	192	48.0	156.0
0914	193	48.0	166.5
0915	194	48.0	174.0
0916	195	48.0	180.0
0917	196	48.0	186.0
0918	197	48.0	193.5
0919	198	48.0	204.0
0920	199	48.0	217.5
0921	200	48.0	232.5
0922	201	48.0	247.5
0923	202	48.0	262.5
0924	203	48.0	277.5
0925	204	48.0	292.5
0926	205	48.0	307.5

0927	206	48.0	322.5
0928	207	48.0	336.0
0929	208	48.0	346.5
0930	209	48.0	354.0
1001	210	54.0	0.0
1002	211	54.0	6.0
1003	212	54.0	13.5
1004	213	54.0	24.0
1005	214	54.0	37.5
1006	215	54.0	52.5
1007	216	54.0	67.5
1008	217	54.0	82.5
1009	218	54.0	97.5
1010	219	54.0	112.5
1011	220	54.0	127.5
1012	221	54.0	142.5
1013	222	54.0	156.0
1014	223	54.0	166.5
1015	224	54.0	174.0
1016	225	54.0	180.0
1017	226	54.0	186.0
1018	227	54.0	193.5
1019	228	54.0	204.0
1020	229	54.0	217.5
1021	230	54.0	232.5
1022	231	54.0	247.5
1023	232	54.0	262.5
1024	233	54.0	277.5
1025	234	54.0	292.5
1026	235	54.0	307.5
1027	236	54.0	322.5
1028	237	54.0	336.0
1029	238	54.0	346.5
1030	239	54.0	354.0
1101	240	60.0	0.0
1102	241	60.0	6.0

1103	242	60.0	13.5
1104	243	60.0	24.0
1105	244	60.0	37.5
1106	245	60.0	52.5
1107	246	60.0	67.5
1108	247	60.0	82.5
1109	248	60.0	97.5
1110	249	60.0	112.5
1111	250	60.0	127.5
1112	251	60.0	142.5
1113	252	60.0	156.0
1114	253	60.0	166.5
1115	254	60.0	174.0
1116	255	60.0	180.0
1117	256	60.0	186.0
1118	257	60.0	193.5
1119	258	60.0	204.0
1120	259	60.0	217.5
1121	260	60.0	232.5
1122	261	60.0	247.5
1123	262	60.0	262.5
1124	263	60.0	277.5
1125	264	60.0	292.5
1126	265	60.0	307.5
1127	266	60.0	322.5
1128	267	60.0	336.0
1129	268	60.0	346.5
1130	269	60.0	354.0
1201	270	66.0	0.0
1202	271	66.0	6.0
1203	272	66.0	13.5
1204	273	66.0	24.0
1205	274	66.0	37.5
1206	275	66.0	52.5
1207	276	66.0	67.5
1208	277	66.0	82.5

1209	278	66.0	97.5
1210	279	66.0	112.5
1211	280	66.0	127.5
1212	281	66.0	142.5
1213	282	66.0	156.0
1214	283	66.0	166.5
1215	284	66.0	174.0
1216	285	66.0	180.0
1217	286	66.0	186.0
1218	287	66.0	193.5
1219	288	66.0	204.0
1220	289	66.0	217.5
1221	290	66.0	232.5
1222	291	66.0	247.5
1223	292	66.0	262.5
1224	293	66.0	277.5
1225	294	66.0	292.5
1226	295	66.0	307.5
1227	296	66.0	322.5
1228	297	66.0	336.0
1229	298	66.0	346.5
1230	299	66.0	354.0
1301	300	72.0	0.0
1302	301	72.0	6.0
1303	302	72.0	13.5
1304	303	72.0	24.0
1305	304	72.0	37.5
1306	305	72.0	52.5
1307	306	72.0	67.5
1308	307	72.0	82.5
1309	308	72.0	97.5
1310	309	72.0	112.5
1311	310	72.0	127.5
1312	311	72.0	142.5
1313	312	72.0	156.0
1314	313	72.0	166.5

1315	314	72.0	174.0
1316	315	72.0	180.0
1317	316	72.0	186.0
1318	317	72.0	193.5
1319	318	72.0	204.0
1320	319	72.0	217.5
1321	320	72.0	232.5
1322	321	72.0	247.5
1323	322	72.0	262.5
1324	323	72.0	277.5
1325	324	72.0	292.5
1326	325	72.0	307.5
1327	326	72.0	322.5
1328	327	72.0	336.0
1329	328	72.0	346.5
1330	329	72.0	354.0
1401	330	78.0	0.0
1402	331	78.0	6.0
1403	332	78.0	13.5
1404	333	78.0	24.0
1405	334	78.0	37.5
1406	335	78.0	52.5
1407	336	78.0	67.5
1408	337	78.0	82.5
1409	338	78.0	97.5
1410	339	78.0	112.5
1411	340	78.0	127.5
1412	341	78.0	142.5
1413	342	78.0	156.0
1414	343	78.0	166.5
1415	344	78.0	174.0
1416	345	78.0	180.0
1417	346	78.0	186.0
1418	347	78.0	193.5
1419	348	78.0	204.0
1420	349	78.0	217.5

1421	350	78.0	232.5
1422	351	78.0	247.5
1423	352	78.0	262.5
1424	353	78.0	277.5
1425	354	78.0	292.5
1426	355	78.0	307.5
1427	356	78.0	322.5
1428	357	78.0	336.0
1429	358	78.0	346.5
1430	359	78.0	354.0
1501	360	84.0	0.0
1502	361	84.0	6.0
1503	362	84.0	13.5
1504	363	84.0	24.0
1505	364	84.0	37.5
1506	365	84.0	52.5
1507	366	84.0	67.5
1508	367	84.0	82.5
1509	368	84.0	97.5
1510	369	84.0	112.5
1511	370	84.0	127.5
1512	371	84.0	142.5
1513	372	84.0	156.0
1514	373	84.0	166.5
1515	374	84.0	174.0
1516	375	84.0	180.0
1517	376	84.0	186.0
1518	377	84.0	193.5
1519	378	84.0	204.0
1520	379	84.0	217.5
1521	380	84.0	232.5
1522	381	84.0	247.5
1523	382	84.0	262.5
1524	383	84.0	277.5
1525	384	84.0	292.5
1526	385	84.0	307.5

1527	386	84.0	322.5
1528	387	84.0	336.0
1529	388	84.0	346.5
1530	389	84.0	354.0
1601	390	88.5	0.0
1602	391	88.5	6.0
1603	392	88.5	13.5
1604	393	88.5	24.0
1605	394	88.5	37.5
1606	395	88.5	52.5
1607	396	88.5	67.5
1608	397	88.5	82.5
1609	398	88.5	97.5
1610	399	88.5	112.5
1611	400	88.5	127.5
1612	401	88.5	142.5
1613	402	88.5	156.0
1614	403	88.5	166.5
1615	404	88.5	174.0
1616	405	88.5	180.0
1617	406	88.5	186.0
1618	407	88.5	193.5
1619	408	88.5	204.0
1620	409	88.5	217.5
1621	410	88.5	232.5
1622	411	88.5	247.5
1623	412	88.5	262.5
1624	413	88.5	277.5
1625	414	88.5	292.5
1626	415	88.5	307.5
1627	416	88.5	322.5
1628	417	88.5	336.0
1629	418	88.5	346.5
1630	419	88.5	354.0

APPENDIX C

The algorithm designed to impart more information than the given cloud amount is described below. It uses the climatological boundary temperatures, the percent land in each STR, the computed radiance temperatures and the root-mean-square deviation from the mean radiance temperatures for both 6.7 and 11.5 μm channels of the THIR to further define the cloud type or flag the cloud types as ambiguous. The symbols are defined as follows:

Symbol	Meaning
N_i	The percent coverage of cloud
T_j	Boundary temperature from climatology
T_R	Computed mean temperature from THIR (°K)
σ_R	Root-mean-square deviation (°C)

Subscripts	
C	Clear
L	Low
M	Middle
H	High
S	Surface
6.7	6.7 μm channel
11	11.5 μm channel

Examples	
$T_{M/H}$	Boundary temperature between middle and high cloud.
$\overline{T}_{L11}$	Computed 11.5 μm radiance temperature in the low cloud bin.

1. For each STA, read STA record from CLE tape. (NOTE 3).

2. If N_H (percent coverage of high cloud) <5%, go to 9, (NOTE 2).

3. If $\bar{\bar{T}}_{H11}$ (mean temperature of high cloud from 11μm $\leq$240, flag as <u>ICE</u>. (NOTE 1)

4. If $T_{M/H}-\bar{T}_{H11}\leq 3$. Flag high cloud as <u>AMBIGUOUS MIDDLE</u>.

5. If σ H6.7 (σ of high cloud from 6.7μm) $\geq$ 2.5 and σH11(σ of high cloud from 11 μm) $\geq$5.5 flag as <u>CONVECTIVE</u>.

6. If σH6.7 <2.5 and σ_{H11} $\geq$5.5 flag as <u>THIN STRATUS</u>.

7. If σH6.7 <2.5 and σ_{H11} <5.5 flag as <u>THICK STRATUS</u>.

8. If $\sigma_{H6.7}$ $\geq$2.5 and σ_{H11} <5.5 flag as <u>BROKEN STRATUS</u>.

9. If N_M (percent coverage of middle cloud) <5% go to 13.

10. If $T_{L/M}-\bar{\bar{T}}_{M11}$ $\leq$3, then flag mid cloud as <u>AMBIGUOUS LOW</u>.
    If $\bar{T}_{M11}-T_{M/H}$ $\leq$3, then flag mid cloud as <u>AMBIGUOUS HIGH</u>.

11. If σM11$\geq$ 4.0, flag as <u>CONVECTIVE</u>, otherwise if σM6.7 $\geq$ 2.3, flag as <u>THIN CIRRUS</u>.

12. If $T_{S/L}$ - $T_{L/M}$ $\leq$2, set low cloud as <u>AMBIGUOUS</u> and go to 21, otherwise go to 13.

13. If both N_L and N_C (percent of low clouds and clear) $\geq$5% proceed to check ambiguities, otherwise to to 24.

14. If $\bar{\bar{T}}_{C11}$ - $\bar{T}_{L11}$ $\geq$3.8, Modes are distinct, go to 18, otherwise, 15.

15. Compute σ_{C+L}, and $\bar{T}_{C+L}$, where $\sigma_{C+L}$and $\bar{T}_{C+L}$ are deviation and mean of 11 μm temperature from clear and low bins combined.

16. If σ_{C+L} $\geq$1.6, low cloud and clear will be flagged as <u>AMBIGUOUS</u>, otherwise low cloud flagged as <u>AMBIGUOUS - CLEAR</u>. Go to 17.

17. If σ6.7 $\geq$2.3 in clear or low cloud bins, flag either as <u>THIN CIRRUS</u>, go to 1.

18. If % land >5, but less than 95, go to 19, otherwise, go to 20.

19. Define F = $(N_C \div (N_L + N_C))$. If |F- % Land/100|<0.1, or | 1 - F - % land/100|< 0.1, flag low cloud as <u>AMBIGUOUS - CLEAR</u>.

20. If σT_{C11} $\geq$ 1.6, flag clear as <u>AMBIGUOUS - LOW</u>. Go to 17.

21. If N_M and N_C>5%, and if $T_{L/M}$ - $\bar{T}_{M11}\leq 3$, then go to 22, otherwise go to 24.

22. If % land >5, but less than 95, go to 23, otherwise go to 20.

23. Define $F = (N_C + 1/2\, N_L)/(N_C + N_L + N_M)$, if $|(F - \%\ \text{land}/100)|$ or $|(1 - F - \%\ \text{land}/100)| < 0.1$ then flag mid cloud as AMBIGUOUS - CLEAR. Set ambiguous low flag = 0. Go to 17.

24. If N_C <5%, go to 26.

25. If % land ≤ 5, or ≥ 95, and $\sigma T_{C11} \geq 1.6$, flag clear as AMBIGUOUS - LOW. Go to 17.

26. If N_L <5%, go to 1.

27. If $\sigma_{L11} < 1.6$ then flag low cloud as AMBIGUOUS - CLEAR. Go to 17.

NOTE:

1. Statistics on tape in units of filtered radiance. Will convert all tested quantities to equivalent black body temperature (degrees Kelvin) before starting this procedure.

2. Percent coverage computed from population of THIR samples in each cloud bin.

3. Cloudiness estimates are not derived for STA's with total THIR population < 100.

APPENDIX D

The sub-target radiance tape is a nine track, 2400 ft. tape with data written at a density of 6250 bpi. The records have variable block lengths, with a maximum block size of 13030 bytes and a maximum logical record length of 13026 bytes. The tape was produced on an IBM 360-195 and is non-labeled. The data definition statement in the job control language (JCL) program that reads an STRT on the IBM computer looks like this:

```
//FT20F001     DD UNIT= TAPE 9, DISP=(OLD,KEEP), LABEL=(1,NL),
//          DCB=(RECFM=FB, LRECL=13026, BLKSIZE=13030, DEN=4),
//          VOL=SER=E08801
```

There is software available that will produce a dump of selected STRT records. This software is archived at NSSDC along with the data tapes and can be requested with any order for data. Two programs exist, one written in PL/1 and the other in FORTRAN. Both programs are extensively documented.

The software is available on a 6-file, non-labeded, 1600 BPI density magnetic tape. Record formats, lengths, and blocking vary from one file to the next, and are described in Table 1-D. Files 1-5 pertain primarily to the PL/1 program. File 6 is the FORTRAN program.

Table 1-D

STRT Software Tape Organization

FILE	RECFM	LRECL	BLKSIZE	DESCRIPTION
1	VB	104	2124	PL/1 Source Code
2	VBA	137	2016	PL/1 Compiler Listing
3	FB	80	1680	JCL (for PL/1 program and creation of this software tape).
4	F	3260	3260	Coded-to Sequential Target Number Table
5	F	5028	5028	Sequential-to-Coded Target Number Table
6	FB	80	1680	FORTRAN Source Code

~~1/23/80~~
Jan. 23, 1980 –
Jan. 30, 1980

78-098A-07G

RECORD 1 OF FILE 1
LENGTH = 12936 BYTES

1980 Jan. 23 –


```
32880000  00640000  C5E3C2E3  40400000  0000F0F0  F0F14BF0  00000000  F8F0F0F1  F2F3F0F0  F0F0F0F0
7FFFFFFF  F8F0F0F1  F2F3F9F9  F9F9F9F9  00000000  00000000  01000100  01000100  00000000  00000000
00000000  00000000  00000000  00000000  00000000  00004040  00440000  C5E3C3C7  D5C20000  0164F0F0
F0F14BF1  D00C1BFF  F8F0F0F1  F2F3F0F0  F0F0F0F0  9008D203  F8F0F0F1  F2F3F2F3  F5F9F5F9  00000000
01000320  00110000  00000000  01180000  C5E3C2D9  40400000  0000F0F0  F0F14BF1  03DF81DC  F8F0F0F1
F2F3F0F1  F5F0F2F0  59542317  23952411  0000F0F3  4BF32CF8  36EDF1F4  F1F60008  00150001  F1F0F0F7
00010001  F1F0F0F9  00020002  F1F1F0F7  00010004  F1F2F0F5  00010005  F1F2F1F1  00020006  F1F2F1F2
00020008  F1F3F0F5  0001000A  F1F4F0F4  0005000B  F1F4F1F2  00030010  F1F4F1F3  00020013  F1F5F1F3
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06EB03A6  0104088A  03900103  C75103A6  010107EC  03800402  0800037B  03010863  03750303  07E2037B
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03B50401  07450376  04010889  03820401  0754039B  01020787  03B00101  08780382  030207F2  03960303
07F903C2  0302092E  03980203  095F0376  020407F2  037A0202  0A370388  03010ACE  03920301  00000000
```

REQ. AGENT	RAND NO.	ACQ. AGENT
RLR		GRM

NIMBUS-7

SUBTARGET RADIANCE/REVIS (SRR)

78-098A-07V ESRB-00018 C tapes are 3480 cartridges

This data set catalog consists of 33 tapes. The tapes are 6250 bpi, 9-track, multifiled, standard labeled, binary, and created on the IBM 3081. Each data file has a header and trailer file which, are reflected in the column "FILES" below. The D and C numbers, time spans, and number of files are as follows:

D#	C#	LABEL#	FILES	TIME SPANS
85427	28900	SRR000	21	04/14/79 - 04/22/79
85428	28901	SRR001	21	04/23/79 - 05/04/79
85429	28902	SRR002	21	05/05/79 - 05/17/79
85430	28903	SRR003	21	05/19/79 - 05/27/79
85431	28904	SRR004	21	05/28/79 - 06/05/79
85432	28905	SRR005	21	06/06/79 - 06/14/79
85433	28906	SRR006	21	06/16/79 - 06/24/79
85434	28907	SRR007	21	06/25/79 - 07/03/79
85435	28908	SRR008	21	07/04/79 - 07/12/79
85436	28909	SRR009	21	07/14/79 - 07/22/79
85437	28910	SRR010	18	07/23/79 - 07/30/79
85438	28911	SRR011	18	07/31/79 - 08/07/79
85439	28912	SRR012	18	08/08/79 - 08/15/79
85440	28913	SRR013	18	08/16/79 - 08/23/79
85441	28914	SRR014	18	08/24/79 - 08/31/79
85442	28915	SRR015	18	09/01/79 - 09/08/79
85443	28916	SRR016	18	09/09/79 - 09/16/79

D#	C#	LABEL#	FILES	TIME SPANS
85444	28917	SRR017	18	09/17/79 - 09/24/79
85445	28918	SRR018	18	09/25/79 - 10/04/79
85446	28919	SRR019	18	10/06/79 - 10/12/79
85447	28920	SRR020	18	10/14/79 - 10/20/79
85448	28921	SRR021	18	10/22/79 - 10/30/79
85449	28922	SRR022	18	11/01/79 - 11/08/79
85450	28923	SRR023	18	11/09/79 - 11/16/79
85451	28924	SRR024	18	11/17/79 - 11/24/79
85452	28925	SRR025	18	11/25/79 - 12/02/79
85453	28926	SRR026	18	12/03/79 - 12/11/79
85454	28927	SRR027	18	12/13/79 - 12/25/79
85455	28928	SRR028	18	12/27/79 - 01/07/80
85456	28929	SRR029	18	01/08/80 - 01/16/80
85457	28930	SRR030	18	01/18/80 - 01/24/80
85458	28931	SRR031	18	01/26/80 - 02/05/80
85459	28932	SRR032	06	02/07/80 - 02/19/80

Please see Table 4 of the Final Report on the Status of Subtarget Radiance/Revised (SRR) Tapes on p. 10 for time spans by tape & file number.

CYN 7/96

B R I E F   D E S C R I P T I O N
ERB Subtarget Radiance/Revis(SRR)
78-098A-07V

The Nimbus-7 ERB Subtarget Revised Radiance (SRR) data set is stored magnetic tapes. The data set consists of short-wave reflected and longwave emitted radiances plus viewing geometry from the Nimbus-7 Earth Radiation Budget (ERB) master archive tapes (NSSDC ID 78-098A-07A), and cloud cover estimates and cloud top radiances from the Nimbus-7 New Cloud ERB (NCLE) tapes (NSSDC ID 78-098A-10D). The data is grouped in 167 km**2 subtarget regions and 18,630 regions cover the Earth. The data set is useful for studying the effects of clouds on the Earth's radiation budget and for examining scene dependent bidirectional reflectance and emission patterns. This data set is similar to the Nimbus-7 ERB Subtarget Radiance (STR) data set (NSSDC ID 78-098A-07G), however, the cloud estimates are much more accurate in the SRR data set and the SRR tapes include only 203 data days as opposed to 272 data days on the STR tapes. All of the tapes are standard lable (SL) with the following DCB characteristics: RECFM=VB, LRECL=13026, and BLKSIZE=13030. The data set was created using the PL/1 programming language. See Stowe, L.L., and Fromm, M.D., "Nimbus-7 ERB Sub-Target Radiance Tape (STRT) Data Base," NOAA Technical Memorandum NESDIS 3, Washington, D.C., December 1983; and Vemury, S.K., "Final report on the Status of Subtarget Radiance/Revised (SRR) Tapes," SMART Inc., Silver Spring, MD, December 1991.

M A T E R I A L S   F O R   D I S T R I B U T I O N
78-098A-07V
ERB Subtarget Radiance/Revis(SRR)

1) Memo dated 23 January 1992 from H.L.Kyle

2) Stowe, L.L., and M.D.Fromm: "Nimbus-7 ERB Sub-Target Radiance Tape (STRT) Data Base", NOAA Tech Memo NESDIS 3, December 1983. (B35463-000A). This document also supports 78-098A-07G (STRT). See -07G for document

3) Vemury, S.K., "Final report on the Status of Subtarget Radiance/Revised (SRR) Tapes", SMART, Inc., NASA Contract NAS5-30953, December 1991 (B41888-000A).

A C K N O W L E D G E M E N T S

When using the data in any reports, publications, or presentations, please acknowledge the National Space Science Data Center and the following individuals or groups:

78-098A-07V
Dr. H. L. Kyle, Nasa/Gsfc, Dr. Herbert Jacobowitz, Noaa/Nesdis, And Members Of The Erb Nimbus Experiment And Information Processing Teams

'78-098A-07V

January 23, 1992

TO: 930.3/National Space Science Data Center (NSSDC)
Dr. J. Green

FROM: 936/Information Systems Development Facility
H.L. Kyle

SUBJECT: Archiving of the Nimbus-7 ERB Subtarget Revised Radiance Tapes (SRRT's)

This memorandum accompanies the Nimbus-7 ERB Subtarget Revised Radiance (SSR) data set (33 9-track 6250bpi tapes). The data set consists of short wave reflected and longwave emitted radiances plus viewing geometry from the Nimbus-7 Earth Radiation Budget (ERB) master archive tapes, and cloud cover estimates and cloud top radiances from the Nimbus-7 New Cloud ERB (NCLE) tapes. The data is grouped in $(167\ km)^2$ subtarget regions and 18,630 of the regions cover the Earth. The data set is useful in studying the effects of clouds on the Earth's radiation budget. To date, it has been used chiefly to examine scene dependent bidirectional reflection and emission patterns. This data set is similar in general make up and purpose to the Nimbus-7 ERB Subtarget Radiance (STR) data set (NSSDC ID No. 07G) already in NSSDC. However, the cloud estimates are much more accurate on the new SRR tapes. But the SRR tapes include only 203 data days as opposed to 272 data days on the STR tapes. For this reason, the new SRR data set is submitted as a supplement to, rather than a replacement of, the present STR data set.

The SRR data set was constructed in 1985 but several problems chiefly related to priorities and the budget, prevented submission of the data set at that time. Sastri Vemury (SMART, Inc.) has recently reviewed the 33 tapes and found them in good condition. He also has completed the documentation of the SRR tapes which originally was left unfinished. This documentation describes the reasons for this new data set and how the tape format differs from the original STR tape format. It is in the form of a supplement to the original STR User's Guide by Stowe and Fromm (1983) and should not be considered as an independent document. Ten copies of this document, plus five additional copies of the original STR tape User's Guide (in case you are short) accompany the SRR tapes.

The physical format of the 33 tapes is summarized in the attached table (Table 4 in the Supplement). Also attached are summaries from the tape scans. Several of the tapes show creation dates in 1991. These recent dates merely refer to the date when the labels were finally put on the tapes. The tapes were first created on unknown days in 1985. Tapes and documentation will be delivered to Ralph Post.

H. Lee Kyle
Leader, ERB Processing Team

enclosures

CONCURRENCE:

Daesoo Han
Manager, Nimbus Project

cc: A. Oakes/936
C. NG/933/STX
R. Post/933/STX
L. Olsen/935
E. Major/STX
L. Stowe/NOAA/NESDIS

78-098A-07V
B 41888-000A

SMART, Inc.

FINAL REPORT ON THE STATUS OF SUBTARGET RADIANCE/REVISED (SRR) TAPES

Under NASA Contract No. NAS5-30953

FOR

DR. H. Lee Kyle/ Code 936
NASA/Goddard Space Flight Center

Prepared by

Sastri K. Vemury
Scientific Management and Applied
Research Technologies, Inc.

December 1991

SCIENTIFIC MANAGEMENT AND
APPLIED RESEARCH TECHNOLOGIES, INC.
9 HUTCHINSON COURT, SILVER SPRING, MD. 20906

FINAL REPORT ON THE STATUS OF THE NIMBUS-7 SUBTARGET RADIANCE/REVISED (SRR) TAPES

Under NASA Contract No. NAS5-30953

FOR

DR. H. Lee Kyle/ Code 936
NASA/Goddard Space Flight Center

Prepared by

Sastri K. Vemury
Scientific Management and Applied
Research Technologies, Inc.

December 1991

FOREWORD

This document is an update and is thus not an independent document. It is meant to be used in conjunction with:

Nimbus-7 ERB Sub-Target Radiance Tape (STRT) Data Base

by L.L.Stowe and M.Fromm

NOAA Technical Memorandum NESDIS 3

Published by U.S.Department of Commerce
Washington, D.C.
December 1983.

CONTENTS

*SF83 refers to a NOAA/NESDIS Technical Memorandum by Stowe and Fromm (1983).

LIST OF TABLES

1. INTRODUCTION

The sub-target radiance tapes (STRTs) were developed as an intermediate, multi-instrument data base with the specific objectives of understanding the bidirectional characterics of broad-band radiation reflected by and emitted from natural surfaces and to develop suitable classifications of the observed cloud types and their bidirectional radiation characteristics. The original data base developed and used for such studies consisted of 36 tapes containing 272 data days derived from observations from the Earth Radiation Budget (ERB) instrument and the cloud observations from the Temperature Humidity Infrared Radiometer (THIR), both of which were flown on Nimbus-7 satellite. There were a total of 385 concurrent days of operation before the failure of the scanner on the ERB instrument in June 1980. However, budgetary constraints limited the number of days in STRT data. The THIR instrument continued to provide cloud observations extending through March 1985. Stowe and Fromm (1983) describe in detail the data sources, STRT tape data organization according to the sub-target areas and the general structure of the data stored. One of the primary uses of the STRT data base had been toward the development of broad band bidirectional reflectance and emission models (Taylor and

Stowe, 1984), which were then used in the estimation of the top-of the atmosphere fluxes for the reflected and emitted radiation and thus to obtain the regional and global net flux (Jacobowitz, et al. 1984).

Improvements in the cloud algorithms from THIR were subsequently developed using twice daily surface temperature fields from the Air Firce 3D Nephanalysis and the appropriate atmospheric corrections and inclusion of cloud classification using ultraviolet observations from the Total Ozone Mapping Spectrometer (TOMS) (Stowe et al., 1988). One of the primary improvements was in the identification of low cloud which the infrared scanners from the THIR instrument generally missed. Temperature of the low cloud is not significantly different from the surface temperature and THIR classification scheme used thresholding methods, thus making the low cloud identification difficult and often an uncertain process. Low cloud could however be detected by a visible channel, but THIR was an IR instrument. Fortunately, another scanner instrument flown on Nimbus-7 was the total ozone mapping spectrometer (TOMS) and it carried several ultra--violet channels. These channels have the advantage that the enhanced reflectance of low cloud over the surface could be detected. There are two other advantages of adding observations from this instrument to the THIR data stream. The first one is the near uniform reflectance in the ultra-violet of most earth scenes including land, ocean and desert etc. In the visible, the clear sky surface reflectivities of these scene vary over a wide range from 0.06 to 0.40, thus making the cloud identification more complicated. In the ultra-violet,the reflectance range is much shorter, thus cloud identification is significantly easier. The second advantage is that the reflectance in the ultra-violet is nearly linear in cloud amount. For further details on the algorithms and on the application of the algorithms, the user may consult Stowe et al., 1988.

A new set of 33 tapes covering 203 data days, have been generated with the improvements incorporated into them. In addition to the corrected cloud amount, the tapes contain necessary radiance, threshold radiance and cloud flag information making the data base useful for additional studies on clouds and radiation. This set of tapes is referred to as the "SRR" tapes. This report documents the changes in data structure and format on the SRR tapes and identifies the additional information that has been added to the data base after creation of the STRTs. Section 2 of this report describes broad details of the data base and section 3 identifies the changes to the report by Stowe and Fromm (1983) (henceforth SF83) in the form of an addendum/corrigendum made necessary because of the additions and changes in the tape content. Section 4 contains the necessary software in Fortran and the appropriate Job Control Language for an IBM 32-bit machine to obtain a dump of some parameters from tape.

2.0 SRR data base relative to ERB scanner data and STRT tape data

"SRR" data tapes are remakes of the STRTs described in SF83 with the additional parameters and information added on to them and some parameters, in particular, cloud amounts corrected. this has become possible through a series of continual efforts to improve the quality and consistency of the data base through a number of studies like Stowe (1984), Eck et al., (1987), Stowe et al., (1984), Stowe et al., (1986), and Stowe et al., (1988).

2.1 Different production levels and data set size

Because of a number of limitations, only a subset of the original ERB tapes were developed into STR tapes. Shown in Table 1 are the set of ERB data dates for which scanner data tapes are available and cover the range of November 16, 1978 through June 23, 1980 when the scanner failed to function. All the data days for which ERB scanner data are available in the form of Master Archival Tapes (MATs) are shown in Table 1. An entry for a given day implies ERB scanner data are available. Only a subset of the original MATs were converted to the Sub-Target Radiance Tapes (STRTs). These are indicated in the table by 'xxx' while the rest of the ERB data days are shown as '000'. Thus out of the total 385 days, only 272 days of data have been converted to STR tapes. Shown in Table 2 is more quantitative information on the tape numbers and the respective file number for each day. The format in the table follows the convention of tape number/-file number. Thus 14/1 in the table indicates that data for day 20 in June 1979 is on STRT014 and on file number 1.

Production of the SRR tapes involved the use of concurrent Air Force Surface Temperature data in the IR cloud detection algorithm. But the Air Force data did not start until April 1979. This further reduced the data base from 272 days to 203 days. Those days for which the SRR tapes are produced are shown in Table 3. This table shows the tape number and file number as in Table 2 for any given day in the month. A separate listing of

Table 1. Dates when STRT data exist (XXX). The data base may be expanded to include the dates flagged with '000'. Dates when no data can be produced are left blank.

	1978		1979												1980					
Day	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
01			XXX		XXX			XXX		XXX	XXX		XXX	XXX		000		000	000	
02		XXX		XXX	000			XXX	XXX		XXX	XXX		XXX	XXX		000		000	000
03		XXX					XXX		XXX	XXX			XXX	XXX	000	000	000	000	000	000
04		XXX	XXX				XXX	XXX	XXX	XXX	XXX	XXX	XXX		000	000	000			000
05			XXX		XXX		XXX	XXX		XXX	XXX		XXX	XXX		XXX		000	000	
06		XXX		XXX	XXX			XXX	XXX		XXX	XXX			XXX		000		000	000
07		XXX							XXX	XXX		XXX	XXX	XXX	XXX	XXX	000	000	000	000
08		XXX	XXX				XXX	XXX	XXX	XXX	XXX	XXX	XXX		XXX	000	000	000		000
09			XXX	XXX	XXX			XXX		XXX	XXX		XXX	XXX		000		000	000	
10				XXX	XXX			XXX	XXX		XXX	XXX		XXX	XXX		000		000	000
11		000					XXX		XXX	XXX		XXX	XXX	XXX	XXX	000	000	000	000	000
12		XXX	XXX					XXX	XXX	XXX	XXX	XXX	XXX		XXX	000	000	000		000
13			XXX	XXX	XXX		XXX	XXX		XXX	XXX		XXX	XXX		000		000	000	
14				XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX		XXX	000		000		000	000
15		XXX				XXX	XXX		XXX	XXX		XXX	XXX	XXX	XXX	000	000	000	000	000
16	XXX	XXX	XXX			XXX		XXX	XXX	XXX	XXX	XXX	XXX		XXX	000	000	000		000
17	XXX		XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX		XXX	000		000		000	000	
18	XXX			XXX	XXX	XXX		XXX	XXX		XXX	XXX			XXX		000		000	000
19		XXX				XXX	XXX		XXX	XXX		XXX	XXX	XXX	XXX	XXX	000	000	XXX	000
20	XXX	XXX	XXX				XXX	XXX	XXX	XXX	XXX	XXX	XXX		XXX	000	000	000		000
21	XXX		XXX	XXX	XXX		XXX	XXX		XXX	XXX		XXX	000		000		000	000	
22	XXX			XXX	XXX	XXX		XXX	XXX		XXX	XXX		000	XXX		000		000	000
23		XXX				XXX	XXX		XXX	XXX		XXX	XXX	XXX	XXX	000	000	000	000	
24	XXX	XXXX					XXX	XXX	XXX	XXX	XXX	XXX	XXX		XXX	000	000	000		
25	XXX		XXX		XXX		XXX	XXX		XXX	XXX		XXX	XXX		000		000	000	
26	XXX				XXX	XXX		XXX	XXX		XXX	XXX		000	XXX		000		000	
27		XXX	XXX			XXX	XXX		XXX	XXX			XXX	XXX	XXX	000	000	000	000	
28	XXX	XXX				XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		XXX	000	000	000		
29	XXX		000		XXX	XXX	XXX	XXX		XXX			XXX	XXX		000		000	000	
30	XXX				XXX			XXX	XXX		XXX	XXX		XXX	XXX		000		000	
31		XXX	XXX				XXX		XXX	XXX				000	XXX		000		000	
	11	17	15	10	16	12	19	23	23	23	22	20	22	22	28	22	23	21	24	16	385
	12	16	14	10	15	12	19	23	23	23	22	20	22	17	20	3	0	0	1	0	272

<u>TABLE 2</u>

ORIGINAL SUBTARGET AREA RADIANCE TAPES (STRTs)

DAY	1978 NOV	DEC	1979 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	1980 JAN	FEB	MAR	APR	MAY
01			03/5		06/5			12/3		18/2	21/4		27/4	30/5					
02		01/5		05/3				12/4	15/2		21/5	24/5		30/6	33/1				
03		01/6					09/8		15/3	18/3			27/5	30/7					
04		01/7	03/6				10/1	12/5	15/4	18/4	21/6	24/6	27/6						
05			03/7		06/6		10/2	12/6		18/5	21/7		27/7	31/1		35/7			
06		01/8		05/4	06/7			12/7	15/5		22/1	24/7			33/2				
07		02/1							15/6	18/6		25/1	28/1	31/2	33/3	36/1			
08		02/2	03/8				10/3	12/8	15/7	18/7	22/2	25/2	28/2		33/4				
09			04/1	05/5	06/8			13/1		19/1	22/3		28/3	31/3					
10				05/6	07/1			13/2	15/8		22/4	25/3		31/4	33/5				
11							10/4		16/1	19/2		25/4	28/4	31/5	33/6				
12		02/3	04/2					13/3	16/2	19/3	22/5	25/5	28/5		33/7				
13			04/3	05/7	07/2		10/5	13/4		19/4	22/6		28/6	31/6					
14				05/8	07/3	08/4	10/6	13/5	16/3		22/7	25/6		31/7					
15		02/4				08/5	10/7		16/4	19/5		25/7	28/7	32/1	34/1				
16		02/5	04/4			08/6		13/6	16/5	19/6	23/1	26/1	29/1		34/2				
17			04/5	06/1	07/4	08/7	10/8	13/7		19/7	23/2		29/2						
18				06/2	07/5	08/8		13/8	16/6		23/3	26/2			34/3				
19		02/6				09/1	11/1		16/7	20/1		26/3	29/3	32/2	34/4	36/2			36/3
20		02/7	04/6				11/2	14/1	16/8	20/2	23/4	26/4	29/4		34/5				
21			04/7	06/3	07/6		11/3	14/2		20/3	23/5		29/5						
22				06/4	07/7	09/2		14/3	17/1		23/6	26/5			34/6				
23		02/8				09/3	11/4		17/2	20/4		26/6	29/6	32/3	34/7				
24		03/1					11/5	14/4	17/3	20/5	23/7	26/7	29/7		35/1				
25			04/8		07/8		11/6	14/5		20/6	24/1		30/1	32/4					
26	01/1				08/1	09/4		14/6	17/4		24/2	27/1			35/2				
27		03/2	05/1			09/5	11/7		17/5	20/7			30/2	32/5	35/3				
28	01/2	03/3				09/6	11/8	14/7	17/6	21/1	24/3	27/2	30/3		35/4				
29	01/3				08/2	09/7	12/1	14/8		21/2			30/4	32/6					
30	01/4				08/3			15/1	17/7		24/4	27/3		32/7	35/5				
31		03/4	05/2				12/2		18/1	21/3					35/6				

Note: Format is Tape No/File NO. 14/8 means file 8 on Tape No. STRT14.

TABLE 3

REVISED STRTS: (STR/R)

	1978		1979												1980				
DAY	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
01								04/4		11/1	15/1		22/1	25/5					
02								04/5	07/6		15/2	18/5		25/6	28/4				
03							01/6		07/7	11/2			22/2	26/1					
04							01/7	04/6	08/1	11/3	15/3	18/6	22/3						
05							02/1	04/7		11/4	15/4		22/4	26/2		31/5			
06								05/1	08/2		15/5	19/1			28/5				
07									08/3	11/5		19/2	22/5	26/3	28/6	32/1			
08							02/2	05/2	08/4	12/1	15/6	19/3	22/6		29/1				
09								05/3		12/2	16/1		23/1	26/4					
10								05/4	08/5		16/2	19/4		26/5	29/2				
11							02/3		08/6	12/3		19/5	23/2	26/6	29/3				
12								05/5	08/7	12/4	16/3	19/6	23/3		29/4				
13							02/4	05/6		12/5	16/4		23/4	27/1					
14						00/1	02/5	05/7	09/1		16/5	20/1		27/2					
15						00/2	02/6		09/2	12/6		20/2	23/5	27/3	29/5				
16						00/3		06/1	09/3	13/1	16/6	20/3	23/6		29/6				
17						00/4	02/7	06/2		13/2	17/1		24/1						
18						00/5		06/3	09/4		17/2	20/4			30/1				
19						00/6	03/1		09/5	13/3		20/5	24/2	27/4	30/2	32/2			
20							03/2	06/4	09/6	13/4	17/3	20/6	24/3		30/3				
21							03/3	06/5		13/5	17/4		24/4						
22						00/7		06/6	09/7		17/5	21/1			30/4				
23						01/1	03/4		10/1	13/6		21/2	24/5	27/5	30/5				
24							03/5	06/7	10/2	14/1	17/6	21/3	24/6		30/6				
25							03/6	07/1		14/2	18/1		25/1	27/6					
26						01/2		07/2	10/3		18/2	21/4			31/1				
27						01/3	03/7		10/4	14/3			25/2	28/1	31/2				
28						01/4	04/1	07/3	10/5	14/4	18/3	21/5	25/3		31/3				
29						01/5	04/2	07/4		14/5			25/4	28/2					
30								07/5	10/6		18/4	21/6		28/3	31/4				
31							04/3		10/7	14/6									

Note: Format is Tape No/File No. 10/7 means file 7 on Tape No. 10.
The first tape number is SRR000 and not SRR001.

the individual SRR tapes and the number of days and the dates for which they contain data are shown in Table 4. The tapes are created as standard label tapes to make the data easily accessible on an IBM computer. Also indicated in the table are the dates when the SRR data tapes were generated in certain cases.

The 33 SRR tapes will be archived at National Space Science Data Center (NSSDC) at Goddard Space Flight Center and will be available for scientific users. The original STRTs are also archived at the same location. Tables 2 and 3 provide a match up list of the STRT tape number and file number and the corresponding SRR tape number and the file number and provide complete traceability of the data.

<u>2.2 Tape Format, software and Data Organization</u>

The SRR tapes were originally made and quality verified in 1986. However, due to pressure of other activities, they were set aside. The final documentation was thus not completed until 1991. As one step in the documentation, a fortran code was developed to verify the data on the tape and that the data conforms to the specifications. Each of the 33 tapes and each of

TABLE 4

'SRR' TAPE DATES AND TAPE CHARACTERISTICS

All tapes are: 6250 BPI, Standard Label
DCB Characteristics: RECFM=VB,LRECL=13026,BLKSIZE=13030
Language used: PL/1

Tape No.	No. of Files	File 1	File 2	File 3	File 4	File 5	File 6	File 7	D/M/Y*
		1979							
SRR000	7	04/14	04/15	04/16	04/17	04/18	04/19	04/22	121891
SRR001	7	04/23	04/26	04/27	04/28	04/29	05/03	05/04	053185
SRR002	7	05/05	05/08	05/11	05/13	05/14	05/15	05/17	060185
SRR003	7	05/19	05/20	05/21	05/23	05/24	05/25	05/27	060185
SRR004	7	05/28	05/29	05/31	06/01	06/02	06/04	06/05	120791
SRR005	7	06/06	06/08	06/09	06/10	06/12	06/13	06/14	060185
SRR006	7	06/16	06/17	06/18	06/20	06/21	06/22	06/24	120791
SRR007	7	06/25	06/26	06/28	06/29	06/30	07/02	07/03	060685
SRR008	7	07/04	07/06	07/07	07/08	07/10	07/11	07/12	060685
SRR009	7	07/14	07/15	07/16	07/18	07/19	07/20	07/22	060785
SRR010	6	07/23	07/24	07/26	07/27	07/28	07/30		062185
SRR011	6	07/31	08/01	08/03	08/04	08/05	08/07		062185
SRR012	6	08/08	08/09	08/11	08/12	08/13	08/15		062485
SRR013	6	08/16	08/17	08/19	08/20	08/21	08/23		062485
SRR014	6	08/24	08/25	08/27	08/28	08/29	08/31		062685
SRR015	6	09/01	09/02	09/04	09/05	09/06	09/08		062785
SRR016	6	09/09	09/10	09/12	09/13	09/14	09/16		062785
SRR017	6	09/17	09/18	09/20	09/21	09/22	09/24		120791
SRR018	6	09/25	09/26	09/28	09/30	10/02	10/04		062885
SRR019	6	10/06	10/07	10/08	10/10	10/11	10/12		070185
SRR020	6	10/14	10/15	10/16	10/18	10/19	10/20		070185
SRR021	6	10/22	10/23	10/24	10/26	10/28	10/30		072385
SRR022	6	11/01	11/03	11/04	11/05	11/07	11/08		072585
SRR023	6	11/09	11/11	11/12	11/13	11/15	11/16		081385
SRR024	6	11/17	11/19	11/20	11/21	11/23	11/24		082985
SRR025	6	11/25	11/27	11/28	11/29	12/01	12/02		082985
SRR026	6	12/03	12/05	12/07	12/09	12/10	12/11		091485
SRR027	6	12/13	12/14	12/15	12/19	12/23	12/25		091485
					1980				
SRR028	6	12/27	12/29	12/30	01/02	01/06	01/07		120791
SRR029	6	01/08	01/10	01/11	01/12	01/15	01/16		120791
SRR030	6	01/18	01/19	01/20	01/22	01/23	01/24		120791
SRR031	5	01/26	01/27	01/28	01/30	02/05			091985
SRR032	2	02/07	02/19						091985

* D/M/Y represents date, month and year when tape was created.

the files on the tapes have been processed with the code to verify the availability of data and their readability. We only confirm that data exists on the tape and it is readable using this or other user generated software; a second scientific quality control was not performed in 1991. A copy of the listing of the code and the necessary job control language for an IBM machines are included as Listing 1 and Listing 2 in Appendix A.

Data organization on the new SRR tapes continues to conform to the structure set up by the STR tape. Data records are stored according to the target area and with in a target area, according to a sub-target area number. Each target area has a topography record, followed by nine (9) sub-target area records. Each subtarget area record contains a geography record, followed by a number of radiance records. The radiance records contain the cloud cover information derived from the bispectral (IR from THIR and U-V from TOMS) method outlined briefly in the next section. It must be pointed out that the algorithm developed and investigated by Stowe et al., (1988) has not been incorporated in deriving these cloud amounts. Instead, an earlier version which was available at the time of the generation of the SRR tapes, was used. Both the intermediate and final versions are outlined in the next section. The revised cloud amount according to the Stowe et al., (1988) version could be computed from the information available on the tape.

In addition to the cloud amounts derived using the bispectral method, a number of cloud flags, TOMS reflectivities, TOMS derived cloud amount etc. are added into the radiance record on the SRR tape. It is believed that some of this information would be highly useful for scientific investigations. Further details on these additions are included in the next section.

ADDENDUM TO NOAA TECHNICAL MEMORANDUM NESDIS

Developed subsequent to changes in

cloud detection algorithm

November 1991

3.0 Changes in SRR from STRT

This section exclusively deals with the changes in the data content made in STRT to produce SRR tapes. Many of these are in the form of enhancements. The primary change is in the cloud amounts corresponding to clear, low cloud, middle cloud and high cloud amounts. It must be pointed out again that these cloud amounts are not <u>the</u> <u>final</u> cloud amounts as presented in Stowe et al., (1988 & 1989). At the time of the development of SRR tapes, an earlier version of the bi-spectral algorithm was used. Both these algorithms are described later in the section and as pointed out before, data on the tape is adequate to make this conversion, if the user desires to do so.

3.1 Enhancement in data records

Changes have occurred in the topography record and in the orbital logical record. The geography record has not been changed. A schematic of the additions in the records are shown below:

a) TOPOGRAPHY RECORD (1 Record for Target Area)

ID Block	Frac Water	Frac. Ice	
1-14	15-21	22-29	

b) GEOGRAPHY RECORD (1 Record for Sub-Target Area)

No changes have been made in this record.

c) ORBITAL LOGICAL RECORD

ID Block	Solar Data	Cloud Data	Cloud Flags	THIR/TOMS NCLE Record	ERB DATA BLOCK
1-14	15-19	20-24	25-53	54-89	89-100

3.2 Addendum/Corrigendum to the NESDIS Document 3.

The following identifies changes in the technical report on the Nimbus-7 ERB sub-target radiance tape (STRT) data base by SF83 published by the U.S. Department of Commerce. Changes described in this section are primarily changes in the data content and any changes necessary in the specific sections of the above document while attempting to retrieve data from the SRR tapes.

3.2.1 Changes to 2.3.1 of SF83

2.3.1 (Addendum)

The cloud detection scheme used in the development of the original STRTs was described in detail in Hwang (1982). Analysis by Stowe (1984) showed that this scheme leads to large uncertainties (errors) due to the use of climatological surface temperature information. A number of changes to the infra-red algorithm have since been made to improve the cloud detection both qualitatively and quantitatively. The primary non-satellite data came from the Air Force 3D Cloud Nephanalysis (Fye, 1978) and consists of the Terrain Height Analysis, the Snow/Ice Analysis and the Surface Temperature Analysis. Over land, the surface temperature analysis is based on conventional shelter temperature reports from NMC and Air Weather Service stations which are received every three hours. Over water, the analysis uses Sea Surface Temperature measurements reported by ships every six hours and by satellite remote sensing twice daily.

In addition to the use of concurrent surface temperatures from Air Force Nephanalysis, a number of improvements were made in the infrared (IR) algorithm. For cloud identification purposes, the following are corrections made to improve the Air Force Surface temperature T_{AF} used (Stowe et al., 1988). (1) Adjustment for atmospheric attenuation using an empirically fitted formula based upon T_{AF} and the satellite zenith angle Θ (Brower et al., 1976). (2) Bias in the attenuation adjustment due to the differences in the spectral responses of the THIR and NOAA radiometers. (3) Errors resulting from horizontal variations in the surface temperature field within a Sub-Target Area (STA). (4) Correction for cloud elements which fill only part of the Field of View (FOV) of the radiometers. (5) Adjustments to climatological low/mid cloud temperature threshold due to atmospheric attentuation and (6) an adjustment based upon latitude to the mid/high cloud threshold.

A second algorithm called the U-V algorithm was also developed independently using the 0.36 and 0.38 micron reflectivity measurements by the Total Ozone Mapping Spectrometer (TOMS). Analysis of cloud-less areas using minimum reflectivity from the TOMS instrument indicated the near uniformity of UV reflectivities for all land, ocean and desert areas. It is also found that the TOMS reflectivity varies between 8% and 50% as cloud amount varies between 0 and 100% in a near linear fashion. The U-V algorithm is thus found to be particularly useful in identifying low level clouds which often tend to be missed by the thresholding methods in the infrared algorithm.

A combined infrared, ultraviolet algorithm was thus developed to incorporate the advantages of the two schemes and is referred to as the bi-spectral cloud algorithm. Such a bispectral algorithm was used in the development of the present dataset. This algorithm gives most weight to the most accurate estimate and is called the NCLE algorithm. The NCLE cloud estimate is thus derived using

$$NCLE = IR*(1-W) + TOMS * W$$

where $W = W1*W2$

$$W1 = N/N+1 \qquad (A)$$

and $W2 = |IR - TOMS|/(IR+TOMS)$.

IR and TOMS are the cloud estimates by the separate IR and U-V algorithms. When W=0, the IR gives the best estimate and as W approaches 1, TOMS gives the best estimate. W consists of two factors: W1 depends on the number of TOMS samples, N, in a STA such that, for oblique views, TOMS estimate will be given less weight than for nadir views; W2 varies in such a way that, when IR and TOMS cloud amounts are in good agreement, TOMS will be given less weight, but when in poor agreement, particularly when the IR indicates less cloud than TOMS (which is typical of low cloud errors in the IR), more weight is given to TOMS.

Further analysis subsequent to the creation of the SRR tapes, revealed that additional improvement can be achieved by modifying the algorithm to

$$NCLE = IR*(1-W) + TOMS*W$$

where $W = W1 * W2$

$$W1 = \cos(\theta) \qquad (B)$$

$$W2 = (Clear + Low)/100.$$

Here θ is the satellite zenith angle and Clear(Low) is the percentage of THIR 11 micron pixels in a given sub-target area classified as clear (low cloud). The total weight, W, is a composite of two weights W_1 and W_2. The factor W_1 reduces the influence of TOMS in the bispectral algorithm as satellite zenith angle increases because TOMS FOV is much larger than THIR FOV at these angles and less reliable. The reduction in the number of TOMS FOVs located in the STA is approximated by Cos θ, which is used to compute W_1. The value of W_1 ranges between 0.5 and 1.0. The weight W_2 is simply the fraction of the STA that is determined by the IR algorithm to be clear and/or covered by low cloud. Results derived with this change are discussed in Stowe et al. (1988). This change however, has not been incorporated in the present database. Data stored on the revised SRR tapes contain cloud information computed according to the equations in (A). The Cloud Processing Team found that algorithm (B) yielded a smoother estimate than (A) of cloud amount as a function of the satellite zenith angle. However, the mean results were fairly similar. Adequate information is retained on the tape for a user to compute the corrected NCLE cloud amount instead of the amount stored on the tape.

The final NCLE clouds derived for the Nimbus-7 Cloud Climatology used equation (B). This equation was also used during the development of angular bidirectional models for clear, partly cloudy, mostly cloudy and overcast scenes derived under the auspicies of the ERBE cloud detection program (Suttles et al., 1988, Suttles et al., 1989). The STR tape data base was used and the cloud amounts were computed using equation (B) and used in the generation of the models.

3.2.2 Changes to 3.5.2 of SF83

3.5.2 (Addendum) Topography Logical Record

The topography logical record has been enhanced by including the fraction of water and fraction of ice in the target area for each of the winter, spring, summer and fall seasons. This information is inserted immediately after the ID block. Parameters 22-25 contain the fraction of Target Area covered with water in the winter, spring, summer and fall respectively. The amount of ice fraction in the Target Area for the same seasons is included as parameters 26-29.

TABLE 8 (REVISED)

Topography Logical Data Record

1-21. ID Block (See Table 7)

```
***All items in this block are two-byte words, written as
***fixed point binary. They consist of one whole bit and 8
**fractional bits are scaled by 2**8. Declare as integer*2
***in Fortran and then divide by 2**8 or FIXED BINARY (9,8)
***in PL/1.
***Note: Equivalent to FIXED BINARY (15,8)
```

22-25 Fraction Water - Fraction of Target Area covered with water in the Winter, Spring, Summer and Fall seasons of the Northern Hemisphere, respectively.

26-29 Fraction Ice - Fraction of Target Area covered with ice in the Winter, Spring, Summer and Fall seasons of the Northern Hemisphere, respectively.

30 Fraction Plain - Fraction of the Target Area covered with plain.

31 Fraction Hilly - Fraction of the Target area covered with hills.

32 Fraction Mountain - Fraction of the Target Area covered by mountain.

33 Fraction Hamada - Fraction of the Target Area covered by hamada.

34 Fraction Erg - Fraction of the Target Area covered by erg.

35 Fraction Balson - Fraction of the Target Area covered by bolson.

36 Mountain Vegetation - Fraction of Target Area covered with mountain vegetation.

37 Selva - Fraction of Target Area covered with selva vegetation.

38 Taiga - Fraction of Target Area covered with taiga vegetation.

39 Scrub - Fraction of Target Area coverd with scrub vegetation.

40 Mixed - Fraction of Target Area covered with mixed vegetation.

41 Savanna - Fraction of Target Area covered with savanna vegetation.

42 Prairie - Fraction of Target Area covered with prairie vegetation.

43 Tundra - Fraction of Target Area covered with tundra vegetation.

44 Desert - Fraction of Target Area covered with desert vegetation.

45 Padding - To force the logical record to end on the full word (4-byte) boundary. Two bytes (EBCDIC). Filled with blanks.

*** End of Topography Logical Record ***

3.2.3 Changes to 3.5.4 of SF83

3.5.4 ORBITAL DATA RECORD

The orbital data record, flagged by the character "R" in the identification block of the logical record, consists of solar geometry, cloud cover and type as derived by using the bi-spectral algorithm described in revised section 2.3.1 and ERB radiance data with the angular information for a single orbital pass of the Nimbus-7 space craft. Also included are the supportive THIR sample radiance data by cloud level and spectral band and TOMS reflectance and cloud data. Each logical record will have a variable length, depending on the number of sightings of the STA by the ERB scanning radio-meter. The record is always padded to achieve a length divisible by four bytes, i.e. each record ends on a full-word boundary. The logical record begins with an identificatios block which is 14 words instead of 20 words long, as shown in Table 7. Table 10 (Revised) gives a detailed listing of the orbital data record.

TABLE 10 (REVISED)

STR/R ORBITAL LOGICAL RECORD

01-14 IDENTIFICATION

***Elements 15-18 constitute a block of solar geometry
***data. All angles are defined in degrees. Azimuths range
***from 0 to +180°, positive (negative) in a clockwise
***(couter-clockwise) direction from North. Zenith angles
***range from 0 (daytime) to 180° (nighttime). Each element
***is two bytes long, which includes a sign bit, 8 whole
***number bits and 7 fractional bits. Equivalently, they
***are INTEGER * 2 words scaled by 2**7 in FORTRAN or FIXED
***BINARY (15,7) in PL/1.

15 Solar Azimuth - Mean solar azimuth from north, defined at the center of the STA.

16 Solar Zenith Minimum - Minimum solar zenith angle of those computed during an orbital sighting of the STA.

17 Solar Zenith Mean - Mean solar zenith angle of those computed during an orbital sighting of the STA, defined at the center of the STA.

18 Solar Zenith Maximum - Maximum solar zenith angle of those computed during an orbital sighting of the STA.

19 Unused - Fifteen (15) unused binary bits set to zero. To be ignored.

***Elements 20 through 53 constitute a block of data descri-
***bing cloud amount and type.

20 Cloud Flag - Flag to indicate if valid cloud data follow. One binary bit.

'1' - Cloud data available
'0' - No cloud data

LIST OF TABLES

1. INTRODUCTION

The sub-target radiance tapes (STRTs) were developed as an intermediate, multi-instrument data base with the specific objectives of understanding the bidirectional characterics of broad-band radiation reflected by and emitted from natural surfaces and to develop suitable classifications of the observed cloud types and their bidirectional radiation characteristics. The original data base developed and used for such studies consisted of 36 tapes containing 272 data days derived from observations from the Earth Radiation Budget (ERB) instrument and the cloud observations from the Temperature Humidity Infrared Radiometer (THIR), both of which were flown on Nimbus-7 satellite. There were a total of 385 concurrent days of operation before the failure of the scanner on the ERB instrument in June 1980. However, budgetary constraints limited the number of days in STRT data. The THIR instrument continued to provide cloud observations extending through March 1985. Stowe and Fromm (1983) describe in detail the data sources, STRT tape data organization according to the sub-target areas and the general structure of the data stored. One of the primary uses of the STRT data base had been toward the development of broad band bidirectional reflectance and emission models (Taylor and

Stowe, 1984), which were then used in the estimation of the top-of the atmosphere fluxes for the reflected and emitted radiation and thus to obtain the regional and global net flux (Jacobowitz, et al. 1984).

Improvements in the cloud algorithms from THIR were subsequently developed using twice daily surface temperature fields from the Air Firce 3D Nephanalysis and the appropriate atmospheric corrections and inclusion of cloud classification using ultraviolet observations from the Total Ozone Mapping Spectrometer (TOMS) (Stowe et al., 1988). One of the primary improvements was in the identification of low cloud which the infrared scanners from the THIR instrument generally missed. Temperature of the low cloud is not significantly different from the surface temperature and THIR classification scheme used thresholding methods, thus making the low cloud identification difficult and often an uncertain process. Low cloud could however be detected by a visible channel, but THIR was an IR instrument. Fortunately, another scanner instrument flown on Nimbus-7 was the total ozone mapping spectrometer (TOMS) and it carried several ultra--violet channels. These channels have the advantage that the enhanced reflectance of low cloud over the surface could be detected. There are two other advantages of adding observations from this instrument to the THIR data stream. The first one is the near uniform reflectance in the ultra-violet of most earth scenes including land, ocean and desert etc. In the visible, the clear sky surface reflectivities of these scene vary over a wide range from 0.06 to 0.40, thus making the cloud identification more complicated. In the ultra-violet,the reflectance range is much shorter, thus cloud identification is significantly easier. The second advantage is that the reflectance in the ultra-violet is nearly linear in cloud amount. For further details on the algorithms and on the application of the algorithms, the user may consult Stowe et al., 1988.

A new set of 33 tapes covering 203 data days, have been generated with the improvements incorporated into them. In addition to the corrected cloud amount, the tapes contain necessary radiance, threshold radiance and cloud flag information making the data base useful for additional studies on clouds and radiation. This set of tapes is referred to as the "SRR" tapes. This report documents the changes in data structure and format on the SRR tapes and identifies the additional information that has been added to the data base after creation of the STRTs. Section 2 of this report describes broad details of the data base and section 3 identifies the changes to the report by Stowe and Fromm (1983) (henceforth SF83) in the form of an addendum/corrigendum made necessary because of the additions and changes in the tape content. Section 4 contains the necessary software in Fortran and the appropriate Job Control Language for an IBM 32-bit machine to obtain a dump of some parameters from tape.

2.0 SRR data base relative to ERB scanner data and STRT tape data

"SRR" data tapes are remakes of the STRTs described in SF83 with the additional parameters and information added on to them and some parameters, in particular, cloud amounts corrected. this has become possible through a series of continual efforts to improve the quality and consistency of the data base through a number of studies like Stowe (1984), Eck et al., (1987), Stowe et al., (1984), Stowe et al., (1986), and Stowe et al., (1988).

2.1 Different production levels and data set size

Because of a number of limitations, only a subset of the original ERB tapes were developed into STR tapes. Shown in Table 1 are the set of ERB data dates for which scanner data tapes are available and cover the range of November 16, 1978 through June 23, 1980 when the scanner failed to function. All the data days for which ERB scanner data are available in the form of Master Archival Tapes (MATs) are shown in Table 1. An entry for a given day implies ERB scanner data are available. Only a subset of the original MATs were converted to the Sub-Target Radiance Tapes (STRTs). These are indicated in the table by 'xxx' while the rest of the ERB data days are shown as '000'. Thus out of the total 385 days, only 272 days of data have been converted to STR tapes. Shown in Table 2 is more quantitative information on the tape numbers and the respective file number for each day. The format in the table follows the convention of tape number/-file number. Thus 14/1 in the table indicates that data for day 20 in June 1979 is on STRT014 and on file number 1.

Production of the SRR tapes involved the use of concurrent Air Force Surface Temperature data in the IR cloud detection algorithm. But the Air Force data did not start until April 1979. This further reduced the data base from 272 days to 203 days. Those days for which the SRR tapes are produced are shown in Table 3. This table shows the tape number and file number as in Table 2 for any given day in the month. A separate listing of

Table 1. Dates when STRT data exist (XXX). The data base may be expanded to include the dates flagged with '000'. Dates when no data can be produced are left blank.

	1978		1979												1980					
Day	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
01			XXX		XXX			XXX		XXX	XXX		XXX	XXX		000		000	000	
02		XXX		XXX	000			XXX	XXX		XXX	XXX		XXX	XXX		000		000	000
03		XXX					XXX		XXX	XXX			XXX	XXX	000	000	000	000	000	000
04		XXX	XXX				XXX	XXX	XXX	XXX	XXX	XXX	XXX		000	000	000			000
05			XXX		XXX		XXX	XXX		XXX	XXX		XXX	XXX		XXX		000	000	
06		XXX		XXX	XXX			XXX	XXX		XXX	XXX			XXX		000		000	000
07		XXX							XXX	XXX		XXX	XXX	XXX	XXX	XXX	000	000	000	000
08		XXX	XXX				XXX	XXX	XXX	XXX	XXX	XXX	XXX		XXX	000	000	000		000
09			XXX	XXX	XXX			XXX		XXX	XXX		XXX	XXX		000		000	000	
10				XXX	XXX			XXX	XXX		XXX	XXX		XXX	XXX		000		000	000
11		000					XXX		XXX	XXX		XXX	XXX	XXX	XXX	000	000	000	000	000
12		XXX	XXX					XXX	XXX	XXX	XXX	XXX	XXX		XXX	000	000	000		000
13			XXX	XXX	XXX		XXX	XXX		XXX	XXX		XXX	XXX		000		000	000	
14				XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX		XXX	000		000		000	000
15		XXX				XXX	XXX		XXX	XXX		XXX	XXX	XXX	XXX	000	000	000	000	000
16	XXX	XXX	XXX			XXX		XXX	XXX	XXX	XXX	XXX	XXX		XXX	000	000	000		000
17	XXX		XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX		XXX	000		000		000	000	
18	XXX			XXX	XXX	XXX		XXX	XXX		XXX	XXX			XXX		000		000	000
19		XXX				XXX	XXX		XXX	XXX		XXX	XXX	XXX	XXX	XXX	000	000	XXX	000
20	XXX	XXX	XXX				XXX	XXX	XXX	XXX	XXX	XXX	XXX		XXX	000	000	000		000
21	XXX		XXX	XXX	XXX		XXX	XXX		XXX	XXX		XXX	000		000		000	000	
22	XXX			XXX	XXX	XXX		XXX	XXX		XXX	XXX		000	XXX		000		000	000
23		XXX				XXX	XXX		XXX	XXX		XXX	XXX	XXX	XXX	000	000	000	000	
24	XXX	XXXX					XXX	XXX	XXX	XXX	XXX	XXX	XXX		XXX	000	000	000		
25	XXX		XXX		XXX		XXX	XXX		XXX	XXX		XXX	XXX		000		000	000	
26	XXX				XXX	XXX		XXX	XXX		XXX	XXX		000	XXX		000		000	
27		XXX	XXX			XXX	XXX		XXX	XXX			XXX	XXX	XXX	000	000	000	000	
28	XXX	XXX				XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		XXX	000	000	000		
29	XXX		000		XXX	XXX	XXX	XXX		XXX			XXX	XXX		000		000	000	
30	XXX				XXX			XXX	XXX		XXX	XXX		XXX	XXX		000		000	
31		XXX	XXX				XXX		XXX	XXX				000	XXX		000		000	
	11	17	15	10	16	12	19	23	23	23	22	20	22	22	28	22	23	21	24	16	385
	12	16	14	10	15	12	19	23	23	23	22	20	22	17	20	3	0	0	1	0	272

TABLE 2

ORIGINAL SUBTARGET AREA RADIANCE TAPES (STRTs)

DAY	NOV 1978	DEC	JAN 1979	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN 1980	FEB	MAR	APR	MAY
01			03/5		06/5			12/3		18/2	21/4		27/4	30/5					
02		01/5		05/3				12/4	15/2		21/5	24/5		30/6	33/1				
03		01/6					09/8		15/3	18/3			27/5	30/7					
04		01/7	03/6				10/1	12/5	15/4	18/4	21/6	24/6	27/6						
05			03/7		06/6		10/2	12/6		18/5	21/7		27/7	31/1		35/7			
06		01/8		05/4	06/7			12/7	15/5		22/1	24/7			33/2				
07		02/1							15/6	18/6		25/1	28/1	31/2	33/3	36/1			
08		02/2	03/8				10/3	12/8	15/7	18/7	22/2	25/2	28/2		33/4				
09			04/1	05/5	06/8			13/1		19/1	22/3		28/3	31/3					
10				05/6	07/1			13/2	15/8		22/4	25/3		31/4	33/5				
11							10/4		16/1	19/2		25/4	28/4	31/5	33/6				
12		02/3	04/2					13/3	16/2	19/3	22/5	25/5	28/5		33/7				
13			04/3	05/7	07/2		10/5	13/4		19/4	22/6		28/6	31/6					
14				05/8	07/3	08/4	10/6	13/5	16/3		22/7	25/6		31/7					
15		02/4				08/5	10/7		16/4	19/5		25/7	28/7	32/1	34/1				
16		02/5	04/4			08/6		13/6	16/5	19/6	23/1	26/1	29/1		34/2				
17			04/5	06/1	07/4	08/7	10/8	13/7		19/7	23/2		29/2						
18				06/2	07/5	08/8		13/8	16/6		23/3	26/2			34/3				
19		02/6				09/1	11/1		16/7	20/1		26/3	29/3	32/2	34/4	36/2			36/3
20		02/7	04/6				11/2	14/1	16/8	20/2	23/4	26/4	29/4		34/5				
21			04/7	06/3	07/6		11/3	14/2		20/3	23/5		29/5						
22				06/4	07/7	09/2		14/3	17/1		23/6	26/5			34/6				
23		02/8				09/3	11/4		17/2	20/4		26/6	29/6	32/3	34/7				
24		03/1					11/5	14/4	17/3	20/5	23/7	26/7	29/7		35/1				
25			04/8		07/8		11/6	14/5		20/6	24/1		30/1	32/4					
26	01/1				08/1	09/4		14/6	17/4		24/2	27/1			35/2				
27		03/2	05/1			09/5	11/7		17/5	20/7			30/2	32/5	35/3				
28	01/2	03/3				09/6	11/8	14/7	17/6	21/1	24/3	27/2	30/3		35/4				
29	01/3				08/2	09/7	12/1	14/8		21/2			30/4	32/6					
30	01/4				08/3			15/1	17/7		24/4	27/3		32/7	35/5				
31		03/4	05/2				12/2		18/1	21/3					35/6				

Note: Format is Tape No/File NO. 14/8 means file 8 on Tape No. STRT14.

<u>TABLE 3</u>

REVISED STRTS: (STR/R)

	1978		1979												1980				
DAY	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
01								04/4		11/1	15/1		22/1	25/5					
02								04/5	07/6		15/2	18/5		25/6	28/4				
03							01/6		07/7	11/2			22/2	26/1					
04							01/7	04/6	08/1	11/3	15/3	18/6	22/3						
05							02/1	04/7		11/4	15/4		22/4	26/2		31/5			
06								05/1	08/2		15/5	19/1			28/5				
07									08/3	11/5		19/2	22/5	26/3	28/6	32/1			
08							02/2	05/2	08/4	12/1	15/6	19/3	22/6		29/1				
09								05/3		12/2	16/1		23/1	26/4					
10								05/4	08/5		16/2	19/4		26/5	29/2				
11							02/3		08/6	12/3		19/5	23/2	26/6	29/3				
12								05/5	08/7	12/4	16/3	19/6	23/3		29/4				
13							02/4	05/6		12/5	16/4		23/4	27/1					
14						00/1	02/5	05/7	09/1		16/5	20/1		27/2					
15						00/2	02/6		09/2	12/6		20/2	23/5	27/3	29/5				
16						00/3		06/1	09/3	13/1	16/6	20/3	23/6		29/6				
17						00/4	02/7	06/2		13/2	17/1		24/1						
18						00/5		06/3	09/4		17/2	20/4			30/1				
19						00/6	03/1		09/5	13/3		20/5	24/2	27/4	30/2	32/2			
20							03/2	06/4	09/6	13/4	17/3	20/6	24/3		30/3				
21							03/3	06/5		13/5	17/4		24/4						
22						00/7		06/6	09/7		17/5	21/1			30/4				
23						01/1	03/4		10/1	13/6		21/2	24/5	27/5	30/5				
24							03/5	06/7	10/2	14/1	17/6	21/3	24/6		30/6				
25							03/6	07/1		14/2	18/1		25/1	27/6					
26						01/2		07/2	10/3		18/2	21/4			31/1				
27						01/3	03/7		10/4	14/3			25/2	28/1	31/2				
28						01/4	04/1	07/3	10/5	14/4	18/3	21/5	25/3		31/3				
29						01/5	04/2	07/4		14/5			25/4	28/2					
30								07/5	10/6		18/4	21/6		28/3	31/4				
31							04/3		10/7	14/6									

Note: Format is Tape No/File No. 10/7 means file 7 on Tape No. 10.
The first tape number is SRR000 and not SRR001.

the individual SRR tapes and the number of days and the dates for which they contain data are shown in Table 4. The tapes are created as standard label tapes to make the data easily accessible on an IBM computer. Also indicated in the table are the dates when the SRR data tapes were generated in certain cases.

The 33 SRR tapes will be archived at National Space Science Data Center (NSSDC) at Goddard Space Flight Center and will be available for scientific users. The original STRTs are also archived at the same location. Tables 2 and 3 provide a match up list of the STRT tape number and file number and the corresponding SRR tape number and the file number and provide complete traceability of the data.

2.2 Tape Format, software and Data Organization

The SRR tapes were originally made and quality verified in 1986. However, due to pressure of other activities, they were set aside. The final documentation was thus not completed until 1991. As one step in the documentation, a fortran code was developed to verify the data on the tape and that the data conforms to the specifications. Each of the 33 tapes and each of

TABLE 4

'SRR' TAPE DATES AND TAPE CHARACTERISTICS

All tapes are: 6250 BPI, Standard Label
DCB Characteristics: RECFM=VB,LRECL=13026,BLKSIZE=13030
Language used: PL/1

Tape No.	No. of Files	File 1	File 2	File 3	File 4	File 5	File 6	File 7	D/M/Y*
		1979							
SRR000	7	04/14	04/15	04/16	04/17	04/18	04/19	04/22	121891
SRR001	7	04/23	04/26	04/27	04/28	04/29	05/03	05/04	053185
SRR002	7	05/05	05/08	05/11	05/13	05/14	05/15	05/17	060185
SRR003	7	05/19	05/20	05/21	05/23	05/24	05/25	05/27	060185
SRR004	7	05/28	05/29	05/31	06/01	06/02	06/04	06/05	120791
SRR005	7	06/06	06/08	06/09	06/10	06/12	06/13	06/14	060185
SRR006	7	06/16	06/17	06/18	06/20	06/21	06/22	06/24	120791
SRR007	7	06/25	06/26	06/28	06/29	06/30	07/02	07/03	060685
SRR008	7	07/04	07/06	07/07	07/08	07/10	07/11	07/12	060685
SRR009	7	07/14	07/15	07/16	07/18	07/19	07/20	07/22	060785
SRR010	6	07/23	07/24	07/26	07/27	07/28	07/30		062185
SRR011	6	07/31	08/01	08/03	08/04	08/05	08/07		062185
SRR012	6	08/08	08/09	08/11	08/12	08/13	08/15		062485
SRR013	6	08/16	08/17	08/19	08/20	08/21	08/23		062485
SRR014	6	08/24	08/25	08/27	08/28	08/29	08/31		062685
SRR015	6	09/01	09/02	09/04	09/05	09/06	09/08		062785
SRR016	6	09/09	09/10	09/12	09/13	09/14	09/16		062785
SRR017	6	09/17	09/18	09/20	09/21	09/22	09/24		120791
SRR018	6	09/25	09/26	09/28	09/30	10/02	10/04		062885
SRR019	6	10/06	10/07	10/08	10/10	10/11	10/12		070185
SRR020	6	10/14	10/15	10/16	10/18	10/19	10/20		070185
SRR021	6	10/22	10/23	10/24	10/26	10/28	10/30		072385
SRR022	6	11/01	11/03	11/04	11/05	11/07	11/08		072585
SRR023	6	11/09	11/11	11/12	11/13	11/15	11/16		081385
SRR024	6	11/17	11/19	11/20	11/21	11/23	11/24		082985
SRR025	6	11/25	11/27	11/28	11/29	12/01	12/02		082985
SRR026	6	12/03	12/05	12/07	12/09	12/10	12/11		091485
SRR027	6	12/13	12/14	12/15	12/19	12/23	12/25		091485
					1980				
SRR028	6	12/27	12/29	12/30	01/02	01/06	01/07		120791
SRR029	6	01/08	01/10	01/11	01/12	01/15	01/16		120791
SRR030	6	01/18	01/19	01/20	01/22	01/23	01/24		120791
SRR031	5	01/26	01/27	01/28	01/30	02/05			091985
SRR032	2	02/07	02/19						091985

* D/M/Y represents date, month and year when tape was created.

the files on the tapes have been processed with the code to verify the availability of data and their readability. We only confirm that data exists on the tape and it is readable using this or other user generated software; a second scientific quality control was not performed in 1991. A copy of the listing of the code and the necessary job control language for an IBM machines are included as Listing 1 and Listing 2 in Appendix A.

Data organization on the new SRR tapes continues to conform to the structure set up by the STR tape. Data records are stored according to the target area and with in a target area, according to a sub-target area number. Each target area has a topography record, followed by nine (9) sub-target area records. Each subtarget area record contains a geography record, followed by a number of radiance records. The radiance records contain the cloud cover information derived from the bispectral (IR from THIR and U-V from TOMS) method outlined briefly in the next section. It must be pointed out that the algorithm developed and investigated by Stowe et al., (1988) has not been incorporated in deriving these cloud amounts. Instead, an earlier version which was available at the time of the generation of the SRR tapes, was used. Both the intermediate and final versions are outlined in the next section. The revised cloud amount according to the Stowe et al., (1988) version could be computed from the information available on the tape.

In addition to the cloud amounts derived using the bispectral method, a number of cloud flags, TOMS reflectivities, TOMS derived cloud amount etc. are added into the radiance record on the SRR tape. It is believed that some of this information would be highly useful for scientific investigations. Further details on these additions are included in the next section.

ADDENDUM TO NOAA TECHNICAL MEMORANDUM NESDIS

Developed subsequent to changes in

cloud detection algorithm

November 1991

3.0 Changes in SRR from STRT

This section exclusively deals with the changes in the data content made in STRT to produce SRR tapes. Many of these are in the form of enhancements. The primary change is in the cloud amounts corresponding to clear, low cloud, middle cloud and high cloud amounts. It must be pointed out again that these cloud amounts are not the final cloud amounts as presented in Stowe et al., (1988 & 1989). At the time of the development of SRR tapes, an earlier version of the bi-spectral algorithm was used. Both these algorithms are described later in the section and as pointed out before, data on the tape is adequate to make this conversion, if the user desires to do so.

3.1 Enhancement in data records

Changes have occurred in the topography record and in the orbital logical record. The geography record has not been changed. A schematic of the additions in the records are shown below:

a) TOPOGRAPHY RECORD (1 Record for Target Area)

ID Block	Frac Water	Frac. Ice	
1-14	15-21	22-29	

b) GEOGRAPHY RECORD (1 Record for Sub-Target Area)

No changes have been made in this record.

c) ORBITAL LOGICAL RECORD

ID Block	Solar Data	Cloud Data	Cloud Flags	THIR/TOMS NCLE Record	ERB DATA BLOCK
1-14	15-19	20-24	25-53	54-89	89-100

3.2 Addendum/Corrigendum to the NESDIS Document 3.

The following identifies changes in the technical report on the Nimbus-7 ERB sub-target radiance tape (STRT) data base by SF83 published by the U.S. Department of Commerce. Changes described in this section are primarily changes in the data content and any changes necessary in the specific sections of the above document while attempting to retrieve data from the SRR tapes.

3.2.1 Changes to 2.3.1 of SF83

2.3.1 (Addendum)

The cloud detection scheme used in the development of the original STRTs was described in detail in Hwang (1982). Analysis by Stowe (1984) showed that this scheme leads to large uncertainties (errors) due to the use of climatological surface temperature information. A number of changes to the infra-red algorithm have since been made to improve the cloud detection both qualitatively and quantitatively. The primary non-satellite data came from the Air Force 3D Cloud Nephanalysis (Fye, 1978) and consists of the Terrain Height Analysis, the Snow/Ice Analysis and the Surface Temperature Analysis. Over land, the surface temperature analysis is based on conventional shelter temperature reports from NMC and Air Weather Service stations which are received every three hours. Over water, the analysis uses Sea Surface Temperature measurements reported by ships every six hours and by satellite remote sensing twice daily.

In addition to the use of concurrent surface temperatures from Air Force Nephanalysis, a number of improvements were made in the infrared (IR) algorithm. For cloud identification purposes, the following are corrections made to improve the Air Force Surface temperature T_{AF} used (Stowe et al., 1988). (1) Adjustment for atmospheric attenuation using an empirically fitted formula based upon T_{AF} and the satellite zenith angle Θ (Brower et al., 1976). (2) Bias in the attenuation adjustment due to the differences in the spectral responses of the THIR and NOAA radiometers. (3) Errors resulting from horizontal variations in the surface temperature field within a Sub-Target Area (STA). (4) Correction for cloud elements which fill only part of the Field of View (FOV) of the radiometers. (5) Adjustments to climatological low/mid cloud temperature threshold due to atmospheric attentuation and (6) an adjustment based upon latitude to the mid/high cloud threshold.

A second algorithm called the U-V algorithm was also developed independently using the 0.36 and 0.38 micron reflectivity measurements by the Total Ozone Mapping Spectrometer (TOMS). Analysis of cloud-less areas using minimum reflectivity from the TOMS instrument indicated the near uniformity of UV reflectivities for all land, ocean and desert areas. It is also found that the TOMS reflectivity varies between 8% and 50% as cloud amount varies between 0 and 100% in a near linear fashion. The U-V algorithm is thus found to be particularly useful in identifying low level clouds which often tend to be missed by the thresholding methods in the infrared algorithm.

A combined infrared, ultraviolet algorithm was thus developed to incorporate the advantages of the two schemes and is referred to as the bi-spectral cloud algorithm. Such a bispectral algorithm was used in the development of the present dataset. This algorithm gives most weight to the most accurate estimate and is called the NCLE algorithm. The NCLE cloud estimate is thus derived using

$$NCLE = IR*(1-W) + TOMS * W$$

where $W = W1*W2$

$$W1 = N/N+1 \qquad (A)$$

and $W2 = | IR - TOMS | / (IR+TOMS)$.

IR and TOMS are the cloud estimates by the separate IR and U-V algorithms. When W=0, the IR gives the best estimate and as W approaches 1, TOMS gives the best estimate. W consists of two factors: W1 depends on the number of TOMS samples, N, in a STA such that, for oblique views, TOMS estimate will be given less weight than for nadir views; W2 varies in such a way that, when IR and TOMS cloud amounts are in good agreement, TOMS will be given less weight, but when in poor agreement, particularly when the IR indicates less cloud than TOMS (which is typical of low cloud errors in the IR), more weight is given to TOMS.

Further analysis subsequent to the creation of the SRR tapes, revealed that additional improvement can be achieved by modifying the algorithm to

$$NCLE = IR*(1-W) + TOMS*W$$

where $W = W1 * W2$

$$W1 = \text{Cos}\ (\theta) \qquad \text{(B)}$$

$$W2 = (\text{Clear} + \text{Low})/100.$$

Here θ is the satellite zenith angle and Clear(Low) is the percentage of THIR 11 micron pixels in a given sub-target area classified as clear (low cloud). The total weight, W, is a composite of two weights W_1 and W_2. The factor W_1 reduces the influence of TOMS in the bispectral algorithm as satellite zenith angle increases because TOMS FOV is much larger than THIR FOV at these angles and less reliable. The reduction in the number of TOMS FOVs located in the STA is approximated by Cos θ, which is used to compute W_1. The value of W_1 ranges between 0.5 and 1.0. The weight W_2 is simply the fraction of the STA that is determined by the IR algorithm to be clear and/or covered by low cloud. Results derived with this change are discussed in Stowe et al. (1988). This change however, has not been incorporated in the present database. Data stored on the revised SRR tapes contain cloud information computed according to the equations in (A). The Cloud Processing Team found that algorithm (B) yielded a smoother estimate than (A) of cloud amount as a function of the satellite zenith angle. However, the mean results were fairly similar. Adequate information is retained on the tape for a user to compute the corrected NCLE cloud amount instead of the amount stored on the tape.

The final NCLE clouds derived for the Nimbus-7 Cloud Climatology used equation (B). This equation was also used during the development of angular bidirectional models for clear, partly cloudy, mostly cloudy and overcast scenes derived under the auspicies of the ERBE cloud detection program (Suttles et al., 1988, Suttles et al., 1989). The STR tape data base was used and the cloud amounts were computed using equation (B) and used in the generation of the models.

3.2.2 Changes to 3.5.2 of SF83

3.5.2 (Addendum) Topography Logical Record

The topography logical record has been enhanced by including the fraction of water and fraction of ice in the target area for each of the winter, spring, summer and fall seasons. This information is inserted immediately after the ID block. Parameters 22-25 contain the fraction of Target Area covered with water in the winter, spring, summer and fall respectively. The amount of ice fraction in the Target Area for the same seasons is included as parameters 26-29.

TABLE 8 (REVISED)

Topography Logical Data Record

1-21. ID Block (See Table 7)

***All items in this block are two-byte words, written as
***fixed point binary. They consist of one whole bit and 8
fractional bits are scaled by 28. Declare as integer*2
***in Fortran and then divide by 2**8 or FIXED BINARY (9,8)
***in PL/1.
***Note: Equivalent to FIXED BINARY (15,8)

22-25 Fraction Water - Fraction of Target Area covered with water in the Winter, Spring, Summer and Fall seasons of the Northern Hemisphere, respectively.

26-29 Fraction Ice - Fraction of Target Area covered with ice in the Winter, Spring, Summer and Fall seasons of the Northern Hemisphere, respectively.

30 Fraction Plain - Fraction of the Target Area covered with plain.

31 Fraction Hilly - Fraction of the Target area covered with hills.

32 Fraction Mountain - Fraction of the Target Area covered by mountain.

33 Fraction Hamada - Fraction of the Target Area covered by hamada.

34 Fraction Erg - Fraction of the Target Area covered by erg.

35 Fraction Balson - Fraction of the Target Area covered by bolson.

36 Mountain Vegetation - Fraction of Target Area covered with mountain vegetation.

37 Selva - Fraction of Target Area covered with selva vegetation.

38 Taiga - Fraction of Target Area covered with taiga vegetation.

39 Scrub - Fraction of Target Area coverd with scrub vegetation.

40 Mixed - Fraction of Target Area covered with mixed vegetation.

41 Savanna - Fraction of Target Area covered with savanna vegetation.

42 Prairie - Fraction of Target Area covered with prairie vegetation.

43 Tundra - Fraction of Target Area covered with tundra vegetation.

44 Desert - Fraction of Target Area covered with desert vegetation.

45 Padding - To force the logical record to end on the full word (4-byte) boundary. Two bytes (EBCDIC). Filled with blanks.

*** End of Topography Logical Record ***

3.2.3 Changes to 3.5.4 of SF83

3.5.4 ORBITAL DATA RECORD

The orbital data record, flagged by the character "R" in the identification block of the logical record, consists of solar geometry, cloud cover and type as derived by using the bi-spectral algorithm described in revised section 2.3.1 and ERB radiance data with the angular information for a single orbital pass of the Nimbus-7 space craft. Also included are the supportive THIR sample radiance data by cloud level and spectral band and TOMS reflectance and cloud data. Each logical record will have a variable length, depending on the number of sightings of the STA by the ERB scanning radio-meter. The record is always padded to achieve a length divisible by four bytes, i.e. each record ends on a full-word boundary. The logical record begins with an identificatios block which is 14 words instead of 20 words long, as shown in Table 7. Table 10 (Revised) gives a detailed listing of the orbital data record.

TABLE 10 (REVISED)

STR/R ORBITAL LOGICAL RECORD

01-14 IDENTIFICATION

***Elements 15-18 constitute a block of solar geometry
***data. All angles are defined in degrees. Azimuths range
***from 0 to +180°, positive (negative) in a clockwise
***(couter-clockwise) direction from North. Zenith angles
***range from 0 (daytime) to 180° (nighttime). Each element
***is two bytes long, which includes a sign bit, 8 whole
***number bits and 7 fractional bits. Equivalently, they
***are INTEGER * 2 words scaled by 2**7 in FORTRAN or FIXED
***BINARY (15,7) in PL/1.

15 Solar Azimuth - Mean solar azimuth from north, defined at the center of the STA.

16 Solar Zenith Minimum - Minimum solar zenith angle of those computed during an orbital sighting of the STA.

17 Solar Zenith Mean - Mean solar zenith angle of those computed during an orbital sighting of the STA, defined at the center of the STA.

18 Solar Zenith Maximum - Maximum solar zenith angle of those computed during an orbital sighting of the STA.

19 Unused - Fifteen (15) unused binary bits set to zero. To be ignored.

***Elements 20 through 53 constitute a block of data descri-
***bing cloud amount and type.

20 Cloud Flag - Flag to indicate if valid cloud data follow. One binary bit.

'1' - Cloud data available
'0' - No cloud data

***Elements 21-24 describe a fraction of the STA covered by
***each of four sky conditions. Each is a two byte binary
***number, with one whole number bit and 8 fractional bits.
***Declare as INTEGER *2 and divide by 2**8 in FORTRAN or
***declare as FIXED BINARY(9,8) in PL/1.
***Note: Equivalent to FIXED BINARY (15,8).

21 Fraction Clear - Fraction of STA with clear sky.

22 Fraction Low Clouds - Fraction of STA containing low clouds.

23 Fraction Middle Clouds - Fraction of STA containing middle clouds.

24 Fraction High Clouds - Fraction of STA containing high clouds.

***Elements 25-53 are one-bit flags or multi-bit padding to
***form 8-bit bytes. These bit flags are turned on (equal to
***1) when the described condition exists and turned off
***(equal to 0) otherwise (See Appendix C Revised for
***conditions). The flag and padding bit strings are 8 bits
***long grouped by sky/cloud type (clear,low,middle,high)
***and named accordingly. In FORTRAN, an INTEGER *2 word
***would encompass bit flags and padding for two cloud
***types. In PL/1, declare as BIT(1) for flags or BIT(n)
***for padding, where n=number of padded bits.

25 Clear/THIR zero - Set to 1 when THIR Clear population equal zero.

26 Clear/TOMS snow - Set to 1 if TOMS is affected by snow.

27 Clear/TOMS Unavailable - Set to 1 if TOMS is unavailable.

28 Clear/Air Force temperature Unavailable Flag - Set to 1 When Air force temperature is unavailable.

29 Clear/Ambiguous Low - Set to 1 when clear amount may actually be low cloud instead.

30 Clear/Low Cloud - unused.

31 Clear/Thin Cirrus - Set to 1 when clear amount may actually be thin cirrus.

32 Clear ambiguous - Set to 1 when clear amount may be indistinguishable from other cloud types.

33 Low/Unused - 2 BITS, set to zero.

34 Low/THIR zero - Set to 1 when THIR low cloud population equal zero.

35 Low/Warm Low - Set to 1 when cloud temperature is greater than surface.

36 Low/Ambiguous Clear - Set to 1 when low amount may actually be clear sky.

37 Low/Clear Area _ not used.

38 Low/Thin Cirrus - Set to 1 when low amount may actually be cirrus cloud.

39 Low/Ambiguous - Set to 1 when low amount may actually be of an indistinguishable type.

40 Middle Unused - Three bits, set to zero.

41 Middle/Thin Cirrus Flag - Set to 1 when the Fraction middle may actually be a thin cirrus cloud.

42 Middle/Convective Flag - Set to 1 when the Fraction middle may be a convective cloud.

43 Middle/Ambiguous Clear Flag - Set to 1 when the Fraction Middle may be a clear area instead.

44 Middle Ambiguous Low Flag - Set to 1 when the Fraction Middle may be low cloud instead.

45 Middle/Ambiguous High Flag - Set to 1 when the Fraction Middle may be a high cloud instead.

46 High/Unused - One bit, set to zero.

47 High/TOMS Cirrus - Set to 1 when TOMS detects cirrus.

48 High/Ice Cloud Flag - Set to 1 when the Fraction High consists predominantly of ice rather than water.

49 High/Broken Stratus Flag - Set to 1 when the Fraction High can be characterized as broken stratus cloud.

50 High/Thick Stratus Flag - Set to 1 when the Fraction High can be characterized as thick stratus cloud.

51 High/Thin Stratus Flag - Set to 1 when the Fraction High can be characterized as thin stratus cloud.

52 High/Convective Flag - Set to 1 when the Fraction High may be convective in nature.

53 High/Ambiguous Middle Flag - Set to 1 when the Fraction High cannot be distinguished in character from the middle cloud.

***Elements 54 through 88 contain the entire NCLE data
***record for each sub-target area, except the following
***redundant elements.

a) ERB sub-target ID (first two bytes of word 6 of NCLE record)
b) Time of first THIR samples (last two bytes of word 11 of NCLE record)
c) Recommended surface, low, mid, high amounts (all of word 16 NCLE record)
d) Surface/Land Fraction (first byte of word 14 of NCLE record)

e) Solar zenith angle (4th byte of word 15 of NCLE record).

***Elements 54-71 and elements 73-87 are 8 bit storage
***values and element 72 (total population) is a byte binary
***with 15 whole number bits and zero fractional bits.
***Elements 54-71 and and 73-87 can be represented as Bit(8)
***element 72 as FIXED BINARY (15,0) in PL/1.

54 Data Quality Flag - The data quality flag is a 3 digit integer, each digit of which indicates (from left to right) the following:

The first digit indicates the aircraft's direction
- 0 -ascending
- 1 -descending

The second digit indicates the data source
- 0 -current Air Force temperature information
- 1 -persistence value from previous day
- 2 -climatology from STAGS tape (used only in Antarctic region)
- 3 -persistence value from previous day (applied to entire hemisphere due to missing action)

The third digit indicates the temperature inversion. The boundary radiances are established according to Figure 14 for inversion flag values 0-3. The population and mean irradiances for surface, low, mid and high clouds are reported in the NCLE data record.

55 S/C Zenith Angle - The zenith angle as measured from the THIR FOV to the space craft given in thirds of a degree.

56 Air Force Surface Temperature - Uncorrected semi-real time Air Force surface temperature interpolated to the time of first THIR sample (degrees K minus 100).

57 Population % Surface - Percentage of total subtarget area population within surface bin.

58 Mean Radiance of Surface (11.5 μm) - The mean of all the 11.5 m. radiances from measured accumulated in item 57. Least significant bit (LSB) represents 0.125 W/m^2-ster.

59 Mean Radiance of Surface (6.7 μm.) - The mean of all the 6.7 m. radiances accumulated in item 57. LSB represents 0.015625 W/m^2-ster.

60 Boundary Radiance Surf/Low - The 11.5 μm. radiance value used to separate the clear and low cloud histogram bins. Same units as item 58.

61 Population % Low - Percentage of total subtarget area population within the low cloud bin.

62 Mean Radiance 11.5 μm. Low - The mean of the 11.5 m. radiances from the samples accumulated in item 61. Same units as item 58.

63 Mean Radiance 6.7μm. Low - The mean of the 6.7 m. radiances from the samples accumulated in item 61. Same units as item 58.

64 Boundary Radiance Low/Mid - The 11.5 μm. radiance value used to separate the low and mid cloud histogram bins. Same units as item 58.

65 Population % Mid - Percentage of total subtarget area population within the mid cloud bin.

66 Mean Radiance 11.5 μm. Mid - The mean of all 11.5 μm. radiances from the samples accumulated in item 65. Same units as item 58.

67 Mean Radiance 6.7 μm. Mid - The mean of all 6.5 μm. radiances from the samples accumulated in item 65. Same units as item 59.

68 Boundary Radiance Mid/High - The 11.5 µm. radiance value used to separate the mid and high cloud histogram bins. Same units as item 58.

69 Population % High - Percentage of total subtarget area population within the high cloud bin.

70 Mean Radiance 11.5 µm. High - The mean of all 1.5 µm. radiances from the samples accumulated in item 69. Same units as item 58.

71 Mean Radiance 6.7 µm. High - The mean of all 6.5 µm. radiances from the samples accumulated in item 69. Same units as item 59.

72 Total Population - This is a two byte binary. Total number of THIR samples located in the subtarget area.

73 RMS Deviation 11.5 µm. Surface - The RMS deviation of the 11.5 µm. samples averaged in item 57. LSB represents 0.015625 W/m^2-ster.

74 RMS Deviation 11.5 µm. Low - The RMS deviation of the 11.5 µm. samples averaged in item 61. Same units as item 73.

75 RMS Deviation 11.5 µm. Medium - The RMS deviation of the 11.5 µm. samples averaged in item 65. Same units as item 73.

76 RMS Deviation 11.5 µm. High - The RMS deviation of the 11.5 µm. samples averaged in item 69. Same units as item 73.

77 RMS Deviation 6.7 µm. Surface - The RMS deviation of the 6.7 µm. samples averaged in item 57. LSB represents 0.00392 W/m^2-ster.

78 RMS Deviation 6.7 µm. Low - The RMS deviation of the 6.7 µm. samples averaged in item 61. Same units as item 77.

79 RMS Deviation 6.7 μm Medium - The RMS deviation of the 6.7 μm. samples averaged in item 65. Same units as item 77.

80 RMS Deviation 6.7 μm High - The RMS deviation of the 6.7 μm. samples averaged in item 69. Same units as item 77.

81 Minimum Radiance Value - Minimum 11.5 μm. radiance value of entire population. Same units as item 58.

82 Maximum Radiance Value - Maximum 11.5 μm. radiance value of entire population. Same units as item 58.

83 Terrain Heights - Terrain height in tenths of Km.

84 TOMS reflectivity - Bidirectional surface reflectivity as measured by TOMS (%) averaged for this ERB sub-target area.

85 TOMS % Cloud - Cloudiness inferred from TOMS reflectivity averaged for this ERB subtarget area (%). (101 will be added to this value where partial snow cover is present. When an TOMS data values are rejected due to snow, 202 will be reported).

86 % Cirrus - Cirrus cloudiness detected by TOMS averaged for the ERB subtarget area (%).

87 Surface/Land Fraction - The percent land in the STA. This information is passed from the ERB STAGS tapes (percent).

88 Unused - 8 bits.

***This is the end of the NCLE data record. The following
***records are from ERB instrument.

89 Number of Bins - Number of angular bins into which satellite observations of this STA were grouped during

the orbital pass. Maximum number is 419. Two byte (binary). Declare as INTEGER * 2 in Fortran or FIXED BINARY (9) in PL/1. (Note: Equivalent to FIXED BINARY (15).)

90 Total Observations - Actual number of sightings of this STA during this orbital pass. Maximum number is 999. Two bytes (binary) with 10 whole number bits. In Fortran, declare as INTEGER *2; in PL/1, declare as FIXED BINARY (10). (Note: Equivalent to FIXED BINARY (15).)

91 Padding Extent - Contains the number of 2-byte padding elements at the end of the logical record so as to end the logical record on a full word boundary after element 99. The possible values of this element are 1 or 2, depending upon the length of the 'Bin Block' and 'Observation Block' described below. Two byte integer, FIXED BINARY (15) in PL/1 or INTEGER *2 in Fortran. (User may ignore this).

***The 'Bin Block' consists of the next 8 times n number of
***bytes of data following element 91. Here n is the number
***of bins in element 89. (For example, if element 89 is 10,
***the 'Bin Block' contains 80 bytes). The 'Bin Block' is
***organized as n sets of 8-byte groups. One 8-byte group
***pertains to each angular bin for which there are one or
***more radiance observations in this record. The 8-byte
***groups are sequenced in increasing order by coded angular
***bin number. Elements 92-94 describe each 8-byte group.

92 Bin Code - Four-character identifier of the bin of the form 'xxyy' where 'xx' is a function of satellite zenith, and 'yy' is a function of relative azimuth. In Fortran, declare as LOGICAL * 4; in PL/1, declare as CHARACTER (4).

93 Number of observations - The number of sightings with the respective bin code. Two byte (binary), with 10 whole number bits. Same as INTEGER *2 in Fortran or FIXED BINARY (10) in PL/1. (Note: Equivalent to FIXED BINARY (15).)

94 First Index - Position in the 'Observation Block' of the first occurrence of the respective bin code. Two bytes (binary) with 10 whole bits. Same as INTEGER *2 and FIXED BINARY (10).

***The 'Observation Block' consists of the next 6 times m
***number of bytes following the 'Bin Block', where m is the
***value of parameter 90. (For example, if element 90 is 20,
***then, the 'Observation Block' will contain 120 bytes).
***The 'Observation Block' is sub-divided into m sets of 6
***byte groups. One 6-byte group pertains to each radiance
***observation in this record. The 6-byte groups are sequ-
***enced first by coded angular bin number (in incrasing
***order of occurrence), and second by time of sighting for
***that angular bin. Elements 96-98 describe each 6-byte
***group.
***The 'Bin Block' and 'Observation Block' are closely
***related. Element 94 in the 'Bin Block' contains the
***index number for the first 6-byte group in the 'Observa-
***tion Block' which pertains to the respective angular
***bin. Element 93 in the 'Bin Block' contains the count of
***how many 6-byte groups in the 'Observation Block' pertain
***to the respective angular bin. Table 11 illustrates how
***to interpret Bin and Observation data. The first 3
***columns contain data from a sample 'Bin Block'. The last
***4 columns contain data from a sample 'Observation Block'.

95 Reflected - Reflected Shortwave radiance. Two bytes (binary) with one sign bit, 11 whole number bits and 4 fractional bits. Declare as INTEGER *2 and divide by 2**4 in Fortran or declare as FIXED BINARY (15,4) in PL/1. Units are Watts/Meter^2/ster.

96 Emitted - Emitted Longwave radiance. Two bytes (binary) with one sign bit, 11 whole number bits and 4 fractional bits. Declare as INTEGER *2 and divide by by 2**4 in Fortran or declare as FIXED BINARY (15,4) in PL/1. Units are Watts/Meter^2/ster.

97 Scope Number - There are four telescopes through which radiance measurements are taken. This word identifies

each observation with its corresponding scope. One byte (binary) with only the three (3) lower order bits ever turned on. Declare as BIT(8) in PL/1 or LOGICAL *1 in Fortran. Maximum value=4.

98 Number of Sub-FOVs - The measuring instrument's field of view is gridded into nine sub-FOVs for weighting purposes. The number of sub-FOVs lying within the STA are recorded in this word. One byte (binary) with only the four (4) lower order bits ever turned on. Declare as BIT (8) in PL/1 or LOGICAL *1 in Fortran. Maximum value=9.

100 Padding - At the end of the 'Observation Block' to force the logical record length to end on a full element boundary. Either one or two 2-byte (binary) zero-fill elements. Number of 2-byte padding elements is given by element 91. Each padding element is INTEGER *2 or FIXED BINARY (15).

End of Orbital Logical Record

4.0 Sample Data Products from SRR:

Sub-target Radiance/Revised (SRR) data base is now a very comprehensive database which combines observations and analyses from 3 different satellite instruments, viz., ERB, THIR and TOMS, all of which flew on the Nimbus-7 satellite. The cloud observations and radiation measurements are spatially gridded into regions of approximately 150 Km x 150 Km. and have retained the angular and time sequence information. The original data extend over a 18 month period, but the present database is limited to 203 days ranging over a 9 month period from April 1979 to February 1980. Section 4.1 and 4.2 present samples of the data products obtained from the database. Section 4.1 describes the cloud products and section 4.2 presents the radiation budget data. A complete discussion of the bispectral cloud algorithm and its validation using a number of verification approaches is presented in Stowe et al., (1988).

4.1 Cloud products from the SRR:

A sample result obtained from the SRR tapes is presented in Table 5. The low cloud, middle cloud and high cloud amounts for a target area (TA 420) for January 26, 1980 along with the clear amount are shown in the table. All sightings of this TA by the

TABLE 5

TAPE = 31 FILE = 1

YEAR = 80 MONTH = 1 DAY = 26

TARGET AREA = 420 NO. OF RECORDS = 43

Rec. No.	Clear Frac.	Low Cld Frac.	Mid Cld Frac.	Hi Cld Frac.	TH SMP	NBIN	NOB
1	0.9297	0.0000	0.0000	0.0664	486	9	10
2	0.9297	0.0000	0.0195	0.0469	366	20	31
3	0.9492	0.0000	0.0000	0.0469	210	10	29
4	0.8984	0.0000	0.0000	0.0977	204	11	22
5	0.3398	0.0000	0.1094	0.5469	508	24	37
6	0.9492	0.0000	0.0078	0.0391	451	1	1
7	0.9063	0.0000	0.0078	0.0781	396	30	41
8	0.9375	0.0000	0.0000	0.0586	226	14	30
9	0.8672	0.0000	0.0586	0.0664	200	15	31
10	0.4297	0.0000	0.2891	0.2773	496	30	47
11	1.0000	0.0000	0.0000	0.0000	437	29	40
12	0.9766	0.0000	0.0000	0.0195	249	13	28
13	0.9688	0.0000	0.0000	0.0273	202	14	33
14	0.7500	0.0000	0.1992	0.0391	469	30	45
15	0.5977	0.0000	0.3281	0.0586	536	20	23
16	0.6875	0.0000	0.1992	0.1172	339	15	25
17	0.6484	0.0000	0.0898	0.2695	199	13	28
18	0.5195	0.0000	0.1797	0.2969	182	7	21
19	0.4570	0.0000	0.4766	0.0586	539	28	43
20	0.4688	0.0000	0.5195	0.0078	505	7	8
21	0.6875	0.0000	0.2969	0.0000	378	17	33
22	0.6367	0.0000	0.2578	0.0977	207	9	22
23	0.4688	0.0000	0.2695	0.2578	175	11	28
24	0.3477	0.0000	0.6094	0.0391	511	33	52
25	0.9375	0.0000	0.0586	0.0000	428	25	39
26	0.8984	0.0000	0.0898	0.0000	207	13	20
27	0.8672	0.0000	0.1289	0.0078	171	10	27
28	0.4688	0.0000	0.5000	0.0273	471	31	47
29	0.0273	0.0000	0.3984	0.5664	590	22	32
30	0.0195	0.0000	0.4063	0.5664	306	14	31
31	0.0273	0.0000	0.4297	0.5391	148	13	24
32	0.0781	0.0000	0.3984	0.5078	154	9	28
33	0.0078	0.0000	0.3984	0.5781	565	31	47
34	0.2695	0.0000	0.3867	0.3281	563	16	16
35	0.2188	0.0000	0.3086	0.4688	353	21	39
36	0.1094	0.0000	0.1289	0.7578	167	8	22
37	0.0000	0.0000	0.0898	0.9063	152	10	24
38	0.0000	0.0000	0.6289	0.3594	516	29	51
39	0.5586	0.0000	0.4297	0.0078	514	1	1
40	0.6797	0.0000	0.3086	0.0078	405	25	48
41	0.7266	0.0000	0.2578	0.0078	189	10	23
42	0.8398	0.0000	0.1484	0.0078	157	13	23
43	0.4492	0.0000	0.5000	0.0469	459	25	44

ERB scanner during the day are included in this list. Both the day-time and night-time classifications are included. At night-time, the cloud determination is based upon THIR observations only while during daytime, both the THIR and TOMS observations help in the cloud classification. The number of sightings of the TA is large for TA 420 (Table 5) and small for TA 2569 (Table 6), since TAs farther away from the equator tend to be observed during larger number of orbits. Note that the TA number as used on the SRR differs from that used in ERB data processing. On the SRRs, TA 420 stands for 20th TA on the 4th latitude band from the South Pole. This convention is the same as that described in SF83. Cloud amount from THIR is computed only if the THIR sample for the ERB siting is greater than or equal to 100. Also included in the last two columns of the table are the number of coincident ERB scanner observations of the TA ('NOB') and the number of angular intervals or bins ('NBIN') into which these observations fall. Both the STRTs and the SRRs use a 419 angular bin scheme to cover the observing Hemisphere. The NBIN thus denotes the number of bins out of these 419 angular bins, into which ERB observations

TABLE 6

TARG AREA 1830 NO.OF RECS 16

	CLEAR	LOW CLD	MID.CLD	HI CLD	THSAMP	NBIN	NOB
1	0.1289	0.2578	0.6094	0.0000	158	15	28
2	0.3672	0.2188	0.4063	0.0000	593	23	32
3	0.0000	0.0195	0.5078	0.4688	161	6	16
4	0.4375	0.2500	0.3086	0.0000	562	12	17
5	0.0000	0.0000	0.1797	0.8164	108	9	15
6	0.7070	0.2188	0.0664	0.0000	512	1	1
7	0.2773	0.0664	0.6484	0.0078	158	16	29
8	0.8281	0.1563	0.0078	0.0000	594	26	37
9	0.0000	0.0000	0.5664	0.4297	146	9	28
10	0.3867	0.1797	0.3789	0.0469	574	14	21
11	0.3398	0.3281	0.3164	0.0078	525	1	1
12	0.6797	0.1289	0.1875	0.0000	161	8	24
13	0.7773	0.1797	0.0391	0.0000	598	28	39
14	0.2188	0.1992	0.5898	0.0000	138	11	28
15	0.7891	0.0391	0.1289	0.0391	581	19	26
16	0.6484	0.0586	0.2188	0.0664	535	8	8

TABLE 7

TARGET AREA = 420
YEAR = 80 MONTH= 1 DAY = 26
SOLAR ZENITH ANGLE RANGE = 0° - 85°

Bin No.	REFLECTED Rad. Means	REFLECTED Samp Size	REFLECTED Sum of Squares	EMITTED Rad. Means	EMITTED Samp Size	EMITTED Sum of Squares
1	81.708	9.889	0.9732E+05	57.390	9.889	0.2162E+05
2	101.993	2.000	0.2361E+05	55.184	2.000	0.3582E+04
3	0.000	0.000	0.0000E+00	59.641	1.778	0.3721E+04
4	0.000	0.000	0.0000E+00	57.359	4.000	0.8426E+04
5	0.000	0.000	0.0000E+00	63.875	1.000	0.2670E+04
6	200.824	1.222	0.4319E+05	58.085	1.222	0.3505E+04
7	198.062	4.000	0.1220E+06	58.500	4.000	0.1059E+05
8	207.550	1.667	0.4345E+05	57.512	1.667	0.3282E+04
9	170.504	1.778	0.4452E+05	56.652	1.778	0.3758E+04
10	200.000	0.222	0.1975E+04	58.875	0.222	0.1712E+03
11	17.484	2.222	0.4599E+03	57.116	2.222	0.4854E+04
12	117.502	4.444	0.7792E+05	59.972	8.333	0.2257E+05
13	73.646	6.111	0.4029E+05	58.907	8.111	0.1725E+05
14	15.403	2.222	0.2364E+03	58.001	5.556	0.1071E+05
15	14.357	1.556	0.2092E+03	58.781	2.667	0.5208E+04
16	0.000	0.000	0.0000E+00	52.852	1.222	0.1315E+04
17	0.000	0.000	0.0000E+00	58.847	1.000	0.2822E+04
18	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
19	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
20	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
21	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
22	215.726	1.778	0.3154E+05	55.582	1.778	0.2028E+04
23	13.062	0.333	0.1896E+02	56.625	0.333	0.3563E+03
24	80.812	0.333	0.5660E+03	59.208	0.333	0.2192E+03
25	116.472	4.000	0.4206E+05	60.278	6.667	0.1364E+05
26	174.100	5.000	0.1052E+06	59.760	6.000	0.1339E+05
27	143.920	3.556	0.5842E+05	58.916	4.778	0.1052E+05
28	67.960	6.000	0.2978E+05	60.562	8.889	0.2050E+05
29	13.131	1.222	0.7969E+02	53.920	1.222	0.1309E+04
30	0.000	0.000	0.0000E+00	52.427	4.667	0.7522E+04
31	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
32	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
33	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
34	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
35	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
36	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
37	21.156	0.667	0.7839E+02	54.115	0.667	0.4923E+03
38	46.747	8.444	0.2898E+05	57.836	8.444	0.1683E+05
39	98.839	3.667	0.4389E+05	60.595	8.333	0.1907E+05
40	163.492	9.333	0.1652E+06	58.767	9.333	0.1987E+05
41	139.609	4.444	0.4324E+05	60.465	5.222	0.9588E+04
42	150.682	9.222	0.1550E+06	61.360	10.444	0.2360E+05
43	94.872	2.556	0.2086E+05	58.049	2.556	0.4231E+04
44	0.000	0.000	0.0000E+00	55.795	4.333	0.6797E+04
45	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
46	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
47	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
48	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
49	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
50	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
51	236.919	2.222	0.6860E+05	56.078	2.222	0.3709E+04
52	168.133	7.444	0.1264E+06	58.187	7.444	0.1279E+05
53	206.221	2.889	0.6253E+05	57.737	6.889	0.1294E+05
54	116.482	17.667	0.1555E+06	58.458	17.667	0.3690E+05
55	134.126	6.111	0.6043E+05	57.934	13.333	0.2297E+05
56	164.222	9.222	0.1463E+06	57.199	9.222	0.1720E+05
57	78.209	8.222	0.4805E+05	58.062	8.222	0.1642E+05
58	0.000	0.000	0.0000E+00	54.220	10.333	0.1568E+05
59	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
60	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
61	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
62	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
63	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
64	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
65	100.208	2.000	0.9786E+04	55.361	2.000	0.3629E+04
66	175.590	19.555	0.3986E+06	55.380	19.555	0.3238E+05
67	175.851	6.667	0.1238E+06	55.858	20.778	0.3352E+05
68	111.607	4.222	0.4014E+05	55.439	4.222	0.8838E+04
69	110.333	0.667	0.2402E+04	54.645	4.444	0.6489E+04
70	120.838	18.889	0.1700E+06	57.350	18.889	0.3650E+05
71	154.762	22.000	0.3002E+06	56.276	22.222	0.3637E+05
72	38.420	0.778	0.6838E+03	52.372	11.222	0.1221E+05
73	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
74	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
75	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
76	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
77	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
78	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
79	189.845	3.667	0.6048E+05	54.036	3.667	0.4839E+04
80	213.806	40.999	0.9138E+06	54.814	40.999	0.5779E+05
81	192.757	13.111	0.2265E+06	53.315	22.444	0.3066E+05
82	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
83	0.000	0.000	0.0000E+00	0.000	0.000	0.0000E+00
84	108.485	12.111	0.7951E+05	53.339	12.111	0.1777E+05
85	134.547	46.555	0.4644E+06	54.982	46.555	0.7212E+05

fall. For details on the 419 angular bin structure, see Section 3.3 of SF83.

4.2 ERB radiance measurements:

Actual ERB scanner observations are binned into 85 angular intervals both for the shortwave and longwave measurements for the day for the TA in Table 7. The 85 bin scheme is a restructuring of the original high resolution 419 bin scheme presented in SF83 and is described in detail by Taylor and Stowe (1984). The values listed in the table are for solar zenith angle range of 0° through 85°. The SW radiance mean, the sample size and the sums of squares are shown as REFLECTED and the corresponding LW measurement values are shown as EMITTED in the table for each angular interval. Note that one of the four SW channels (channel 4 or ERB instrument channel 18) did not function properly after December 20, 1979 and the SW radiances corresponding to that channel need to be ignored. One further note to be mentioned is that the sample sizes for the STA can be fractions. ERB scanner measurements could cover more than one STA requiring us to compute the fraction of the radiance measurement which falls in the STA and the appropriate fraction of the radiance to be assigned to the

STA. This leads to fractional sample sizes. During any given day, only a few of the 85 bins are filled and these correspond to the angular views from the satellite of the given region. SW or LW flux determination requires a near complete sampling of all angular intervals for an appropriate angular bidirectional model. Thus observations from a number of days are required to fill the bins to be able to develop angular models and this was done by Taylor and Stowe (1984).

5.0 Data Retrieval from the SRR tapes

Variable data record sizes and the data storage procedure on the tape have made the data access slightly difficult from the STR tapes. The SRR uses the same data structure. Even though, data is stored on the tape in PL/1 using variable record lengths, it can be retrieved using Fortran software. This section provides a Fortran code listing (LISTING 1) to recover the data on an IBM machine.

A version of the Job Control Language needed to recover the data is also included as LISTING 2. There are 33 data tapes, all of which are now standard label tapes. Listing 2 thus assumes that a standard labelled tape is being used and the dates for each of the files on the tape are known in advance.

<u>LISTING 1</u>

```
C
C   THIS ROUTINE IS A SAMPLE ROUTINE USED TO PULL PACKED DATA
C   FROM THE SUB-TARGET RADIANCE (STR) TAPES AND OBTAIN INFORMATION
C   LIKE THE GEOGRAPHY AND TOPOGRAPHY OF THE VIEWED REGION, SURFACE
C   CONDITION, VIEWING ANGLES, CLOUD COVER AND HEIGHT AND THE EARTH
C   RADIATION BUDGET (ERB) INSTRUMENT MEASUREMENTS FROM NIMBUS-7.
C   SOME OF THESE QUANTITIES ARE STORED FOR 5 TARGET AREA (TA) REGIONS
C   IN A NEW DATA SET FOR LATER USE.
C
      CHARACTER*1 BUFF(13030),BUFF1(13030),VARB
      CHARACTER*1 RECRD1,DAT(6),RECTYP,R,T,G
      INTEGER*2 IBUFF(6515)

      DIMENSION TR1(34),TR2(10),LTAR(5)
      DIMENSION NS(5),GEOG(5,9,3)
      COMMON /CBUFF/ BUFF,IBUFF
C
      CHARACTER * 2 RECORD
      CHARACTER * 4 RECRD
      EQUIVALENCE (IBUFF(1),DAT(1))
      EQUIVALENCE (RECTYP,BUFF(4))
      DATA R/'R'/,T/'T'/,G/'G'/
      DATA LTAR/420,1830,2569,2918,3304/
      JFL=0
      NWR =90

C   THE STRTS CONTAIN 7 OR 8 FILES AND EACH FILE CONTAINS DATA FOR ONE
C   DAY.  THE LOOP FOR READING THE FILES BEGINS HERE.
C
 4001 CONTINUE
      IFLG =  0

      IUNIT=10
      JFL = JFL+1
      IF(JFL .GE. 8) STOP
      INIT=0
      IREC = 1

      DO 3100 IP=1,5
      NS(IP)=0
 3100 CONTINUE
```

```
      DO 3121 IQ=1,34
 3121 TR1(IQ)=0.0
      DO 3122 IS=1,10
 3122 TR2(IS)=0.0
      DO 3101 IP=1,5
      DO 3101 IQ=1,9
      DO 3101 IX=1,3
      GEOG(IP,IQ,IX)=0.0
 3101 CONTINUE
  10  CONTINUE
      READ(10,END=89,NUM=LEN) BUFF

 301  FORMAT (5X,'IREC,LEN,JFL',2X,3I8,2X,A1/)
      IREC = IREC + 1

      ASSIGN 1001 TO LK
C        CALL CMOVE(BUFF(1),IBUFF(1),LEN)

      CALL FMOVE(IBUFF(1),LEN,BUFF(1))

      CALL FMOVE(RECORD,2,BUFF(25))
C        CALL INCORE(IBUFF(13),  KDAY, 5,  1, 2)

      READ(UNIT=RECORD,FMT=LK) KDAY
      IF (INIT.GT.0) GO TO 3221
      NDAY=KDAY
      INIT=INIT+1
 3221 CONTINUE
 3222 CONTINUE
 1001 FORMAT(I2)
 302 FORMAT(5X,'KDAY=',2X,I5/)

C

C     IFLG IS SET TO 1 WHEN TWO DAYS MATCH.

C        TO READ  THE 1ST  RECORD AGAIN,  DO REWIND  ON THE  TAPE

C

      IFLG =  1

      ASSIGN 1004 TO LM
      ASSIGN 1005 TO LM2
      CALL FMOVE(RECRD,4,BUFF(11))
      CALL FMOVE(RECRD1,1,BUFF(16))
```

```
      READ (UNIT=RECRD1,FMT=LM2) ISTRG
      READ (UNIT=RECRD,FMT=LM) ITARG
 1005 FORMAT (I1)
 1004 FORMAT (I4)




C
C  THE TARGET AREA NUMBER IS CHECKED IN TURN AGAINST THE 5 TA NUMBERS
C  FOR WHICH WE WISH TO STORE DATA FROM TAPE.
C
      DO 401 JTA=1,5
      MRTAR=LTAR(JTA)
      JTS = JTA
      IF (MRTAR.EQ.ITARG) GO TO 402
  401 CONTINUE
      GO TO 10
  402 CONTINUE
C
C  IDENTIFY THE RECORD.  IF IT IS A RADIANCE RECORD, RECOVER
C  VIEWING ANGLE INFORMATION, CLOUD COVER, AND RADIATION BUDGET
C  INSTRUMENT RADIANCE MEASUREMENTS FOR THE STA FOR THIS ORBIT.
C
      IF (RECTYP.NE.R) GO TO 11
      TR2(1)= IBUFF(19)*0.0078125
      TR2(2)= IBUFF(17)*0.0078125
      TR2(3)= IBUFF(37)*1.00
      TR2(4) = IBUFF(46)*1.00
      TR2(5)= IBUFF(47)*1.00
      TR2(6)=       IBUFF(22)/256.
      TR2(7)=      IBUFF(23)/256.
      TR2(8)=      IBUFF(24)/256.
      TR2(9)=      IBUFF(25)/256.
      LA=0
      DO 371 LM=57,90
      CALL FMOVE(VARB,1,BUFF(LM))
      LA=LA+1
      IS = ICHAR(VARB)
      TR1(LA)=FLOAT(IS)
  371 CONTINUE
      SURTMP=TR1(1) + 100.
      TPOPL=TR2(3)
      IF (TPOPL.LE.0.0.OR.TPOPL.GT.5000) GO TO 14
C
```

```
      WRITE (6,1101) KDAY,ITARG,ISTRG,RECTYP,IREC,(TR2(JP),JP=1,2),
     1                   JTS,MRTAR
 1101 FORMAT (2X,'R,DAY',2X,3I5,2X,A1,2X,I8,2F7.2,5X,2I5/)
C     WRITE (6,1121) (TR2(JR),JR=3,5),SURTMP
 1121 FORMAT (10X,'TOTAL POPULATION= ',3X,F8.2/
     1        10X,'NUMBER OF BINS    ',3X,F8.2/
     2        10X,'TOTAL OBSERVATIONS',3X,F8.2/
     3        10X,'SURFACE TEMPERATUR',3X,F8.2)
 1122 FORMAT (20X,'CLEAR  ',5X,'  LOW  ',5X,'  MID  ',5X,' HIGH '/)
 1123 FORMAT (3X,'CLOUD FRACTION',3X,4F11.3)
 1124 FORMAT (3X,' %  POPULATION', 3X,4F11.3)
 1125 FORMAT (3X,'MEAN RAD 11.5 ', 3X,4F11.3)
 1126 FORMAT (3X,'MEAN RAD  6.7 ',3X, 4F11.3)
 1127 FORMAT (3X,'BOUNDARY RADIA',3X,4F11.3/)
 1128 FORMAT (5X, 'MIN RAD.=',2X,F8.3,5X,'MAX RAD.=',2X,F8.3/
     1        5X,'TER.HIT',2X,F8.2,5X,'TOMS REFLECT',2X,F8.2,
     2       5X,'TOMS % CLD',2X,F8.2/)
     NWRT = NWR+JFL
     WRITE (NWRT) KDAY,ITARG,TR1,TR2
     ZENAVG= TR2(1)
C
      GO TO 10
C
C  IF THE RECORD TYPE IS A TOPOGRAPHY RECORD, THE FRACTION OF WATER
C  IS RETRIEVED AND STORED.
C
   11 IF (RECTYP.NE.T) GO TO 12
      IFRWT1 = IBUFF(25)
      IFRWT2 = IBUFF(26)
      IFTWT3 = IBUFF(27)
      IFRWT4 = IBUFF(28)
      WRITE (6,1102) IFRWT2,IFRWT2,IFRWT3,IFRWT4
 1102 FORMAT (2X,'T; WAT FRA;',2X,4I6/)
      GO TO 10
C
C  IF THE RECORD TYPE IS A GEOGRAPHY RECORD, FRACTIONS OF LAND,
C  WATER AND SNOW COVERAGE ARE RETRIEVED AND STORED.
C
```

```
   12   IF (RECTYP.NE.G) GO TO 14
        LANDCV=IBUFF(25)
        IWATCV=IBUFF(26)
        ISNWCV=IBUFF(27)+IBUFF(28)
        GEOG(JTS,ISTRG,1)= FLOAT(LANDCV)
        GEOG(JTS,ISTRG,2)= FLOAT(IWATCV)
        GEOG(JTS,ISTRG,3)= FLOAT(ISNWCV)
CC
        WRITE (6,1103) RECTYP,LANDCV,IWATCV,ISNWCV
 1103   FORMAT (2X,'RECTYP',2X,A1,3X,3I6/)
   14   CONTINUE
        GO TO 10
   88   CONTINUE
C

C          READ ERROR

C

        WRITE(6,220) IREC,JFL

  220    FORMAT('0TAPE READ  ERROR IN  RECORD',I4,' FILE  NO. ',I2)

        GO TO  10

C

C          END OF  FILE ON  THE STR  TAPE

C

   89    WRITE(6,200) IREC,JFL

  200   FORMAT('0END OF FILE ENCOUNTERED IN  RECORD  NO.',I8,5X,I3,

     1         2X, 'FILE  NO.')

C

   20    CONTINUE

        IF (JFL.LE.7) GO TO 4001
        STOP

        END
```

LISTING 2

```
//          JOB (      ,     ,   ),'RDSRR TAPE',TIME=(01,00),
//   CLASS=N,MSGCLASS=X
//STEP EXEC FORTVCLG,
//   PARM.FORT='SOURCE,NOFIPS,LANGLVL(77),FLAG(E)',
//   GOREGN=3000K,GOF6DD='SYSOUT=A',
//   REGION.LKED=1500K,
//   PARM.LKED='SIZE=(2500K,20K),LIST'
//FORT.SYSIN DD  DSN=                    (RDSRR),DISP=SHR
//LKED.SYSLIB DD
//             DD DISP=SHR,DSN=SYS2.IMSLS
//             DD DISP=SHR,DSN=SYS2.FORTLIB
//GO.FT05F001 DD *
//GO.FT06F001 DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=133)
//GO.FT10F001 DD UNIT=(6250,,DEFER),LABEL=(1,SL,,IN),
// DCB=(RECFM=VB,LRECL=13026,BLKSIZE=13030),DISP=SHR,
// VOL=(,RETAIN,,SER=SRR002),DSN=STRR.Y79.M05.D05
//*
//GO.FT91F001 DD DSN=                  .DATA,DISP=(NEW,CATLG),
//  UNIT=SYSDA,VOL=SER=USERDA,SPACE=(TRK,(20,20),RLSE),
//  DCB=(RECFM=VS,LRECL=X,BLKSIZE=24848)
// EXEC NTSO
```

6.0 REFERENCES

Brower, R.L., H.S.Gorband, W.G.Pichel, T.L.Signore and C.Walton, 1976: Satellite derived sea surface temperatures from NOAA spacecraft, Tech Memo. NESS 78, NOAA, Washington, D.C. 74 pp.

Eck, T.F., P.K.Bhartia, P.H.Hwang, and L.L.Stowe, 1987: Reflectivity of Earth's surface and clouds in ultraviolet from satellite observations, J. Geophys. Res., 92, (D4), 4287-4296.

Fye, F.K., 1978: The AFGWC Automated cloud analysis model, HQ AFGWC, TM 78-002, Air Force Global Weather Central, Nebraska, 97 pp.

Hwang, P.H., Ed., 1982: Nimbus-7 Temperature Humidity Infrared Radiometer (THIR) dagta user's guide, NASA/Goddard Space Flight Center, Greenbelt, MD. 20771. 52 pp.

Jacobowitz, H., H.V.Soule, H.L.Kyle, F.B.House and the Nimbus-7 ERB experiment team, 1984: The Earth radiation budget (ERB) experiment: An overview, J. Geophy. Res., 89, 5021-5038.

Stowe, L.L.,1984: Evaluation of Nimbus-7 THIR/CLE and Air Force Three-Dimensional Nephanalysis estimates of cloud amount, J. Geophys. Res., 89,D$, 5370-5380.

Stowe, L.L. and M.Fromm, 1983: Nimbus-7 ERB sub-target radiance tape (STRT) database, NOAA Tech. Memo. NESDIS 3, U.S. Department of Commerce, Washington, D.C. 54 pp.

Stowe, L.L.,P.Pellegrino,P.H.Hwang, P.K.Bhartia, T.F.Eck, C.G. Wellemeyer, S.M.Read and C.S.Long, 1984: Validation of Nimbus-7 cloud products, Proc. Intern. Rad. Symp., Perugia, Italy, A.Deepak, 228-231.

Stowe, L.L.,C.G.Wellemeyer, T.F.Eck, H.Y.M.Yeh, and Nimbus-7 cloud data processing team, 1988: Nimbus-7 global cloud climatology. Part I: Algorithm and valiation, J. Climate, 1, 445-470.

Stowe, L.L., H.Y.M.Yeh, T.F.Eck, C.G.Wellemeyer, H.L.Kyle, the Nimbus-7 cloud data processing team, 1989: Nimbus-7 global cloud climatology. Part II. First year results, J. Climate, 2, #7, 671-709.

Suttles, J.T., R.N.Green, P.Minnis, G.L.Smith, W.F.Staylor, B.A. Wielicki, I.J.Walker, D.F.Young, V.R.Taylor and L.Stowe, 1988: Angular radiation models for earth-atmosphere system, Vol. I - Shortwave Radiation, NASA Refeference Publication 1184 (National Technical Information Service, Springfield, VA.), 144 pp.

Suttles, J.T., R.N.Green, G.L.Smith, B.A.Wielicki, I.J.Walker, V.R.Taylor, and L.L.Stowe, 1989: Angular radiation models for the Earth-atmosphere system, Vol. II: Longwave Radiation, NASA RP-11

Taylor, J.R. and L.L.Stowe, 1984: Reflectance characteristics of uniform Earth and cloud surface derived from Nimbus-7 ERB, J.Geophy. Res., 89, (4), pp. 4987-4996.

D - 85998

DUMP OF TAPE RR001

MONTH 08/16/79 - 08/23/79

INPUT TAPE RR001 ON FT1

2-digit Year | Day of the Month

DATA INPUT H9 NF=18 SR=2=1=1 SR=16=1=1

FILE	INPUT RECS.	DATA RECORDS INPUT	MAX. SIZE	READ ERROR SUMMARY PERM	ZERO B	SHORT	UNDEF.	INPUT RETRIES #RECS.	TOTAL#
1	3	3	80	0	1	0	0	0	0

790816?? RTBT

FILE 2 RECORD 1 LENGTH 10976BYTES

01.0 79/08/1600 0000

(0)	32B00000	00640000	D9E3C2E3	40400000	0000F0F0	F0F14BF0	00000000	F7F9F0F8	F1F6F0F0	F0F0F0F0
(40)	7FFFFFFF	F7F9F0F8	F1F6F9F9	F9F9F9F9	00000000	00000000	01000100	01000100	00000000	00000000
(80)	00000000	00000000	00000000	00000000	00000000	000C4140	00440000	D9E3C3C7	D5C20000	42A5F0F0
(120)	F0F143F1	42910000	F7F9F0F8	F1F6F0F0	F0F0F0F0	42A50000	F7F9F0F8	F1F6F2F3	F5F9F5F9	00000000
(160)	01000320	00070000	00000000	00B00000	D9E3C3D9	C3F30000	0000F0F0	F0F14BF1	030CA915	F7F9F0F8
(200)	F1F6F0F3	F2F9F2F5	43333FB	345E34D6	000CB800	B800B800	B800FFFF	FFFFFFFF	00FF0000	00FF0000
(240)	00FF0000	00FF0000	80010000	00000000	00000000	FFFFFFFF	FFFF0003	00180002	F1F0F0F9	00020001
(280)	F1F3F0F5	00040003	F1F4F1F2	00020007	000D0218	03030013	02430301	FFF10226	0405FFF8	02550405
(320)	FFE901F2	0401FEE2	02380401	000701FD	0204FFF6	022A0204	00000000	00A80000	D9E3C3D9	C3F30000
(360)	0000F0F0	F0F14BF1	030CC195	F7F9F0F8	F1F6F0F5	F1F3F5F7	373333E7	340E343E	0000B800	B800B800
(400)	B800FFFF	FFFFFFFF	00FF0000	00FF0000	00FF0000	00FF0000	80010000	00000000	00000000	FFFFFFFF
(440)	FFFF0003	00070001	F1F0F0F9	00020001	F1F3F0F5	00030003	F1F4F1F2	00020006	FFFA0220	0304FFF6
(480)	02480303	FFD7021D	0404FFF6	02100404	FFF5020D	0403FFF6	023B0203	FFE6023B	02010000	00A40000
(520)	D9E3C3D9	C3F30000	0000F0F0	F0F14BF1	030CDA15	F7F9F0F8	F1F6F0F6	F5F8F2F9	18A93399	33BC33E8
(560)	0000B800	B800B800	B800FFFF	FFFFFFFF	00FF0000	00FF0000	00FF0000	00FF0000	80010000	00000000
(600)	00000000	FFFFFFFF	FFFF0004	00050001	F1F0F0F9	00010001	F1F3F0F5	00020002	F1F3F1F2	00010004
(640)	F1F4F0F5	00010005	FFEF0233	0303000F	01FE0401	FFF1021D	0403000C	02260201	0008022E	04030000
(680)	00980000	D9E3C3D9	C3F30000	0000F0F0	F0F14BF1	030CF295	F7F9F0F8	F1F6F0F8	F4F3F0F1	3DF333F3
(720)	34123422	0000B800	B800B800	B800FFFF	FFFFFFFF	00FF0000	00FF0000	00FF0000	00FF0000	80010000
(760)	00000000	00000000	FFFFFFFF	FFFF0003	00040002	F1F0F0F8	00020001	F1F3F1F2	00010003	F1F4F1F2
(800)	00010004	00030213	0201FFE2	02260202	FFFB0248	01020010	022BC102	00000000	00B00000	D9E3C3D9
(840)	C3F30000	0000F0F0	F0F143F1	030D0315	F7F9F0F8	F1F6F1F0	F2F7F3F3	3EEF3385	33C4341C	0000B800
(880)	B800B800	B800FFFF	FFFFFFFF	00FF0000	00FF0000	00FF0000	00FF0000	80010000	00000000	00000000
(920)	FFFFFFFF	FFFF0003	00080002	F1F0F0F8	00030001	F1F3F1F2	00030004	F1F4F0F4	00020007	00030233
(960)	0202000C	02220264	FFF60226	02040009	02480103	0005022B	0102FFE7	021B0101	FFF6022B	0303FFFA
(1000)	02060301	00000000	00A80000	D9E3C3D9	C3F30000	0000F0F0	F0F14BF1	030D2395	F7F9F0F8	F1F6F1F2
(1040)	F1F2F0F5	0F963320	337C33F1	0000B800	B800B800	B800FFFF	FFFFFFFF	00FF0000	00FF0000	00FF0000
(1080)	00FF0000	80010000	00000000	00000000	FFFFFFFF	FFFF0003	00070001	F1F0F0F8	00020001	F1F3F1F2
(1120)	00020003	F1F4F0F4	00030005	00170245	0201FFF6	02220201	00050223	0102FFE5	02280101	0003024D
(1160)	03050016	02100304	000A0216	03020000	00E80000	D9E3C3D9	C3F30000	0000F0F0	F0F14BF1	030D3B35
(1200)	F7F9F0F8	F1F6F1F3	F5F2F5F3	005F330E	338A33E5	0000B800	B800B800	B800FFFF	FFFFFFFF	00FF0000
(1240)	00FF0000	00FF0000	00FF0000	80010000	00000000	00000000	FFFFFFFF	FFFF0007	000C0002	F1F0F0F7
(1280)	00020001	F1F1F0F7	00010003	F1F2F1F1	00010004	F1F2F1F2	00010005	F1F3F1F2	00010006	F1F4F0F4
(1320)	00050017	F1F5F1F3	0001000C	FFFB0213	0101FFF7	02430106	000C021B	01010009	02280101	00050230
(1360)	0103FFFB	023B0102	00010215	0302FFE3	020A0303	FFF60236	03030000	02220301	000A0236	0302FFFA
(1400)	01F80301	00000000	00B40000	D9E3C3D9	C3F30000	0000F0F0	F0F14BF1	030D53B5	F7F9F0F8	F1F6F1F5
(1440)	F3F7F2F5	EDC43321	337433CF	0000B800	B800B800	B800FFFF	FFFFFFFF	00FF0000	00FF0000	00FF0000
(1480)	00FF0000	80010000	00000000	00000000	FFFFFFFF	FFFF0005	00060002	F1F0F0F7	00010001	F1F2F1F1
(1520)	00020002	F1F2F1F2	00010004	F1F4F0F4	00010005	F1F5F1F3	00010006	FFF00253	01020000	01F80104
(1560)	FFF00235	01020005	02230116	FFE5026E	0302FFFA	02180302	00000000	00AC0000	D9E3C3D9	C3F30000
(1600)	0000F0F0	F0F143F1	030D6C35	F7F9F0F8	F1F6F1F7	F2F1F5F7	C0D5333C	33933410	0000B800	B800B800
(1640)	B800FFFF	FFFFFFFF	00FF0000	00FF0000	00FF0000	00FF0000	80010000	00000000	00000000	FFFFFFFF
(1680)	FFFF0004	00060002	F1F1F1F1	00010001	F1F2F1F2	00020002	F1F5F0F4	00010004	F1F5F1F3	00020005
(1720)	FFF00230	01040000	02330103	FFEC0253	0101FFE6	022A0301	000301F5	0201000A	020D0301	00000000
(1760)	00AC0000	D9E3C3D9	C3F30000	0000F0F0	F0F14BF1	030D84B5	F7F9F0F8	F1F6F1F9	F0F6F2F9	B9A233D2
(1800)	34023437	0000B800	B800B800	B800FFFF	FFFFFFFF	00FF0000	00FF0000	00FF0000	00FF0000	80010000
(1840)	00000000	00000000	FFFFFFFF	FFFF0004	00060002	F1F2F0F5	00030001	F1F4F1F3	00010004	F1F5F0F3
(1880)	00010005	F1F5F1F3	00010006	FEF50222	0404FFBC	02030402	00310222	0402FFF6	02130201	FFED0216
(1920)	02010003	02130201	00000000	00CC0000	D9E3C3D9	C3F30000	0000F0F0	F0F14BF1	030D9D35	F7F9F0F8
(1960)	F1F6F2F0	F5F1F0F1	C1FF33CD	341E3463	0000B800	B800B800	B800FFFF	FFFFFFFF	00FF0000	00FF0000
(2000)	00FF0000	00FF0000	80010000	00000000	00000000	FFFFFFFF	FFFF0005	000A0002	F0F9F1F0	00010001
(2040)	F1F0F1F0	00020002	F1F2F0F5	00030004	F1F4F1F3	00030007	F1F5F0F3	0001000A	0274020A	04020071
(2080)	02450401	01D9021A	04010329	02330403	00B90233	0401FFB5	02400405	FFDF0233	02020013	0225020?

```
( 12720)  D9E3C3D9  C3F30000  0000F0F0  F0F143F5  C30D6C35  F7F9F0F8  F1F6F1F7  F2F1F5F7  F866325A  32C83348
( 12760)  00010110  00000000  00003824  00401492  7864221A  1A000000  2D000000  2B001A15  01331900  00010700
( 12800)  00011A27  19FFFFFF  64000007  00110001  F0F9F0F6  00010001  F0F9F0F7  00010002  F1F0F0F7  00030003
( 12840)  F1F2F1F1  00000006  F1F2F1F2  00030009  F1F4F0F4  0003000C  F1F5F1F3  000350CF  0005027E  0101FFE0
( 12880)  02900101  FFF7027D  0105FFFB  026D0103  0009024D  01020005  0208C103  00000253  01020005  02530105
( 12920)  0005025E  0104FFF0  02480107  FFEC0253  0103FFFD  021E0306  FFF30266  0304FFE0  02320303  001101E0
( 12960)  0302FFFA  02350305  000A0200  03010000

        FILE   INPUT    DATA RECORDS    MAX.            READ ERROR SUMMARY          INPUT RETRIES
               RECS.       INPUT        SIZE      PERM  ZERO B   SHORT  UNDEF.  #RECS.  TOTAL#
          2    1784     1784           13028        0       0       0       0       0       0

FILE      16  RECORD        1  LENGTH     80 BYTES
(     0)  C8C4D9F1  4BE2E3D9  D94BE8F7  F94BD4F0  F84BC4F2  F3E2D9D9  F0F1F3F0  F0F0F1F0  F0F0F640  40404040
(    40)  4040F8F5  F1F7F540  F0F0F0F1  F0F0F0F0  F0F0F0F0  C9C2D440  D6E261E5  E240F3F7  F0404040  40404040

        FILE   INPUT    DATA RECORDS    MAX.            READ ERROR SUMMARY          INPUT RETRIES
               RECS.       INPUT        SIZE      PERM  ZERO B   SHORT  UNDEF.  #RECS.  TOTAL#
         16       2        2              80        0       0       0       0       0       0

EOJ        DUMP STOPPED AFTER FILE   16         # OF PERMANENT READ ERRORS   0

START TIME  3/09/92  15:48:14        STOP TIME  03/09/92  15:53:42
```