NASA CR-170,616

NASA
Contractor
Report
CR 170616

April 1984

User's Guide for ERB 7 SEFDT

Volume I - User's Guide
Volume II - Quality Control Report, Year-1

S. N. Ray
Richard J. Tighe
Steven A. Scherrer

NASA

NASA
Contractor
Report
CR 170616

1984

User's Guide for ERB 7 SEFDT

Volume I - User's Guide
Volume II - Quality Control Report, Year-1

S. N. Ray
Richard J. Tighe
Steven A. Scherrer

Prepared For:

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND 20771

Prepared By:

SYSTEMS AND APPLIED SCIENCES CORPORATION
5809 ANNAPOLIS ROAD, SUITE 414
HYATTSVILLE, MARYLAND 20784

UNDER CONTRACT NO. NAS 5-28063
TASK ASSIGNMENT 03

N84-26553 #

NIMBUS-7

NIMBUS OBSERVATION PROCESSING SYSTEM (NOPS)

EARTH RADIATION BUDGET (ERB)
SOLAR AND EARTH FLUX DATA TAPE (SEFDT)

DATA USER'S GUIDE

VOLUME I

REVISION A

APRIL, 1984

REVISED BY: KLVasanth
Dr. Kunigahalli L. Vasanth (04/20/84)
SASC/SQC Task Leader

REVIEWED BY: Richard J. Tighe
Dr. Richard J. Tighe (04/20/84)
SASC/NOPS ERB Project Manager

APPROVED BY:
Mr. Lonnie H. Bowlin (04/20/84)
SASC/NOPS Program Manager

Prepared For:

National Aeronautics and Space Administration
Goddard Space Flight Center
Greenbelt, Maryland 20771

Prepared By:

Systems and Applied Sciences Corporation
5809 Annapolis Road, Suite 414
Hyattsville, Maryland 20784

Contract No. NAS5-26773

REVISION A: (04/17/84) KLV

(1) This volume will become Volume I of the ERB SEFDT Data User's Guide. Subsequent volumes will contain Scientific Quality Control (SQC) information.

(2) The reference page was updated to provide more precise information on References 9 and 11.

PREFACE

This document provides necessary background information on the Solar and Earth Flux Data Tape (SEFDT) generated from Nimbus-7 Earth Radiation Budget (ERB) instrument data. There will be two volumes of this document, the first volume of which will contain a general description of data including the processing method, and the second volume will contain details of science data quality.

Procedure followed to certify First Year SEFDT's for archive:

The solar data were validated by Mr. John Hickey. The Earth Flux data were validated by Dr. Herbert Jacobowitz.

Nimbus Experimenters Team (NET) Members

Dr. Albert Arking**
NASA/Goddard Space Flight Center
Code 915.0
Greenbelt, MD 20771
(301) 344-7208

Dr. Garrett Campbell**
c/o CRIA
Department of Atmospheric Sciences
Colorado State University
Fort Collins, CO 80523
(303) 491-8566

Mr. John R. Hickey
EPPLEY Laboratory, Inc.
12 Sheffield Avenue
Newport, RI 02840
(401) 847-1020

Dr. Frederick B. House
Department of Physics and Atmospheric Science
Drexel University
32 & Chestnut Streets
Philadelphia, PA 19104
(215) 895-2725

Dr. Andrew Ingersoll
Department of Geological and Planetary Science
170-25
California Institute of Technology
Pasadena, CA 91125

Dr. Herbert Jacobowitz*
E/RA-11
National Oceanic and Atmospheric Administration
National Environmental Satellite Service
Suitland Professional Center
5001 Silver Hill Road
Stop L
Washington, D.C. 20233
(301) 763-4290

Dr. H. Lee Kyle*
NASA/Goddard Space Flight Center
Code 910.2
Greenbelt, MD 20771
(301) 344-9140

---

*Dr. Jacobowitz was elected team leader in 1976. He was succeeded by Dr. Kyle in 1983.

**Elected members.

Mr. Robert Maschhoff**
Gulton Data Systems Division
Albuquerque, NM 87190

Dr. G. Louis Smith
Mail Stop 420
Langley Research Center
Hampton, VA 23665
(804) 865-2977

Dr. Larry L. Stowe
E/RA-11
National Oceanic and Atmospheric Administration
National Environmental Satellite Service
Suitland Professional Center
5001 Silver Hill Road
Stop L
Washington, D.C. 20233
(301) 763-4290

Dr. Thomas H. Vonder Haar
Department of Atmospheric Sciences
Colorado State University
Fort Collins, CO 80523
(303) 491-8566

SEFDT Data User's Guide

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

GLOSSARY OF ACRONYMS

CAT -	Calibration Adjustment Table
DSAS -	Digital Solar Aspect Sensor
ERB -	Earth Radiation Budget
MAT -	Master Archive Tape
MATRIX -	Mapped Data Matrix Tape
NASA -	National Aeronautics and Space Administration
NFOV -	Narrow Field Of View
SEFDT -	Solar and Earth Flux Data Tape
SZA -	Solar Zenith Angle
WFOV -	Wide-Angle Field of View

SECTION 1. INTRODUCTION

The Nimbus-7 ERB SEFDT Data User's Guide was written by a team. Dr. H. Lee Kyle, Manager of Science Data Validation Task, acted as Editor; Dr. Herbert Jacobowitz, Chairman of NET; Mr. John Hickey, NET Member; and Mr. Michael Forman, Nimbus Operations Manager have contributed to different sections of the document. Dr. Surendra N. Ray, Systems and Applied Sciences Corporation (contractor for this task), coordinated the writing of this document.

In this section, there are four subsections: Subsection 1.1 describes the scope of the Data User's Guide, Subsection 1.2 describes the background on Nimbus-7 Spacecraft and the ERB Experiment, Subsection 1.3 describes the SEFDT Data Product and Processing Scenario, and Subsection 1.4 describes other related products and documents.

1.1 DESCRIPTION OF THE DATA USER'S GUIDE

The SEFDT Data User's Guide describes the contents of the tape, the origin of the data, and the method of processing these data. It also describes accuracy of data, general problems, and limitations on the use of these data. This Data User's Guide will serve as the principal document for use of the SEFDT by the scientific community. Volume I will serve as general reference to use the product, whereas Volume II will contain the details. As the processing goes on from year to year, additions will be made to Volume II of the document. General information regarding the related products, their availability, and references will be listed in this Data User's Guide. A list of first year SEFDT tape numbers will be provided in this document.

1.2 BACKGROUND ON NIMBUS-7 AND THE ERB EXPERIMENT

A short description of the Nimbus-7 ERB experiment is given here. More detailed information is included in Reference 1. The new inflight calibration adjustment of the Nimbus-6 and -7 ERB Wide Field of View (WFOV) radiometers is given in Reference 2. Also, the reader is referred to the ERB Bibliography which contains numerous references related to the experiment (Reference 3).

The ERB is one of the experiments aboard the Nimbus-7 satellite which includes seven experiments and one subsystem. The subsystem is the THIR (Temperature Humidity Infrared Radiometer), and the experiments are:

- Coastal Zone Color Scanner (CZCS)
- Earth Radiation Budget (ERB)
- Limb Infrared Monitor of the Stratosphere (LIMS)
- Stratospheric Aerosol Measurement II (SAM II)

- Solar Backscatter Ultraviolet/Total Ozone Mapping (SBUV/TOMS)
- Stratospheric and Mesopheric Sounder (SAMS)
- Scanning Multichannel Microwave Radiometer (SMMR)

The Nimbus-7 spacecraft was launched on October 24, 1978 from the Western Test Range of Vandenberg Air Force Base, California by a thrust-augmented Delta vehicle. The satellite was placed in a 955 kilometer, Sun-synchronous polar orbit, having local noon (ascending node) and midnight (descending node) equator crossings, with 26.1 degrees of longitude separation. The orbital period is 104.16 minutes.

The ERB experiment was also included on the Nimbus-6 spacecraft. The Nimbus-7 version is almost identical to its predecessor with a few minor modifications. The Nimbus-7 ERB was the actual flight backup for the Nimbus-6 mission before these modifications were made.

The objective of the ERB experiment is to determine, over a period of one year, the radiation budget of the Earth on both synoptic and planetary scales by the simultaneous measurement of:

- Incoming Solar Radiation

- Outgoing Earth reflected (shortwave) and Earth emitted (longwave) radiation by:

  (a) Fixed wide angle sampling of these terrestrial fluxes at the satellite altitude, and

  (b) Scanned narrow angle sampling of the angular radiance components.

Another objective is to develop angular models of the reflection and emission of radiation from clouds and Earth surfaces (References 4, 5, 6, and 7).

The sensor array may be divided into three general categories:

(1) Solar Sensing Channels

(2) Fixed Wide-Field Earth Sensing Channels

(3) Scanning Channels

The first operational science data were available from November 16, 1978. The spacecraft and the ERB fixed channels are operating at the time of this writing. In order to make the ERB data meaningful, the following decisions were made by the NET members:

- The Nimbus-7 ERB data year starts on the first day of November of each year. The first data year starts on November 1, 1978.

- Since the complete data were not available for the first month of the first year, December 1978 is considered the first month for monthly and seasonal products. The first ERB cycle begins on December 1, 1978.
- Archivable data will be available only starting in December 1978.*
- Nimbus Week-1 starts on October 29, 1978.

The main purpose of the SEFDT program discussed in this document is to produce a tape containing the solar data and the wide angle terrestrial flux data only, i.e., no scanning channel data. A short description of the solar and wide field sensors (channels) will be given here.

Solar Channels

The incoming solar radiation is measured by ten channels. Since the solar array faces forward on the spacecraft, the solar measurements are made as the satellite traverses the terminator over the Southern Hemisphere just before it starts its trip northward on the Sun-lit side of the Earth. The characteristics of the solar sensors are given in Table 1.1. The spectral range of the filtered channels are shown superimposed on the 1971 NASA Standard Curve of Extraterrestrial Solar Spectral Irradiance in Figure 1.1. The major measurement for Earth Radiation Budget studies is that of the total solar irradiance sometimes called the "Solar Constants". On Nimbus-7, the ERB has two total irradiance channels, Channel 3 and Channel 10C. The latter is a self-calibrating cavity pyrheliometer. There was no matching channel aboard Nimbus-6; Channel 10C replaced Channel 10S which was a low ultraviolet channel. The spectral channels were included in the ERB complement mainly to yield broad band, but reliable, spectral information which may help resolve the differences in the existing (conflicting) extraterrestrial solar spectral curves and also to identify spectral regions of solar variability in the visible and near-ultraviolet.

---

*MAT, MATRIX, and SEFDT; however, are available for November, 1978. For SAVER, TABLES, and ZMT, data start in December, 1978.

TABLE 1.1

ERB Nimbus Solar Sensing Channels[(a)]

CHANNEL NUMBER	SPECTRAL BAND (μm)	FILTER	THERMOPILE TYPE[(d)]
1s[(b)]	0.200 - 3.8	Suprasil W Fused Silica	N3 - Flat
2s[(b)]	0.200 - 3.8	Suprasil W Fused Silica	N3 - Flat
3s	<0.200 - >50.0	None	N3 - Flat
4s	0.526 - 2.8	OG530	N3 - Flat
5s	0.698 - 2.8	RG695	N3 - Flat
6s	0.395 - 0.508	Interference Filter	N3 - Flat
7s	0.344 - 0.460	Interference Filter	N3 - Flat
8s	0.300 - 0.410	Interference Filter	N3 - Flat
9s	0.275 - 0.360	Interference Filter	K2 - Flat
10s	0.252 - 0.324	Interference Filter	K2 - Flat
10c[(c)]	<0.200 - >50.0	None	HF - Cavity

NOTES: (a) All channels have a 10° full response field of view and maximum field of 26°: Solar measurement is about three minutes in each orbit centered on the satellite crossing of the Southern Terminator. Channels 3s of both Nimbus-6 and Nimbus-7, and Channel 10c of Nimbus-7 are total radiation (solar constant) channels.

(b) Channels 1s and 2s are redundant: Channel 1S is a reference channel which is normally shuttered.

(c) Channel 10c is a self-calibrating cavity channel which is on Nimbus-7 only: Channel 10s is a UV channel on Nimbus-6 only.

(d) All are types of Eppley wire wound thermopiles.

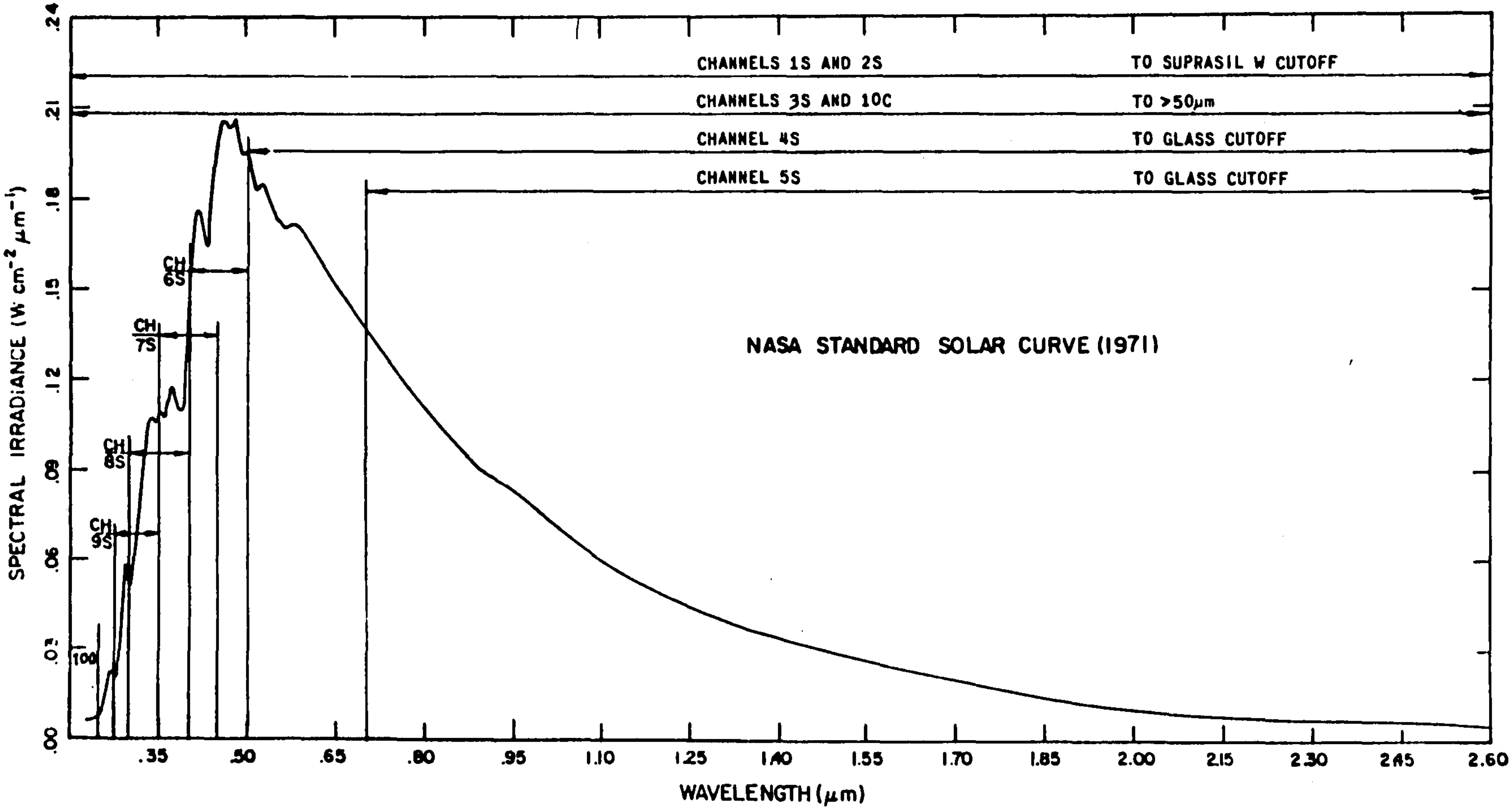


FIGURE 1.1

Spectral Intervals Monitored by the ERB Solar Channels (With 1971 NASA Standard Extraterrestrial Solar Curve)

Fixed Wide-Angle FOV Channels

The Earth-emitted infrared radiation and Earth-reflected solar radiation are measured in fixed, Wide-angle Fields of View (WFOV) sensors. The four sensors have unencumbered Fields of View of 121 degrees and maximum fields of 133.3 degrees. From the Nimbus-7 orbit altitude of 955 km the Earth subtends an angle of 120.8 degrees.

The measurements taken by these channels provide a direct measure of the terrestrial flux passing through a unit-area at satellite altitude. An integration of these measurements over the entire globe, together with the solar constant observations, provides a measure of the net radiation balance for the Earth-atmosphere system. In principle, the accuracy of this measurement should be compromised only by the diurnal sampling restrictions of the Nimbus sun-synchronous orbit. Measurements of the radiation flux reflected in the shortwave region (0.2 µm to 3.8 µm), in addition to those of the total earth radiation flux (0.2 µm to >50 µm), permit separation of the planetary albedo and longwave flux components of the observed net radiation flux.

Channel 14 (WFOV) and Channel 5 (solar) measure radiation in the 0.698 µm to 2.8 µm interval enabling the planetary albedo to be defined for the spectral subregions <0.695 µm and >0.695 µm. These two spectral regions separate the total backscattered radiation into the molecular-plus-aerosol contribution and the aerosol-dominant spectral contribution. This separation was made to assist in studying the contribution of aerosols to any detectable variations of the Earth's planetary albedo.

The characteristics of the WFOV channels are depicted in Table 1.2.

TABLE 1.2

Characteristics of ERB Fixed Wide-Angle FOV Channels

CHANNEL	WAVELENGTH LIMITS (μm)	FILTER	IRRADIANCE RANGE ANTICIPATED (Wm^{-2})	APPROXIMATE NON-AMPLIFIED SIGNAL OUTPUT (mV)	AMPLIFIED OPERATIONAL SENSITIVITY (BITS/Wm^{-2})	NOISE EQUIVALENT IRRADIANCE (Wm^{-2})
11	<0.2 to >50	None	-200 to +600	-2.1 to 7.6	1.707	6.55 x 10^{-2}
12*	<0.2 to >50	None	-200 to +600	-2.1 to 7.6	1.707	6.55 x 10^{-3}
13	0.2 to 3.8	2 Suprasil W Hemispheres	0 to 450	0 to 5.7	2.276	6.55 x 10^{-3}
14	0.695 to 2.8	RG695 Hemispheres Between 2 Suprasil W Hemispheres	0 to 250	0 to 3.2	4.096	6.65 x 10^{-3}

NOTES: *Channels 11 and 12 are redundant channels. Channel 11 has black painted baffles and is used for in-flight calibration of Channel 12. Channel 12 has polished aluminum baffles similar to those on Nimbus-6.

- All channels have Type N3 thermopile sensors.
- All channels have an unencumbered FOV of 121 degrees and a maximum FOV of 133.3 degrees. Channel 12 has an additional FOV selection of 89.4 degrees unencumbered, 112.4 degrees maximum.
- Output of these channels is a 3.8-second integral of the instaneous readings.

1.3 SEFDT DATA PROCESSING SYSTEM

The ERB Level II processing scenario is illustrated in Figure 1.2. The MAT tapes used as inputs to SEFDT processing are daily products (containing data only for those days on which ERB is ON). These tapes contain calibrated and raw digital data values for all channels, plus housekeeping data such as temperatures, attitude, and DSAS data. Further details on the MAT product are given in References 8 and 9.

The first step in SEFDT processing is performed by the DELSPIKE program. This program performs a pre processing step where spikes in the Earth flux data are removed. DELSPIKE creates a pseudo-MAT on which major frames containing Earth flux irradiance spikes are flagged as data quality losses. The pseudo-MAT is a temporary tape used only in the production of SEFDT. DELSPIKE was integrated into the processing system at the start of production of Year-4 SEFDT.

A post-processing step is performed by the SEFDTFIX program. This program recalibrates the Earth flux irradiances by adding DELMAT offsets (see Reference 10). SEFDTFIX also implements the Channel 13 CAT. These corrections account for thermal response of the ERB sensors as well as long term degradation effects. Both of these corrections are discussed in more detail in References 11 and 12. The SEFDTFIX product replaces the SEFDT product in archive (SEFDT products are archived as they are produced in order to expedite shipment of high quality ERB solar data to the scientific community).

Users of SEFDT products may distinguish between the "solar" SEFDTs and the SEFDTFIX product by examining the NOPS Standard Header File. SEFDTFIX products are clearly labelled as such in the NOPS Standard Header.

1.4 RELATED PRODUCTS AND DOCUMENTS

As discussed in the previous subsection, SEFDTs are produced from MATs. MATRIX is another monthly product also produced from MATs, but the MATRIX months do not necessarily coincide with calendar months. The first day of the calendar month coincides with the first day of the MATRIX, but the last day of MATRIX might run into the next calendar month depending on when the last day of the six-day cycle ends. MATRIX contains daily, six-day, and monthly world grids of data, and polar stereographic map matrices of derived parameters. These tapes are utilized in generating the contoured map microfilm displays. For further detail see References 11 and 12.

The TABLES and ZMT program accepts MATRIX and SEFDT tapes as input to produce the TABLES and ZMT tapes. TABLES tape contains data for production of all ERB tables and microfilm. For further details see Reference 13. This program also produces Zonal Means Tape (ZMT) which contains, in computer-compatible format, the tabular listings of solar irradiances, zonally averaged insolation, longitudinal and latitudinal averages of Earth Flux, Albedo, and Net Radiation. The contents of TABLES and ZMT are identical and are described in Reference 13.

SAVER is output from the program SAVER. This contains seasonally (3 months) averaged data derived from MATRIX tapes. The details on this product are given in Reference 14.

All these products are available from NSSDC as described in Appendix B.

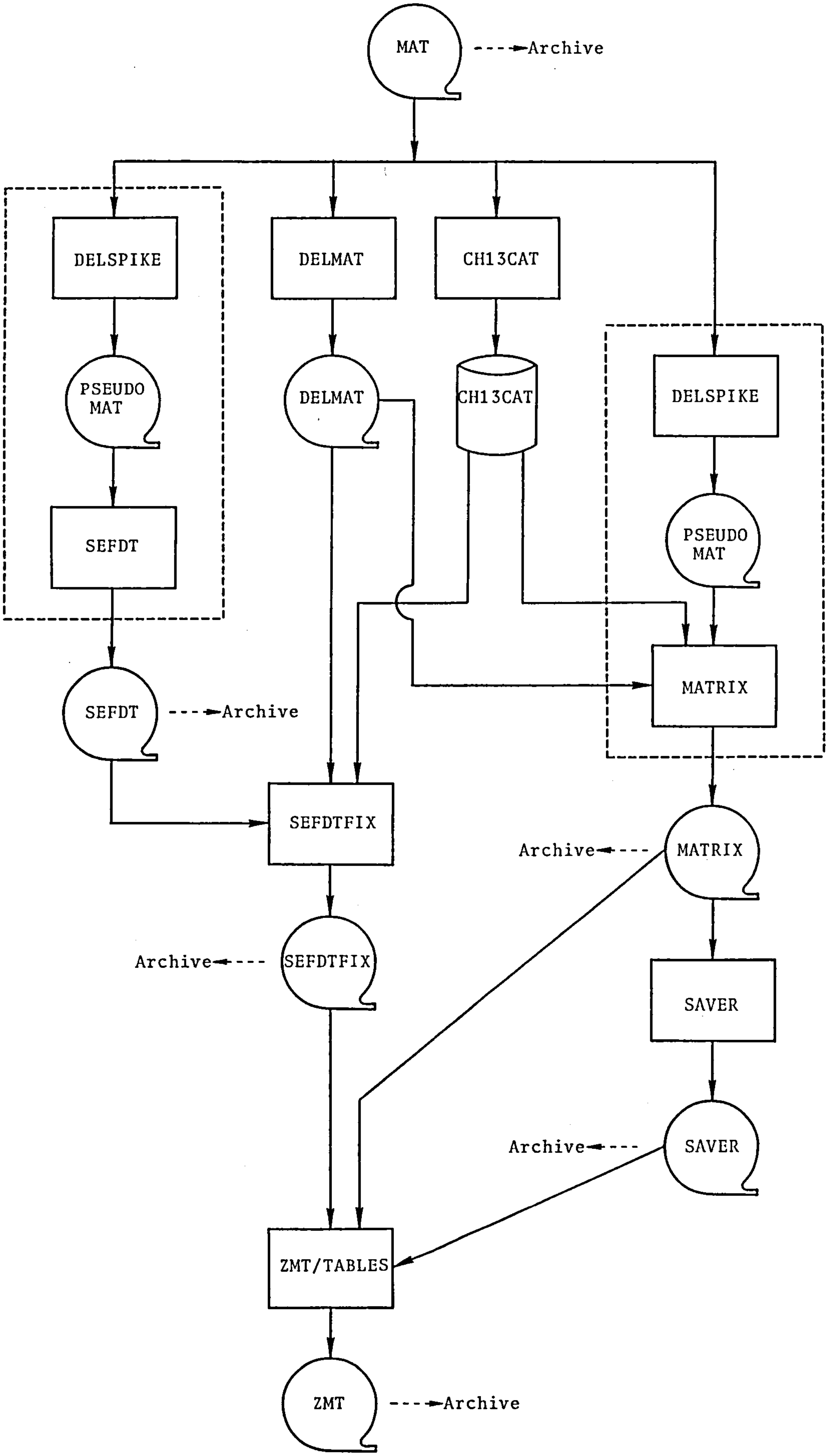


FIGURE 1.2. Processing Scenario of SEFDT

SECTION 2. DESCRIPTION OF SEFDT DATA

In this section a short description of the origin on SEFDT data and processing algorithm is given. In Subsection 2.1 origin of data is described, and in Subsection 2.2 algorithm description is given.

2.1 ORIGIN OF SEFDT DATA

As described in Section 1, the input data to the SEFDT program are from MATs. The intent of the MAT was to archive raw data in counts as well as in engineering units. However, at the time MATs were produced the in-flight behavior of instruments were not completely understood. In producing the subsequent products such as SEFDT and MATRIX, some of the known anomalies and errors have been corrected. So far as solar channel data are concerned the SEFDT has used much improved algorithm compared to that used in MAT. For WFOV data, however, one may use MATRIX or SEFDT depending on requirements. The following are the main differences between MAT, MATRIX, and SEFDT data:

Differences Between MAT and SEFDT Data

(1) The algorithm used for the determination of minimum solar elevation were different in MATGEN and SEFDT. In MATGEN, the predicted southern terminator time is to be the time for minimum solar elevation. In SEFDT, as described in Subsection 2.2, the Channel 5 counts are examined for a saddle point and the corresponding time is recorded as the time of minimum solar elevation (T_0).

(2) The irradiances in MAT from Channels 11 - 14 (Earth Fluxes) are calibrated but calibrations are not adjusted, whereas in SEFDT calibrations have been adjusted to take into account the instruments behavior.

(3) The Solar data on SEFDT have been limit checked as described in Section 2.

(4) MAT retains all data whether or not quality flags are set. SEFDT has rejected all data for which the VIP quality flags have been set.

(5) An offset value of 84 counts was used for Channel 9 at time T_0-13 in MATGEN which has not been used in SEFDT. Furthermore, in MATGEN the $T_0 \pm 13$ values were taken only from T_0-13 whereas in SEFDT it was taken as average of $T_0 \pm 13$.

(6) The solar channel sensitivity correction factors used in SEFDT are more up to date than those used in MATGEN.

(7) The channel 10C irradiance was corrected by a factor .998 in SEFDT (see Subsection 4.2) which was not done in MATGEN.

(8) The temperature (refer to Eq. 2.2.1(1)) for Channel 10C was 0 for MATGEN and 22°C for SEFDT.

(9) Channel 10C Coefficient A was .000072 in MATGEN and 0.000524 in SEFDT.

(10) Channel 10C sensitivity S_v was 1 in MATGEN and 1.3013 in SEFDT.

Differences Between MATRIX and SEFDT Data

(1) The WFOV data in SEFDT are not corrected for the satellite altitude whereas in MATRIX, the inverse square factor is applied to reduce all flux densities to a common 15Km altitude, troposphere level.

(2) Limit checking on WFOV data were done before accepting on MATRIX, not done in SEFDT.

(3) Data during Sunblip rejected in MATRIX, not in SEFDT. The MATRIX rejects WFOV data at: Satellite Sunrise 99 degrees $\leq$ SZA $\leq$ 123 degrees and Satellite Sunset 102 degrees $\leq$ SZA $\leq$ 123 degrees, although the Sunblip is most obvious for 113 degrees $\leq$ SZA $\leq$ 121 degrees. Careful study and computations indicate scattered solar radiation is the dominant contributor to the WFOV signals for 100 degrees $\leq$ SZA $\leq$ 113 degrees.

2.2 BRIEF DESCRIPTION OF ALGORITHM

In this section a brief description of the SEFDT algorithm is presented. For MATGEN and MATRIX algorithms one should see References 8 and 11, respectively.

2.2.1 Net Solar Irradiance Algorithm

STEP 1: Compute the Temperature Sensitivity Correction Factor

$$S(T) = S_V (1 + A (T - L)) \qquad 2.2.1(1)$$

S_V - Channel sensitivity in a vacuum at 25°C (22°C for Channel 10C only) in counts per Watts/m^2.

A - Temperature sensitivity at 25°C (22°C for Channel 10C only) in per °C.

T - Temperature in Centigrade

L - Reference Temperature:

Channels 1-9: 25°C

Channel 10C : 22°C

Table 2.1 contains the values of S_v and A that are used in SEFDT.

STEP 2: Compute the Uncorrected Net Solar Irradiance

$$R = [\ V_0 - 1/2\ (V_- + V_+)\ ]\ /\ S(T) \qquad 2.2.1(2)$$

V_0 - Solar Channel Detector Output in Counts at T_0

V_- - Solar Channel Detector Output in Counts at T_0-13

V_+ - Solar Channel Detector Output in Counts at T_0+13

S(T) - Temperature Sensitivity Correction Factor

STEP 3: Adjustment of Channel 10C for Reflectance. (Note: This correction is applied to Channel 10C only).

$$R_{10C} = U_{10C} * 0.998$$

U_{10C} = Unadjusted Channel 10C Net Solar Irradiance

R_{10C} = Adjusted Channel 10C Net Solar Irradiance

COMMENT: At this point, all the net solar'irradiances must be corrected for Sun-Earth distance.

STEP 4: Correction of Net Solar Irradiance for Sun-Earth Distance

$$NSR = R * R_{SE}{}^2$$

R - Uncorrected Net Solar Irradiance

R_{SE} - Instantaneous Sun-Earth Distance in Astronomical units. Note that the average Sun-Earth distance in astronomical units is 1.0.

NSR is the final corrected Net Solar Irradiance that will appear in the SEFDT Solar Orbital Summary Records.

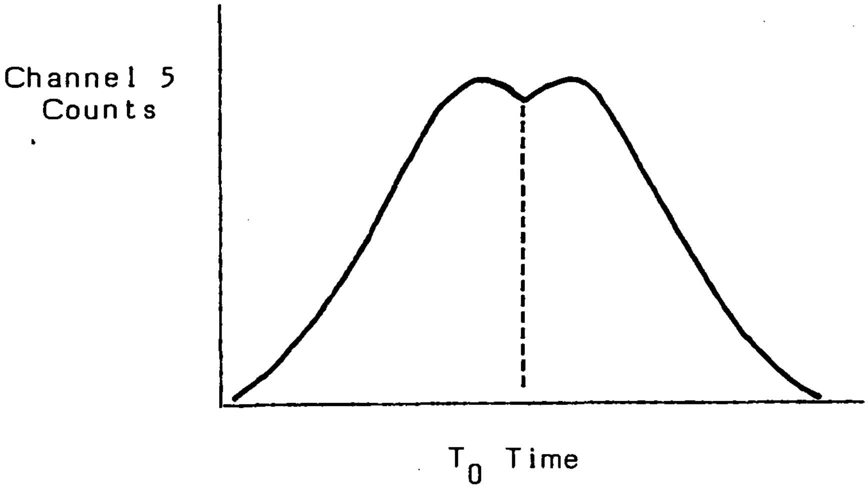
TABLE 2.1

Channel Coefficients

CHANNEL	S_V	A
1	1.299	0.0007
2	1.275	0.0008
3	1.214	0.0008
4	1.719	0.0007
5	2.424	0.0006
6	6.931	0.0007
7	9.588	0.0003
8	12.715	-0.0004
9	30.170	-0.0011
10	1.3013	0.000524

2.2.2 Determination of the Time of Minimum Solar Elevation T_0

The time of minimum solar elevation is defined to be the relative minimum of the Channel 5 counts for each orbit as illustrated below:



The time of minimum solar elevation was labelled T_0 for all of the ten solar channels.

The algorithm for determining T_0 was a 3-step process:

1) Search the Channel 5 counts for the orbit and tabulate the occurrence of counts between 1000 and 2000.
2) Find, in the table, the smallest count value occurring more than four times (occurring n times).
3) T_0 is the time associated with the median of the possible smallest count values (n/2). (i.e., if the smallest count value occurs 8 times, T_0 will be the time associated with the fourth occurrence).

If no time of minimum solar elevation was found, T_0 was set to the southern terminator time for selection of solar data records.

2.2.3 Validation Procedure for Orbital Summary Records

2.2.3.1. Valid T_0

If T_0 was set to the southern terminator time (see above), then the orbital summary record for the orbit has the following data set to a fill value (-10,000):

a) Hours/Minutes

b) Seconds

c) Thermopile Base Temperatures

d) Mean Counts

e) Channels 1 through 10 Net Irradiances

If no solar data is available at time T_0, T_0-13 minutes, or at T_0+13 minutes, then no solar data records are written to tape and again the orbital summary record is filled (except for the orbit number, record number, and southern terminator time).

2.2.3.2. Valid Thermopile Base Temperature (TBT)

Thermopile Base Temperatures (TBT) were checked before they were stripped from preliminary solar data records to be sure they met the following criteria:

a) 10 degrees $\leq$ T $\leq$ 30 degrees C.

b) Consecutive temperatures at T_0 and T_0 + 16 seconds were within 2 degrees C.

Otherwise, TBT was selected from the closest solar data record where the criteria was met. Each channel was tested independently to verify that all met the criteria. If both criteria were not met for a channel examined between T_0 and T_0 + 12 MF, the TBT was set to -10,000.

If the TBT for a solar data channel was set to a fill value, the net solar irradiance for that channel was also set to a fill value (-10,000).

2.2.3.3. Valid Mean Counts

Limit checking was done after the mean counts were computed for each channel at times T_0 - 13, T_0, and T_0 + 13.

Before the mean counts were computed, the 9 values surrounding T_0-13, T_0, or T_0+13 were checked to verify that each value

fell within the minimum/maximum limits in Table 2.2. Any count values that fell outside the limits were not included in the mean averages. If fewer than 4 valid points were found for a channel at the testing time, the mean counts were set to -10,000.

TABLE 2.2

Solar Data Count Limits

	MINIMUM			MAXIMUM		
CHANNEL	T_0-13	T_0	T_0+13	T_0-13	T_0	T_0+13
1	- 12	1200	- 12	12	2000	12
2	- 10	1000	- 10	10	2000	10
3	- 20	1000	- 20	10	2000	10
4	- 15	1000	- 15	10	2000	10
5	- 15	1000	- 15	10	2000	10
6	- 35	800	- 35	15	1800	35
7	- 35	800	- 35	20	2000	40
8	- 70	500	- 70	40	1800	60
9	-120	1000	-120	50	2044	70
10	- 30	1200	- 30	5	2044	5

If any of the three mean counts for a channel were invalid (-10,000), the irradiance for that channel was set to -10,000.

2.2.4 Channels 11 through 14 Irradiance Corrections Algorithm

2.2.4.1 Correcting Channels 11, 12, and 14 Irradiances

Channels 11, 12, and 14 irradiances were corrected for channel degradation by applying the SLOPE and INTERCEPT values contained in the Calibration Adjustment Table (CAT) residing on each MAT. The constants were applied regardless of whether the electronic calibration was ON or OFF as follows:

$$I_c = M * I_u + B$$

I_c - Corrected Irradiance

I_u - Uncorrected Irradiance

M - Slope

B - Intercept

2.2.4.2 Correcting Channel 13 Irradiances

Channel 13 irradiances were corrected for degradation and in orbit sensor behavior by applying the SLOPE and INTERCEPT values contained in the Channel 13 Calibration Adjustment Table (CH13CAT), which consists of values as a function of day and solar zenith angle (-100 to +100).

Determination of the sign of the Solar Zenith Angle (SZA) was as follows:

- If the MAT SZA is less than or equal to 90 degrees and the latitude minus declination is negative, the SZA is negative. If it is positive, the SZA is positive.
- If the MAT SZA is greater than 90 degrees and the latitude plus declination is negative, the SZA is negative. If it is positive, the SZA is positive.

In addition, any MAT SZA greater than 100 (-100) degrees was assigned the correction factors appropriate for 100 degrees (or -100 degrees).

The constants were applied regardless of whether the electronic calibration was ON or OFF as illustrated in the formula above.

SECTION 3. DATA VALIDATION RESULTS

In Section 3, a description of the data quality checks (QC) will be given. The results of this QC for Year-1 will be described briefly. The details of the quality control results will be included in Volume II of the SEFDT Data User's Guide.

3.1 THE ITEMS CHECKED IN THE QC

The following items are checked in the QC program:

- NOPS Tape Standard Header
- Sequencing of Logical and Physical Records
- Logical Record Identification Numbers
- Physical Record Length
- Number of Logical Records in a Physical Record (should be less than 66)
- CAT File
- Missing or Duplicate Frames
- Orbit/Day Numbers
- TDF
- Tape Read Errors
- Limit Checks for Alpha angle, Beta angle, Latitude, and Longitude
- Limit Checks for Temperatures
- Limit Checks for Calibrated Earth Fluxes, Solar Counts, and Mean Solar Irradiances

Limits for which different channels are checked are depicted in Tables 2.2.

Further, internal consistency checks are done for the following:

- The times $T_0 \pm 13$ and T_0
- Test T_0 against time of Middle Solar Frame and against time of Southern Terminator

Reasonableness checks are also made as follows:

(1) Latitude band averages are computed for ascending and descending parts of the orbits for:

- Channel 12 - Channel 13
- Channel 12
- Channel 13
- Channel 14

(2) Global averages are computed for the above.

(3) Channel 11 and Channel 12 irradiances are compared for periods when both are open.

(4) Daily mean solar irradiances are compared with known degradation/recovery pattern.

Other items checked by EPPLEY Laboratory:

(1) Earth-Sun distance is checked against the Ephemeris value.

(2) Gamma angle setting is checked against the ground station command list document.

A flow diagram of the program used by EPPLEY Laboratory is attached in Appendix D.

3.2 THE KNOWN GLITCHES IN YEAR-1 SEFDT DATA

Earth Channels

This subsection describes the glitches in SEFDT data so far. While details will appear in Volume II, a list of glitches are given here. These are:

(1) For some months in the first year data, the Channel 13 Calibration Adjustment Table (CAT) was computed improperly with the following minor defects:

A) The calibration values (slopes and intercepts) from -15 degrees to 15 degrees in solar zenith angle were interpolated for 31 points instead of 30.

B) The further effect of the above interpolation was that the calibration values for solar zenith angles were shifted by one degree up for the range 15 degrees - 74 degrees.

(2) The effect of the error, illustrated in Item 1, is within 0.1% on the SW Earth fluxes. The CAT at the end of the SEFDT could either be the old or the new one.

(3) Due to the erroneous use of engineering coefficients in the calibration equations for the Platinum Temperature Monitors (PTMs), some error has been introduced into the Channel 11-12 irradiances.

(4) In the WFOV channel data there is a three-day-on, one-day-off cycle effect on Channels 13 and 14. Channel 12 is affected for only a few orbits immediately following turn on.

(5) Channel 11 status occasionally indicates OPEN for very short periods of time (one or two major frames). On these occasions, the Channel 11 irradiances show very poor agreement with those for Channel 12.

(6) Due to software problem, <u>some</u> Earth Flux data have been passed to SEFDT even if the VIP Quality Loss Flags were set to 1. This problem may affect data up to August, 1980.

Solar Channels

(1) There may be fewer solar data records for some orbits due to data gaps.

(2) A software error occasionally caused a value of -4062 to be given to orbital summary parameters which were actually zero. No solar irradiances were affected. This problem was corrected prior to the production of Year-2 SEFDT.

(3) The VIP data quality flags were not used to reject data for some months.

(4) Due to data gaps for some orbits, the computed solar peak value at T_0 or $T_0 \pm 13$ may be in error.

(5) During the Minimum Solar Elevation, the solar azimuth angles and the zenith angles are sometimes equal. However, this has no impact on the data.

(6) There might be mismatch of orbits between MAT and SEFDT because for some months, in the first year, the MATs were regenerated to add more orbits after SEFDTs were generated.

(7) For some days in the first year data set, the solar azimuth and zenith angles coming from DSAS are beyond ± 180 degrees limit. The zenith angles are due to round-off error and are in the vicinity of ±180 degrees, but the azimuth angles may sometimes be very high. However, the irradiances do not depend on these angles.

(8) The angle between the pointing vector of the solar channel assembly and the sun defines the off-axis angle. The γ angle is commanded to keep the off-axis angle less than 0.5 degree. Sometimes though, operationally there were deviations from this. The SEFDT Data Validation documents (to be published as Volume II of this document) will list all orbits where the off-axis angles exceed 0.5 degree.

(9) The solar channels exhibited a degradation and recovery cycle in Year-1 which has been explained in the paper in Reference 14.

(10) Occasionally the ECAL makes the solar data look like a step function and the MSE algorithm cannot find solar peaks. This problem was corrected for data beyond October, 1980.

(11) Sometimes due to missing data in solar peaks, the peak values are misleading.

SECTION 4. LIMITATIONS OF DATA

4.1 ESTIMATION OF ACCURACY

Solar Channels:

The stated accuracy of any thermopile based radiometers is usually based on comparison with a standard. All of the sensors included in this discussion are thermopiles. However, one is a self-calibrating cavity radiometer. That is, Channel 10C. Its accuracy is based on its in-flight electrical calibration and the derived values of its instrument constants generally termed "Characterization". The major derived quantity is the "non-equivalence" which relates to the signal measured for a given radiant power to that for a set electrical power dissipated in the calibration heater. If there are no changes in absorbtivity as a result of exposure to the space environment, then the in-flight electrical calibration, together with the derived instrument constants, set the accuracy limit for the major measurement - the total solar irradiance. Our preflight analysis set the estimated accuracy at better than 0.5%. In-flight calibrations through September, 1982 (almost 4 years after launch) are holding steady at the resolution limit of ±0.026%. These calibrations are calculated from realtime output of Channel 10C and not from processed data such as the SEFDT discussed here.

Analysis of the flight data has allowed refinement of the Channel 10C temperatures coefficient as noted earlier.

All the other solar channels rely on preflight calibration data to obtain the results given in the SEFDT. Their stability is checked relative to an electrical calibration of the electronics (not the sensor) and radiometrically their performance may be checked by comparison with Channel 10C and with each other in a relative sense. The pre-flight accuracy and precision estimates for the various channels have been published earlier (Reference 16) and are given in Table 1.1. However, some logic must be employed in translating these preflight estimates to the actual flight conditions. Among the criteria are:

(1) A temperature coefficient cannot change sign.

(2) A spectral channel cannot yield a change greater than that in the total radiation unless it is compensated in another spectral channel in the opposite sense.

(3) There is not enough energy in the wavelength region below the range of the solar channels to account for large changes in the total.

(4) The channels must acquire the sun, on-axis, to yield a meaningful result.

(5) Degradation and recovery phenomena have been experienced by the channels having optical filters (see Predmore et al Reference 12).

(6) Large changes in the solar radiation in the ERB sensing regions would have been discovered by other means - possibly even by earthbound sensors.

(7) The in-flight radiometric calibration of Channels 1, 2, and 3 versus Channel 10C is superior to any calibration which could have been performed prior to launch.

(8) The results of other solar experiments, and the phenomena described by other solar indices may be considered in assessing the variability found in the ERB results.

(9) The angular response functions of channels other than 10C, must be considered in the selection of the on-sun time. Channel 5 has been chosen as the solar alignment indicator because it suffers the least degradation of those channels which have the proper angular response function.

Thus, the preflight calibrations of the filtered solar channels may be employed to assess the accuracy of the values measured shortly after launch, but beyond that, careful reasoning must be employed to assess radiometric accuracy.

It is interesting to discuss the adequacy of the prelaunch calibrations of the main ERB solar channels (1, 2, and 3) other than 10C since it relates to the reliability of the Nimbus-6 measurements. It is also of interest to discuss the stability of: (1) Channel 1 which is normally shuttered, and (2) Channel 3 which has no filters. Volume II, SEFDT Data Validation Document, includes discussions of these topics for the first year's data.

Channel 3 on Nimbus-6 had returned values believed to be about 1.8% too high for the solar constant, although carefully calibrated against cavity radiometers on the ground. Channel 3 on Nimbus-7 also returned values which were high relative to Channel 10C. However, Channels 1 and 2 have exhibited remarkable accuracy for filtered channels. While Channel 2 degrades, Channel 1 retains its agreement with Channel 10C when it is opened for periodic calibration orbits.

Wide Field of View Channels:

The WFOV Channels 11, 12, and 14 have shown little degradation throughout their first two years in orbit, while Channel 13 degraded about 3% during the first four months and little thereafter. Adjustment factors have been applied to remove the degradation. A comparison of the results from two years on Nimbus-6 WFOV with those from Nimbus-7 show that on the average the longwave fluxes differ about 3% while the albedos differ by a little over 1%. Studies of the absolute accuracy are currently being investigated and will be added later as an appendix to this document.

4.2 GENERAL PROBLEMS

Solar Channels:

It was found that a reflection phenomenon was present in the Channel 10C data that was not identified during ground testing. This required that the calculated irradiance be lowered by 0.2% (multiplied by 0.998). This has been applied to data on SEFDT.

The filter channels all suffered a rapid degradation and a later recovery making it very difficult to assess the data in the December, 1978 through March, 1979 time frame.

When the off-axis angle is greater than 1.1 degree, there is an apparent drop-off of Channel 10C and enhancement of Channel 3 signals. The mechanism was not identified during ground testing. It applies only to negative values of off-axis angle and is apparently caused by some spacecraft component or material not present during the ground testing.

When the off-axis angle approaches 1 degree, the on-sun identification using Channel 5 becomes difficult because the saddle shape of the angular response function becomes distorted.

For some orbits there appears to be anomalies which pertain to only one or two channels. These are easily identified as outliers for regression analysis and should be discarded. Orbits which have been identified are listed in the Volume II - SEFDT Data Validation Document.

APPENDIX A.

SEFDT Tape Specification

NIMBUS-7

NIMBUS OBSERVATION PROCESSING SYSTEM (NOPS)

REQUIREMENTS DOCUMENT #NG-15

EARTH RADIATION BUDGET (ERB) EXPERIMENT SOLAR AND EARTH FLUX DATA TAPE

ERB SEFDT TAPE SPECIFICATION NO. T134021

VERSION H02M/H03B

JUNE, 1984

Revised For:

National Aeronautics and Space Administration
Goddard Space Flight Center
Greenbelt, Maryland 20771

Revised By:

Systems and Applied Sciences Corporation
5809 Annapolis Road, Suite 414
Hyattsville, Maryland 20784

Contract No. NAS5-26773

Document No. SASC-T-5-5077-008-84

NIMBUS-7

NIMBUS OBSERVATION PROCESSING SYSTEM (NOPS)

REQUIREMENTS DOCUMENT #NG-15

EARTH RADIATION BUDGET (ERB) EXPERIMENT SOLAR AND EARTH FLUX DATA TAPE

ERB SEFDT TAPE SPECIFICATION NO. T134021

VERSION H02M/H03B

JUNE, 1984

REVISED BY: Sheldon T. Nutter
Mr. Sheldon T. Nutter/SASC (06/05/84)

REVIEWED BY: Richard J. Tighe
Dr. Richard J. Tighe (06/05/84)
SASC/ERB Project Manager

APPROVED BY:
Mr. Lonnie H. Bowlin (06/05/84)
SASC/NOPS Program Manager

Revised For:

National Aeronautics and Space Administration
Goddard Space Flight Center
Greenbelt, Maryland 20771

Revised By:

Systems and Applied Sciences Corporation
5809 Annapolis Road, Suite 414
Hyattsville, Maryland 20784

Contract No. NAS5-26773
Document No. SASC-T-5-5077-008-84

REVISION G: 01/26/82 (KMS)

All formats have been revised. The old specifications should be disregarded.

REVISION H: 09/16/82 (SNR)

(1) Channel 13 CAT reformatted. The current Channel 13 CAT file contains last file flags and last record flags which were not present earlier.

(2) Under Earth Flux Logical Record Format, clarifications are made as to how Channels 11 through 14 digital counts are actually arranged.

(3) Under Solar Data Logical Records, corrections are made in the Channels 1 through 10 data mean counts.

VERSION H02M/H03B: 06/05/84 (STN)

(1) Section V was revised to eliminate redundant descriptions of the standard header records.

(2) Descriptions of the data, CAT, and Channel 13 CAT files are now included under Section VI.

ABSTRACT

The ERB-SEFDT tape will be a 9-track, 1600 BPI tape containing five files. It will be generated on the SACC/GSFC IBM 3081 computer.

The first file will contain a NOPS Standard Header written twice.

The second file will accommodate up to thirty-one days' worth of Solar and Earth Flux Data stripped from the ERB Master Archive Tapes (MAT's). There will be five different types of logical records. The Earth Flux record will contain two VIP Major Frames (MF's) of data. The two separate solar records will contain one VIP MF of data per record. The irradiance calibration constant record will specify what calibration constants were used to compute solar irradiances. The solar orbital summary record will be the last record within an orbit block.

The third file contains a Calibration Adjustment Table (CAT) containing information on the calibration constants followed by an End of File (EOF) mark.

The fourth file contains a.Channel 13 CAT followed by an EOF mark. This table contains information on the Channel 13 calibration constants as a function of time and Solar Zenith Angle (SZA).

The fifth and final file contains the Trailing Documentation File (TDF) followed by a double EOF mark.

The data orbit will begin on the Descending Node (DN) of the satellite. The end of an orbit occurs when a solar summary record is read. All logical records within File 2 are the same length - 240 bytes.

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

I. REQUIREMENT IDENTIFICATION

ERB SEFDT Tape Specification Number T134021.

II. INPUT DATA SOURCE

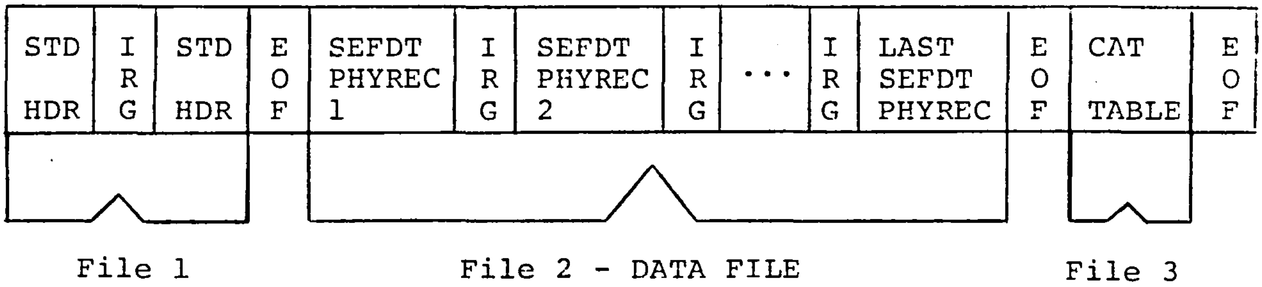
ERB MAT Tape Specification Number T134081.

III. OPERATING MODE

The SEFDT program will generate the tape monthly. The tape will have five files: one for the standard headers, one for the data records, one for the calibration adjustment table (CAT), one for the Channel 13 CAT, and one for the trailing documentation file (TDF).

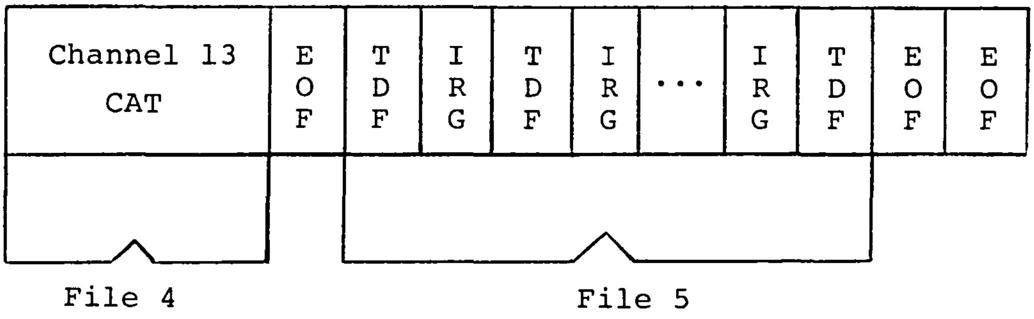
IV. GROSS FORMAT

The gross format is as shown below:



One Calendar Month's Data

Number of records will vary with number of orbits/month where maximum month = 31 days.



V. STANDARD HEADER SPECIFICATION AND TAPE DOCUMENTATION

V.1 GENERAL

All computer compatible tapes (CCTs) that are used as interfaces within NOPS require some form of identification. This applies to all CCTs that are currently defined by a NOPS tape specification, and that are also used for distribution or archiving purposes.

In addition to defining a "latest" product, data relating to previous products that went into the making of the "latest" product provides useful information when system problems occur.

The purpose of this section is to describe a system that allows the recording of the genealogy of a "latest" product, and in general, adheres to existing tape documentation standards.

In brief, the system consists of the following:

(1) The NOPS standard header (STD HDR) file remains as defined previously, with minor modifications to the standard header record that reflect both the existence of a TDF and adherence to the IPD standard for sequence numbers.

(2) A documentation file that consists of a string of physical records follows the data on any tape defined by a current NOPS tape specification. This will be referred to as a TDF and will be the last file on a tape when it exists.

The following sections define the NOPS standard header records and file, and the TDF.

V.2 STANDARD HEADER RECORD (SHR) FORMAT

The STD HDR will contain the following:

Two identical records (physical) of 630 characters (eight bits each) followed by an end-of-file (EOF).

The first 126 characters of the first record will consist of (see Figure V-1):

*NIMBUS-7$_b$NOPS$_b$SPEC$_b$NO$_b$T optional[1]	(1- 24 Characters)
XXXXXX (6-digit spec number)[2]	(25- 30 Characters)
$_b$SQ$_b$NO$_b$	(31- 37 Characters)
ADXXXXX (5-digit sequence number)[3]	(38- 44 Characters)

NOTE: If sequence number is zero, the tape is not a finished product (i.e., definitive ephemeris not used, artificial VIP data, etc.).

redo character -X (copy number 1 or 2)	(45- 46 Characters)
$_b$YYYY$_b$ (4-character subsystem ID)	(47- 52 Characters)
YYYY (Generation Facility ID)	(53- 56 Characters)
$_b$TO$_b$YYYY (4-character Destination Facility ID)	(57- 64 Characters)
$_b$START$_b$19XX$_b$DDD$_b$HHMMSS$_b$	(65- 87 Characters)
(start year, day of year, hours, minutes, seconds)	
$_b$TO$_b$19XX$_b$DDD$_b$HHMMSS$_b$	(88-106 Characters)
(end data and time of data)	
GEN$_b$19XX$_b$DDD$_b$HHMMSS$_b$	(107-126 Characters)
(date and time tape was generated)	

The second logical record, consisting of 126 characters, will contain information that is required to complete the history of the product.

---

[1] Character 1 will contain an asterisk (*) and serve to notify all sytems that a TDF is likely to follow the main data files and that the next logical record contains information relevant to complete identification.

[2] See Table V-1 for a detailed description of the NOPS specification codes.

[3] See Table V-2 for a description of the NOPS sequence numbering scheme.

CHARACTERS 1- 12 = Software program name and version number.

CHARACTERS 13- 18 = Program documentation reference number, if it exists.

CHARACTERS 20-126 = User defined comments that may be more relevant to the user than the preceding ones.

The third, fourth, and fifth groups of 126 characters each are intended for the use of the Subsystem Analysts for further identifications of their data. They may contain blanks, EBCDIC, BDC, or binary characters or zeros. However, in the case of CZCS, these logical records are used to define the genealogy of the image rather than the method of V.3.

The second record in the file is a duplicate of the first record for redundancy.

FIGURE V-1. Standard Header (Physical Record Format)

(1 Character = 8 Bits)

MSB 24 22 20 18 16 14 12 10 8 6 4 2 1 LSB

1	*NIMBUS-7$_b$NOPS$_b$SPEC$_b$NO$_b$T		
8	↑ IF TDF EXISTS	(24 CHARACTERS)	192
9	SPECIFICATION NUMBER (6 DIGITS)		
10	$_b$SQ$_b$NO$_b$	(7 CHARACTERS)	
13	PDFC CODE	(2 CHARACTERS)	
14	5-DIGIT SEQUENCE NUMBER - YJJJN *FOR CZCS, THESE CHARACTERS (40-45) ARE A 6-DIGIT SEQUENCE NUMBER (INCLUDES REDO)	(5 CHARACTERS)	
15	REDO CHARACTER		408
16	1-CHARACTER TAPE COPY NUMBER BLANK CHARACTER		
17	SUBSYSTEM I.D.	(4 CHARACTERS)	
18	BLANK CHARACTER SOURCE FACILITY	(4 CHARACTERS)	
19	BLANK CHARACTER		
20	(T) CHARACTER (0) CHARACTER BLANK CHARACTER		
21	DESTINATION FACILITY I.D.	(4 CHARACTERS)	
22	START YEAR, DAY, HOURS, MINUTES, SECONDS $_b$START$_b$19XX$_b$DDD$_b$HHMMSS$_b$	(23 CHARACTERS)	696
29	END DATE AND TIME OF DATA TO$_b$19XX$_b$DDD$_b$HHMMSS$_b$	(19 CHARACTERS)	
36	*SOME FACILITIES MAY NOT INCLUDE END TIME IN HEADER		
42	DATE AND TIME TAPE WAS GENERATED GEN$_b$19XX$_b$DDD$_b$HHMMSS$_b$	(20 CHARACTERS)	1008
84	SOFTWARE PROGRAM NAME (1-12) DOCUMENTATION (13-18) COMMENTS (19-126) BLANK	(126 CHARACTERS)	2016
126	BLANK	(126 CHARACTERS)	3024
168	BLANK	(126 CHARACTERS)	4032
210	BLANK	(126 CHARACTERS)	5040

EBCDIC TAPE FORMAT

TABLE V-1.

NOPS Specification Numbering Code

T X X X X X X

Tape Description:
1 = 9-track 1600 BPI
2 = 9-track 800 BPI
3 = 7-track 800 BPI
4 = 7-track 556 BPI
5 = HDT (IPD)
6 = 9-track 6250 BPI

Tape Number in Sequence for Subsystem (Code to be Derived)

Destination Facility:
1 = NOC (Pre-NOPS)
2 = MDHS (NOPS)
3 = SACC
4 = IPD
5 = LaRC
6 = NCAR
7 = NOAA
8 = OXFD
9 = LANN

Source Facility:
Same Code as Destination Facility

1 = ERB
2 = SMMR
3 = THIR
4 = SAM2
5 = LIMS
6 = SBUV
7 = CZCS
8 = SAMS
9 = ILT

Tapes: A 6-digit number prefixed with a T to denote TAPE will be used.

TABLE V-2.

NOPS Sequence Number Specification

CHARACTER 40 : The last digit of the year in which the data were acquired.

CHARACTERS 41-43: Julian day of the year in which the data were acquired.

CHARACTER 44 : Sequence number for this particular product (usually a 1) (e.g., CLDTs will have a 1 and 2, as there are two products per day).

CHARACTER 45 : The existing hyphen remains unless there is a remake of the tape for any reason. In this case, an ascending alpha character will replace the hyphen, and the most recent reasons for remake will be recorded in Logical Record 4 of the header.

CHARACTER 47 : This will remain as a blank unless it is needed to remove ambiguities in CHARACTER 40. This may occur if data are being acquired on October 24, 1988.

NOTE: For CZCS, Characters 40 through 45 are a 6-digit sequence number.

The ERB PDFC codes are as defined in Table V-3.

EXAMPLE: An ERB MATRIX tape covering the month of February 1979 is generated by SACC and sent to IPD for production of contour maps on 35mm microfilm. The NOPS standard header file on the tape that IPD receives would contain two of the following records:

*NIMBUS-7$_{b}$NOPS$_{b}$SPEC$_{b}$NO$_{b}$T134031$_{b}$SQ$_{b}$NO$_{b}$

AA90321-2$_{b}$ERB$_{bb}$SACC$_{b}$TO$_{b}$IPD$_{bb}$START$_{b}$1979$_{b}$

032$_{b}$000432$_{b}$TO$_{b}$1979$_{b}$059$_{b}$235742$_{b}$GEN$_{b}$

1979$_{b}$104$_{b}$094500$_{b}$followed by 504 blanks

First day of time period may not be first data day in the event of multi-day stacked products that are based in an ILT week.

TABLE V-3.

ERB PDF Codes

TAPE ID	PDF	DATA TYPE
MAT	AC	MTAC
SEFDT	AD	SEAD
MATRIX	AA	MAAA
DELMAT	AJ	DEAJ
SAVER	AI	SEAI
TABLES	AB	TAAB
ZMT	AE	ZMAE

V.3 TRAILING DOCUMENTATION FILE (TDF)

The TDF will consist of all NOPS standard header records (non-duplicated) that relate to products that have gone into the making of the current product. Documentation records will be sequenced in accordance with their access; that is, first in is the first recorded. Every TDF is 630 bytes in length.

The first record of this file will serve to identify the file as a TDF. This will be accomplished by placing asterisks in CHARACTERS 1 through 10 followed by NOPS TRAILING DOCUMENTATION FILE FOR TAPE PRODUCT T [SPEC NO (six digits)] GENERATED ON DDD HH MM. The exact spacing of this comment is noncritical as long as it is less than 116 characters. The second physical record will be a repeat of the header file NOPS standard header record for this type with the proviso that data referring to the end time are correct for the data set. Following physical records will be an accumulation of TDFs of all input tapes. For those products that require more than one tape, the TDF will appear on the last tape only as well as the warning asterisk.

V.4 TAPE DUPLICATION

It has been determined that the duplication of master tapes is neither time nor cost effective; thus, the requirement of duplication implied in the preceding specification is rescinded. However, some tapes that require a great deal of effort to produce in terms of manpower and computer time should be duplicated.

If a redo is required due to tape errors or algorithm changes, this will be noted both on the CCT (HEADER C-45) and on the canister.

V.5 SHIPPING LETTERS

IPD will include a shipping letter with every tape distributed. The shipping letter will be printed directly from the first 126 (or 138) characters of the first physical record of the standard header file (SHF). In the event of copies made from CCTs that are not generated in IPD, a new physical record reflecting IPD as the source and the Nimbus experimenter to whom the tape is being sent as the destination, will be added as the second record of the TDF. All existing records in the TDF will be pushed down, but none will be lost. This record should also replace those in the SHF.

VI. DATA FILE

The data file will contain one month's worth of solar and earth flux data. All data are right justified, 16-bit integers unless otherwise stated.

Within the file, there will be five types of logical records:

(1) Type 21 - Earth Flux Logical Record

(2) Type 22 - Solar Data Logical Record #1 (Channels 1-5)

(3) Type 23 - Solar Data Logical Record #2 (Channels 6-10)

(4) Type 24 - Solar Orbital Summary Record

(5) Type 25 - Irradiance Calibration Constant Record

The first logical record of any orbit will be an earth flux record. After all the earth flux records for that orbit will come 110 solar data records in the following order:

(1) Two each of Types 22 and 23 records centered at T_0-13 minutes.

(2) Fifty each of Types 22 and 23 records centered at T_0 minutes (25 frames on either side of the frame that includes T_0 for a total of 51 frames).

(3) Two each of Types 22 and 23 records centered at T_0+13 minutes.

The records will be interleaved (i.e., for each VIP major frame time, a Type 22 record will appear first followed by a Type 23 record).

The solar orbital summary record is the very last logical record of an orbit block. The next logical record will therefore begin a new orbit data block.

The time T_0 is the time of the minimum solar elevation (MSE) with respect to the ERB instrument as determined by Channel 5 data only. This time is the reference for extracting data from the other solar channels.

The irradiance calibration constant record will be the last record in the data file. This record will contain information regarding the computation of solar irradiances.

Some additional information is inserted into the physical record after it has been filled with 66 logical data records. There is a 16-bit word giving the number ('N') of solar orbital summary records in this physical record. Following this word, there are 'N' 16-bit words giving the numbers of the logical records which contain solar orbital summary records.

There are 240-16N spare bits following the 66th logical record which are zero filled. These bits are used to fill out the physical record to a size which can be read on any 24-, 32-, or 36-bit machine. Also included is a 16-bit 1's complement add checksum word which can be used for checking the hardware that processes the data.

DATA FILE

GROSS PHYSICAL RECORD

60	LOGICAL RECORD 1	
61-120	LOGICAL RECORD 2	
121-180	LOGICAL RECORD 3	
181-240	LOGICAL RECORD 4	
241-300	LOGICAL RECORD 5	
301-360	LOGICAL RECORD 6	
361-420	LOGICAL RECORD 7	
	⋮	
3661-3720	LOGICAL RECORD 62	
3721-3780	LOGICAL RECORD 63	
3781-3840	LOGICAL RECORD 64	
3841-3900	LOGICAL RECORD 65	
3901-3960	LOGICAL RECORD 66	
3961		
3962	LOGICAL RECORD # OF FIRST SOLAR ORBITAL SUMMARY RECORD	LOGICAL RECORD # OF SECOND SOLAR ORBITAL SUMMARY RECORD
	SPARES	NUMBER OF SOLAR ORBITAL SUMMARY LOGICAL RECORDS IN CURRENT PHYSICAL RECORDS
3968	LOGICAL RECORD # OF (N-2) th SOLAR ORBITAL SUMMARY RECORD	LOGICAL RECORD # OF (N-1) th SOLAR ORBITAL SUMMARY RECORD
3969	LOGICAL RECORD # OF Nth SOLAR ORBITAL SUMMARY RECORD	CHECKSUM

15876	8-bit bytes
7938	2-byte words
3969	4-byte words

DATA FILE GROSS PHYSICAL RECORD FORMAT

Up to sixty-six logical records can appear in a physical record. Sixty 4-byte (8 bits/byte) words are needed for each logical record.

(1) Logical Record

Each logical record requires 240 bytes within the physical record. Data file physical records will contain Record Types 21, 22, 23, 24, and 25.

(2) Spares

These two spare bytes will be zero filled.

(3) Number of Solar Orbital Summary Logical Records (16 bits)

The number of solar orbital summary records contained within the specified physical record. There can be a maximum of fifteen summary records per physical record.

(4) Solar Orbital Summary Logical Record Numbers

The logical record numbers of any solar orbital summary records appearing within the specified physical record.

(5) Checksum

This is a 16-bit 1's complement checksum. The checksum will use all words except the last, where the checksum will be placed. Each word is added together and checked for overflow. Any overflow is added back into the least significant side of the summation word. The final summation is the checksum.

EARTH FLUX LOGICAL RECORD

1	PHYSICAL RECORD NO.	SPARES	FILE CONT	RECORD ID	LOGICAL RECORD NO.
2	PHYSICAL RECORD NO.		RECORD ID		
3	LOGICAL RECORD NO.		ALGORITHM ID		
4	CALIBRATION SET NO.		ORBIT NO.		
5	YEAR		DAY OF YEAR		
6	GMT HOURS/MIN		GMT SEC		
7	SOLAR AZIMUTH		SOLAR ZENITH		
8	S/C SUBLATITUDE		S/C SUBLONGITUDE		
9	INSTRUMENT STATUS WORD		S/C ALTITUDE		
10	TIME SINCE ERB TURN ON				
11 ↓ 18	CH 11-14 IRRADIANCES 4 SAMPLES/CHANNEL IN CHANNEL ORDER				
19 ↓ 26	CH 11-14 DIGITAL COUNTS 4 SAMPLES/CHANNEL IN CHANNEL ORDER				
27 28	CH 11-14 THERMOPILE BASE TEMPERATURES				
29 30	CH 11-14 MODULE TEMPERATURES				
31	CH 11 SHUTTER TEMPERATURE		CH 12 SHUTTER TEMPERATURE		
32	CH 12 FOV STOP TEMPERATURE		SPARES		
33 ↓ 60	WORDS 5 → 32 INCLUSIVE REPEATED FOR NEXT VIP MAJOR FRAME				

EARTH FLUX LOGICAL RECORD FORMAT

The reference time associated with all the information below is the beginning of the VIP major frame, unless otherwise stated.

(1) Physical Record Number (12 bits)

The physical record count will start at 1 and will increment by 1 for each physical record in a data file.

(2) Spare (4 bits)

These bits are zero filled.

(3) File Continuation (2 bits)

The MSB will be set to 1 if that record is the last one written in the file. The LSB will be set to 1 on all records contained in the last file on the tape.

(4) Record Identification (6 bits)

Identifies the record type. For earth flux records, the record ID is 21.

(5) Logical Record Number (8 bits)

The logical record count will start at 1 at the beginning of a physical record and will increment by 1 for each logical record actually placed within the physical record.

(6) Physical Record Number

Same as Item 1.

(7) Record Identification

Same as Item 2.

(8) Logical Record Number

Same as Item 5.

(9) Algorithm Identification

SEFDT program version number.

(10) Calibration Set Number

Identifies the calibration data used in computing solar irradiances.

(11) Orbit Number

Data orbit number.

(12) Year

4-Digit year number.

(13) Day of Year

GMT day number.

(14) GMT Hours/Minutes

GMT hours*100+minutes of the start of data for this VIP major frame.

(15) GMT Seconds

GMT seconds of the start of data for this VIP major frame (0-59).

(16) Solar Azimuth

Solar azimuth angle at the subsatellite point in degrees (-180 to +180), scaled by 10.

(17) Solar Zenith

Solar zenith angle at the subsatellite point in degrees (0 to 180), scaled by 10.

(18) S/C Subsatellite Latitude

Geodetic latitude at the subsatellite point in degrees (-90 south to +90 north), scaled by 100. The reference time is two seconds into the start of the major frame.

(19) S/C Subsatellite Longitude

Geodetic longitude at the subsatellite point in degrees (-180 west to +180 east), scaled by 100. The reference time is two seconds into the start of the major frame.

(20) Instrument Status Word

Sixteen bits converted to a decimal number and interpreted as follows:

Units Decimal Digit

(indicates position of scanhead)

0 = scan mode
1 = nadir position
2 = space position
3 = LW check position
4 = SW check position
9 = transition mode

Tens Decimal Digit

(indicates status of shutters, Channels 1, 11, and 12)

0 = reference channels CLOSED, Channel 12 OPEN
1 = reference channels CLOSED, Channel 12 CLOSED
2 = reference channels OPEN, Channel 12 OPEN
3 = reference channels OPEN, Channel 12 CLOSED
9 = status unknown

Hundreds Decimal Digit

(indicates status of Channel 12 FOV)

0 = Channel 12 FOV wide
1 = Channel 12 FOV narrow
9 = status unknown

Thousands Decimal Digit

(indicates status of electronic calibration and GO/NOGO heater)

0 = GO/NOGO heater OFF, electronic calibration OFF
1 = GO/NOGO heater OFF, electronic calibration ON
2 = GO/NOGO heater ON, electronic calibration OFF
9 = status unknown

(21) S/C Altitude

The S/C altitude in km scaled by 1000. The reference time is two seconds into the start of the major frame.

(22) Time Since ERB Turn On

Time, in seconds, from the ERB instrument being turned on, to the beginning of the major frame.

(23) Channels 11 through 14 Irradiances

Four irradiances each for Channels 11 and 12 (0-12000), four irradiances for Channels 13 (0-9000), and four irradiances for Channel 14 (0-5000), all scaled by 10.

(24) Channels 11 through 14 Digital Counts

Earth flux channels detector output in counts with four samples per channel. The channels are grouped together and then time ordered.

(25) Channels 11 through 14 Thermopile Base Temperatures

Instrument temperatures in centigrade measured with a thermistor and scaled by 10.

(26) Channels 11 through 14 Module Temperatures

Module temperature in centigrade measured with a thermistor and scaled by 10.

(27) Channel 11 Shutter Temperature

Channel 11 shutter temperature in centigrade measured with a thermistor and scaled by 10.

(28) Channel 12 Shutter Temperature

Channel 12 shutter temperature in centigrade measured with a thermistor and scaled by 10.

(29) Channel 12 FOV Stop Temperature

Channel 12 FOV stop temperature in centigrade measured with a thermistor and scaled by 10.

(30) Spares

These two spare bytes will be zero filled.

(31) Second VIP Major Frame

Items 12 through 30 are repeated to the next VIP major frame. These correspond to Words 5 through 32.

SOLAR DATA LOGICAL RECORDS

<table>
<tr><td>1</td><td>PHYSICAL RECORD NO.</td><td>SPARES</td><td>FILE CONT</td><td>RECORD ID</td><td>LOGICAL RECORD NO.</td></tr>
<tr><td>2</td><td colspan="2">PHYSICAL RECORD NO.</td><td colspan="3">RECORD ID</td></tr>
<tr><td>3</td><td colspan="2">LOGICAL RECORD NO.</td><td colspan="3">ALGORITHM ID</td></tr>
<tr><td>4</td><td colspan="2">CALIBRATION SET NO.</td><td colspan="3">ORBIT NO.</td></tr>
<tr><td>5</td><td colspan="2">YEAR</td><td colspan="3">DAY OF YEAR</td></tr>
<tr><td>6</td><td colspan="2">GMT HOURS/MIN</td><td colspan="3">GMT SEC</td></tr>
<tr><td>7</td><td colspan="2">SOLAR AZIMUTH</td><td colspan="3">SOLAR ELEVATION</td></tr>
<tr><td>8</td><td colspan="2">SOLAR RIGHT ASCENSION</td><td colspan="3">SOLAR DECLINATION</td></tr>
<tr><td>9</td><td colspan="2">ISW</td><td colspan="3">GAMMA ANGLE</td></tr>
<tr><td>10</td><td colspan="5">SUN-EARTH DISTANCE</td></tr>
<tr><td>11 ↓ 15</td><td colspan="5">THERMOPILE BASE TEMPERATURES</td></tr>
<tr><td>16 ↓ 55</td><td colspan="5">DIGITAL COUNTS CH 1-5 OR CH 6-10</td></tr>
<tr><td>56 ↓</td><td colspan="5">MISCELLANEOUS SOLAR ASSEMBLY TEMPERATURES</td></tr>
<tr><td>60</td><td colspan="2"></td><td colspan="3">SPARES</td></tr>
</table>

SOLAR DATA LOGICAL RECORDS

The reference time associated with all the information below is the beginning of the VIP major frame unless otherwise stated:

(1) Physical Record Number (12 bits)

The physical record count will start at 1 and will increment by 1 for each physical record in a data file.

(2) Spare (4 bits)

These bits are zero filled.

(3) File Continuation (2 bits)

The MSB will be set to 1 if that record is the last one written in the file. The LSB will be set to 1 on all records contained in the last file on the tape.

(4) Record Identification (6 bits)

Identifies the record type. For solar data record #1, the record ID is 22. For solar data record #2, the record ID is 23.

(5) Logical Record Number (8 bits)

The logical record count will start at 1 at the beginning of a physical record and will increment by 1 for each logical record actually placed within the physical record.

(6) Physical Record Number

Same as Item 1.

(7) Record Identification

Same as Item 2.

(8) Logical Record Number

Same as Item 5.

(9) Algorithm Identification

SEFDT program version number.

(10) Calibration Set Number

Identifies the calibration data used in computing fluxes.

(11) Orbit Number

Data orbit number.

(12) Year

4-Digit year number.

(13) Day of Year

GMT day number.

(14) GMT Hours/Minutes

GMT hours*100+minutes of the start of data for this VIP major frame.

(15) GMT Seconds

GMT seconds of the start of data for this VIP major frame (0-59).

(16) Solar Azimuth

Azimuth of the sun relative to the S/C axes from the ERB ILT. Value is in degrees (-180 to +180), scaled by 10. This is the DSAS beta angle. The reference time is seven seconds into the start of the major frame (i.e., the time associated with the 8th sample).

(17) Solar Elevation

Elevation of the sun relative to the S/C axes from the ERB ILT. Value is in degrees (-180 to +180), scaled by 10. This is the DSAS alpha angle. The reference time is seven seconds into the start of the major frame (i.e., the time associated with the 8th sample).

(18) Solar Right Ascension

Right ascension of the sun in degrees (-180 to +180), scaled by 100 and taken from the ERB ILT ephemeris data. The reference time is two seconds into the start of the major frame.

(19) Solar Declination

Declination of the sun in degrees (-90 to +90), scaled by 100 and taken from the ERB ILT ephemeris data.

(20) Instrument Status Word

Sixteen bits converted to a decimal number and interpreted as follows:

Units Decimal Digit

(indicates position of scanhead)

0 = scan mode
1 = nadir position
2 = space position
3 = LW check position
4 = SW check position
9 = transition mode

Tens Decimal Digit

(indicates status of shutters, Channels 1, 11, and 12)

0 = reference channels CLOSED, Channel 12 OPEN
1 = reference channels CLOSED, Channel 12 CLOSED
2 = reference channels OPEN, Channel 12 OPEN
3 = reference channels OPEN, Channel 12 CLOSED
9 = status unknown

Hundreds Decimal Digit

(indicates status of Channel 12 FOV)

0 = Channel 12 FOV wide
1 = Channel 12 FOV narrow
9 = status unknown

Thousands Decimal Digit

(indicates status of electronic calibration and GO/NOGO heater)

0 = GO/NOGO heater OFF, electronic calibration OFF
1 = GO/NOGO heater OFF, electronic calibration ON
2 = GO/NOGO heater ON, electronic calibration OFF
9 = status unknown

(21) Spares

These two spare bytes will be zero filled.

(22) Gamma Angle

The solar channel subassembly position at the middle of the major frame.

(23) Sun-Earth Distance

The Sun-Earth distance in astonomical units scaled by 10000.

(24) Thermopile Base Temperatures

Thermistor temperatures in centigrade for Channels 1 through 10 with a scale factor of 10.

(25) Digital Counts

The sixteen 16-bit samples for each channel are given in channel number order with time increasing in each channel's group. For example:

Channel 1 Group

S1, S2, S3, S4, S5, S6, ... S16

T_0, T+1, T+2, T+3, T+4, T+5, ... T+15 seconds

Channel 2 Group

S1, S2, S3, S4, S5, S6, ... S16

T_0, T+1, T+2, T+3, T+4, T+5, ... T+15 seconds

where

Sx = sample number

T_0 = time of earliest sample in major frame

Solar data record #1 contains the data for Channels 1 through 5, and solar data record #2 contains the data for Channels 6 through 10.

(26) Solar Assembly Temperatures

Miscellaneous solar assembly temperatures in the following order:

1 Channel 1S Module Temperature
2 Channel 2S Module Temperature
3 Channel 3S Module Temperature
4 Channel 6S Module Temperature
5 Channel 9S Module Temperature
6 Channel 10S Module Temperature
7 Solar Channel Assembly, Top
8 Solar Channel Assembly, Bottom
9 Solar Assembly Drive Motor Temperature

(27) Spares

These two spare bytes will be zero filled.

SOLAR ORBITAL SUMMARY RECORD

<table>
<tr><td>1</td><td>PHYSICAL RECORD NO.</td><td>SPARES</td><td>FILE CONT</td><td>RECORD ID</td><td>LOGICAL RECORD NO.</td></tr>
<tr><td>2</td><td colspan="2">PHYSICAL RECORD NO.</td><td colspan="3">RECORD ID</td></tr>
<tr><td>3</td><td colspan="2">LOGICAL RECORD NO.</td><td colspan="3">ALGORITHM ID</td></tr>
<tr><td>4</td><td colspan="2">CALIBRATION SET NO.</td><td colspan="3">ORBIT NO.</td></tr>
<tr><td>5</td><td colspan="2">YEAR</td><td colspan="3">DAY OF YEAR</td></tr>
<tr><td>6</td><td colspan="2">GMT HOURS/MIN</td><td colspan="3">GMT SEC</td></tr>
<tr><td>7</td><td colspan="2">SOLAR AZIMUTH</td><td colspan="3">SOLAR ELEVATION</td></tr>
<tr><td>8</td><td colspan="2">SOLAR RIGHT ASCENSION</td><td colspan="3">SOLAR DECLINATION</td></tr>
<tr><td>9</td><td colspan="2">ISW</td><td colspan="3">GAMMA ANGLE</td></tr>
<tr><td>10</td><td colspan="5">SUN-EARTH DISTANCE</td></tr>
<tr><td>11 → 15</td><td colspan="5">THERMOPILE BASE TEMPERATURES</td></tr>
<tr><td>16 → 30</td><td colspan="5">MEAN COUNTS CH 1-10 T_o-13, T0, T_o+13</td></tr>
<tr><td>31 → 35</td><td colspan="5">NET SOLAR IRRADIANCES CHS 1-10</td></tr>
<tr><td>36</td><td colspan="2">SOUTHERN TERMINATOR HOURS/MIN</td><td colspan="3">SOUTHERN TERMINATOR SEC</td></tr>
<tr><td>37 → 60</td><td colspan="5">SPARES</td></tr>
</table>

SOLAR ORBITAL SUMMARY RECORD

The reference time for all the information below is T_0 - the time of the minimum solar elevation with respect to the ERB instrument as determined from Channel 5.

(1) Physical Record Number (12 bits)

The physical record count will start at 1 and will increment by 1 for each physical record in a data file.

(2) Spare (4 bits)

These bits are zero filled.

(3) File Continuation (2 bits)

The MSB will be set to 1 if that record is the last one written in the file. The LSB will be set to 1 on all records contained in the last file on the tape.

(4) Record Identification (6 bits)

Identifies the record type. For solar orbital summary records, the record ID is 24.

(5) Logical Record Number (8 bits)

The logical record count will start at 1 at the beginning of a physical record and will increment by 1 for each logical record actually placed within the physical record.

(6) Physical Record Number

Same as Item 1.

(7) Record Identification

Same as Item 2.

(8) Logical Record Number

Same as Item 5.

(9) Algorithm Identification

SEFDT program version number.

(10) Calibration Set Number

Identifies the calibration data used in computing fluxes.

(11) Orbit Number

Data orbit number.

(12) Year

4-Digit year number.

(13) Day of Year

GMT day number.

(14) GMT Hours/Minutes

GMT hours*100+minutes of Channel 5 T_0.

(15) GMT Seconds

GMT seconds of Channel 5 T_0.

(16) Solar Azimuth

Azimuth of the sun relative to the S/C axes from the ERB ILT. Value is in degrees (-180 to +180), scaled by 10. This is the DSAS beta angle.

(17) Solar Elevation

Elevation of the sun relative to the S/C axes from the ERB ILT. Value is in degrees (-180 to +180), scaled by 10. This is the DSAS alpha angle.

(18) Solar Right Ascension

Right ascension of the sun in degrees (0 to +360), scaled by 100 and taken from the ERB ILT ephemeris data. The reference time is two seconds into the start of the major frame containing the Channel 5 T_0.

(19) Solar Declination

Declination of the sun in degrees (-90 to +90), scaled by 100 and taken from the ERB ILT ephemeris data.

(20) Instrument Status Word

Determined from VIP major frame containing Channel 5 T_0.

Units Decimal Digit

(indicates position of scanhead)

0 = scan mode
1 = nadir position
2 = space position
3 = LW check position
4 = SW check position
9 = transition mode

Tens Decimal Digit

(indicates status of shutters, Channels 1, 11, and 12)

0 = reference channels CLOSED, Channel 12 OPEN
1 = reference channels CLOSED, Channel 12 CLOSED
2 = reference channels OPEN, Channel 12 OPEN
3 = reference channels OPEN, Channel 12 CLOSED
9 = status unknown

Hundreds Decimal Digit

(indicates status of Channel 12 FOV)

0 = Channel 12 FOV wide
1 = Channel 12 FOV narrow
9 = status unknown

Thousands Decimal Digit

(indicates status of electronic calibration and GO/NOGO heater)

0 = GO/NOGO heater OFF, electronic calibration OFF
1 = GO/NOGO heater OFF, electronic calibration ON
2 = GO/NOGO heater ON, electronic calibration OFF
9 = status unknown

(21) Spares

These two spare bytes will be zero filled.

(22) Gamma Angle

The solar channel subassembly position at the middle of the major frame containing T_0.

(23) Sun-Earth Distance

The Sun-Earth distance in astonomical units scaled by 100,000.

(24) Thermopile Base Temperatures

Thermistor temperatures in centigrade for Channels 1 through 10 with a scale factor of 10.

(25) Channels 1 through 10 Mean Counts

The mean value in counts for each channel. Values within each channel set are centered at times T_0-13, T_0, and T_0+13 minutes where T_0 is the time of the MSE

determined from Channel 5. Nine points are used in computing the average. The order the data appears within the record is as follows:

Channel 1 Group

T_0-13, T_0, T_0+13 minutes

Channel 2 Group

T_0-13, T_0, T_0+13 minutes

.
.
.

Channel 10 Group

T_0-13, T_0, T_0+13 minutes

(26) Net Solar Irradiance

The net solar irradiance in W/m^2 for each channel in order. The scale factor for Channels 1 through 5 and 10C is 10, and the scale factor for Channels 6 through 9 is 100.

An explanation of the formulas used to compute the net solar irradiance is given in Section 2.2.

(27) Time at Southern Terminator

GMT hours*100+minutes of southern terminator crossing.

(28) Time at Southern Terminator

GMT seconds of southern terminator crossing.

(29) Spares

These 96 spare bytes will be zero filled.

IRRADIANCE CALIBRATION DATA RECORD

<table>
<tr><td>1</td><td>PHYSICAL RECORD NO.</td><td>SPARES</td><td>FILE CONT</td><td>RECORD ID</td><td>LOGICAL RECORD NO.</td></tr>
<tr><td>2</td><td colspan="2">PHYSICAL RECORD NO.</td><td colspan="3">RECORD ID</td></tr>
<tr><td>3</td><td colspan="2">LOGICAL RECORD NO.</td><td colspan="3">ALGORITHM ID</td></tr>
<tr><td>4</td><td colspan="2">CALIBRATION SET NO.</td><td colspan="3">SPARE</td></tr>
<tr><td>5 ↓ 14</td><td colspan="5">CHANNEL SENSITIVITY IN VACUUM AT 25° C
CH 1-10</td></tr>
<tr><td>15 ↓ 24</td><td colspan="5">CHANNEL SENSITIVITY TEMPERATURE CORRECTION FACTOR
CH 1-10</td></tr>
<tr><td>25 ↓ 60</td><td colspan="5">SPARES</td></tr>
</table>

IRRADIANCE CALIBRATION DATA RECORD

(1) Physical Record Number (12 bits)

The physical record count will start at 1 and will increment by 1 for each physical record in a data file.

(2) Spare (4 bits)

These bits are zero filled.

(3) File Continuation (2 bits)

The MSB will be set to 1 if that record is the last one written in the file. The LSB will be set to 1 on all records contained in the last file on the tape.

(4) Record Identification (6 bits)

Identifies the record type. For calibration records, the record ID is 25.

(5) Logical Record Number (8 bits)

The logical record count will start at 1 at the beginning of a physical record and will increment by 1 for each logical record actually placed within the physical record.

(6) Physical Record Number

Same as Item 1.

(7) Record Identification

Same as Item 2.

(8) Logical Record Number

Same as Item 5.

(9) Algorithm Identification

SEFDT program version number.

(10) Calibration Set Number

Identifies the calibration data used in computing fluxes.

(11) Spares

These two spare bytes are zero filled.

(12) Channel Sensitivity

Channel sensitivity in a vacuum at 25°C (22°C for Channel 10 only) in counts per Watts/m^2. The coefficients are scaled by 10^4. These values are stored as 32-bit integers. See Section 2.2 for more information.

(13) Temperature Sensitivity

Temperature sensitivity in a vacuum at 25°C (22°C for Channel 10 only) in per °C. The coefficients appear in channel order and are scaled by 10^6. These values are stored as 32-bit integers. See Section 2.2 for more information.

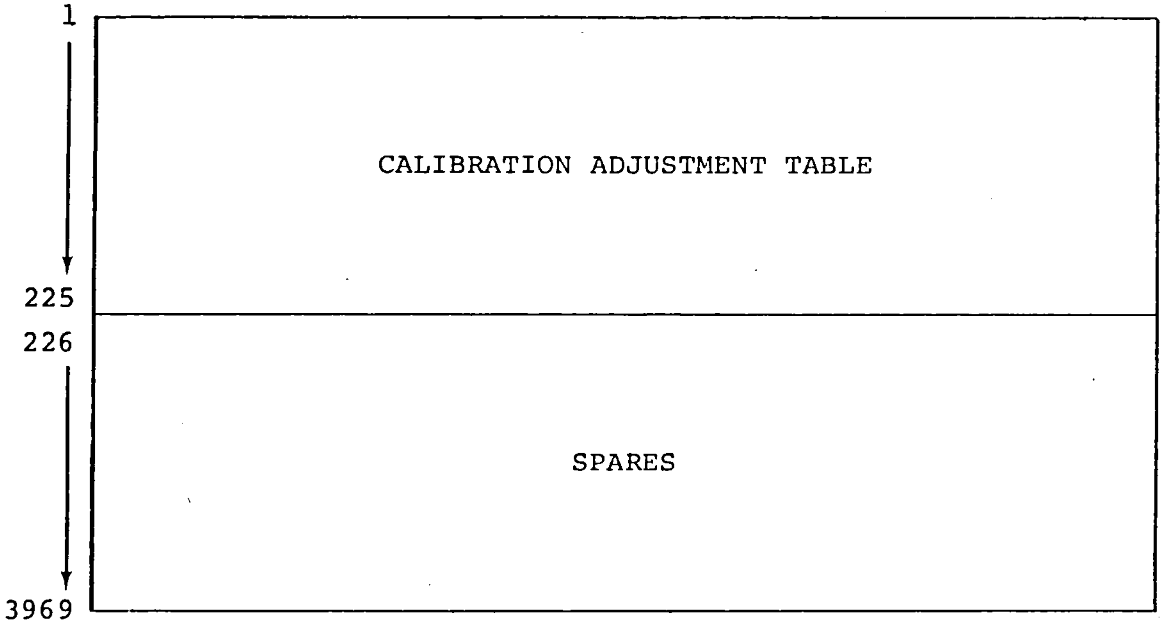
(14) Spares

These 144 spare bytes are zero filled.

CALIBRATION ADJUSTMENT TABLE FILE - GROSS PHYSICAL RECORD FORMAT

This file will contain one logical record, the calibration adjustment table. This record will be 900 bytes (8 bits/byte) long. The remainder of the physical record will be zero filled.

CAT FILE GROSS PHYSICAL RECORD



15876	8-bit bytes
7938	2-byte words
3969	4-byte words

CALIBRATION ADJUSTMENT TABLE RECORD FORMAT

<table>
<tr><td>1</td><td>PHYSICAL RECORD NO.</td><td>SPARES</td><td>FILE CONT.</td><td>RECORD I.D.</td><td>LOGICAL RECORD NO.</td></tr>
<tr><td>2</td><td colspan="2">START YEAR</td><td colspan="3">START MONTH</td></tr>
<tr><td>3</td><td colspan="2">START DAY</td><td colspan="3">END YEAR</td></tr>
<tr><td>4</td><td colspan="2">END MONTH</td><td colspan="3">END DAY</td></tr>
<tr><td>5</td><td colspan="2">GENERATION YEAR</td><td colspan="3">GENERATION MONTH</td></tr>
<tr><td>6</td><td colspan="2">GENERATION DAY</td><td colspan="3">SPARES</td></tr>
<tr><td>7
↓
18</td><td colspan="5">CHANNEL ADJUSTMENT SLOPES</td></tr>
<tr><td>19
↓
29</td><td colspan="5">CHANNEL ADJUSTMENT INTERCEPTS</td></tr>
<tr><td>30
↓</td><td colspan="5">CHANNEL ADJUSTMENT UNCERTAINTIES</td></tr>
<tr><td>41</td><td colspan="2"></td><td colspan="3">SPARES</td></tr>
<tr><td>42
↓
225</td><td colspan="5">CHANNEL ADJUSTMENT TABLE COMMENTS</td></tr>
</table>

CALIBRATION ADJUSTMENT TABLE (CAT)

This record contains a table of suggested adjustments to the ERB radiances and irradiances (CAT) for Channels 1 through 10C, 11, 12, 12N, and 13 through 22. These adjustment factors are computed after the MAT has been produced and are added to the SEFDT and to the MAT before archiving. The description of the constituent items are as follows:

(1) Physical Record Number (12 bits)

The physical record number will be set to 1. There is only one physical record in this file.

(2) Record ID (8 bits)

Identifies record type in a file, last record in file and records in last file on tape. The MSB will be set to 1 if that record is the last one written in the file. The second most MSB will be set on all records in the last file on the tape. The record type will use the 6th LSB of that byte to identify the type of record being read. A value of 26 indicates a CAT record.

(3) Logical Record Number (8 bits)

This identifies the logical record within the physical record. It will be set to 1.

(4) Start Year (16 bits)

The units and tens digits of the calendar year of the start of the period for which the adjustments apply.

(5) Start Month (16 bits)

The month (1-12) of the start of the period for which the adjustments apply.

(6) Start Day (16 bits)

The day of month of the start of the period for which the adjustments apply.

(7) Stop Year (16 bits)

The units and tens digits of the calendar year of the end of the period for which the adjustments apply.

(8) Stop Month (16 bits)

The month (1-12) of the end of the period for which the adjustments apply.

(9) Stop Day (16 bits)

The day of month of the end of the period for which the adjustments apply.

(10) Generation Year (16 bits)

The units and tens digits of the year in which the CAT was generated.

(11) Generation Month (16 bits)

The month (1-12) in which the CAT was generated.

(12) Generation Day (16 bits)

The day of month on which the CAT was generated.

(13) Spares

These two spare bytes will be zero filled.

(14) Adjustment Slopes (23 channels x 16 bits = 368 bits)

The adjustment slopes A_1 to be applied to the ERB channel radiances: $S^* = A_1 S + A_2$ where S^* = corrected channel value, S = uncorrected channel value. The slopes are stored in the following order: Channels 1 through 10C, 11, 12, 12N, 13 through 22. The adjustment slopes are stored with a scale factor of 1000.

(15) Adjustment Intercepts (23 channels x 16 bits = 368 bits)

The adjustment intercepts A_2 to be applied to the ERB channel radiances: $S^* = A_1 S + A_2$ where S^* = corrected channel radiance, S = uncorrected channel radiance. The intercepts are stored in the following order: Channels 1 through 10C, 11, 12, 12N, 13 through 22. The adjustment intercepts are stored with a scale factor of 10.

(16) Adjustment Uncertainties (23 channels x 16 bits = 368 bits)

The percent uncertainty of the channel values after the correction has been applied (scaled by 10). The uncertainties are stored in the following order: Channels 1 through 10C, 11, 12, 12N, 13 through 22.

(17) Spares

These two spare bytes will be zero filled.

(18) <u>Adjustment Comments</u> (32 characters x 23 channels x 8 bits)

A comment field of 32 EBCDIC characters for each of the 23 adjustments above.

CHANNEL 13 CALIBRATION ADJUSTMENT TABLE FILE - GROSS PHYSICAL RECORD FORMAT

Up to nine logical records can appear in a phyiscal record. 404 4-Byte (8 bits/byte) words are needed for each logical record. The remainder of the physical record will be zero filled.

CH13 CAT

GROSS PHYSICAL RECORD

404	LOGICAL RECORD 1
808	LOGICAL RECORD 2
1212	LOGICAL RECORD 3
1616	LOGICAL RECORD 4
2020	LOGICAL RECORD 5
2424	LOGICAL RECORD 6
2828	LOGICAL RECORD 7
3232	LOGICAL RECORD 8
3636	LOGICAL RECORD 9
3638 3969	SPARES

15876 8-bit words
7938 2-byte words
3969 4-byte words

CH13CAT LOGICAL RECORD

1	PHYSICAL RECORD NUMBER	SPARES	FILE CONT.	RECORD ID	LOGICAL RECORD NUMBER
2	YEAR		DAY OF YEAR		
3	CHANNEL 13 ADJUSTMENT SLOPES				
203					
204	CHANNEL 13 ADJUSTMENT Y-INTERCEPTS				
404					

CHANNEL 13 CALIBRATION ADJUSTMENT TABLE

Each record contains a table of adjustments to the ERB Channel 13 irradiances for the day as a function of solar zenith angle. These adjustment factors are interpolated from correction factors determined for several days of a year for solar zenith angles (90-60, 60-30, 30-0, 0-30, 30-60, and 60-90 degrees). The description of the constituent items are as follows:

(1) Physical Record Number (12 bits)

The physical record count will start at 1 and will increment by 1 for each physical record (CAT) in the file.

(2) Record ID (8 bits)

Identifies record type in a file, last record in file and records in last file on tape. The MSB will be set to 1 if that record is the last one written in the file. The second most MSB will be set on all records in the last file on the tape. The record type will use the 6th LSB of that byte to identify the type of record being read. A value of 27 indicates a Channel 13 CAT record.

(3) Logical Record Number (8 bits)

The logical record count will start with 1 at the beginning of a physical record and will increment by 1 for each logical record actually placed within the physical record.

(4) Year (16 bits)

The units and tens digits of the calendar year of the start of the period for which the adjustments apply.

(5) Day of Year (16 bits)

GMT day number of the day of year for which the adjustments apply.

(6) Channel 13 Adjustment Slopes (32 bits)

201 Slopes by solar zenith angle (-100° to $+100^{\circ}$).

(7) Channel 13 Adjustment Y-Intercepts (32 bits)

201 Y-intercepts by solar zenith angle (-100° to $+100^{\circ}$).

APPENDIX B.

Data Availability and Cost

B.1 Availability of Data Tapes

ERB data tapes are archived and available from the National Space Science Center (NSSDC). The NSSDC will furnish limited quantities of data to qualified users without charge. The NSSDC may establish a nominal charge for production and dessemination if a large volume of data is requested. Whenever a charge is required, a cost estimate will be provided to the user prior to filling the data request.

Domestic requests for data should be addressed to:

National Space Science Data Center
Code 601
NASA/Goddard Space Flight Center
Greenbelt, Maryland 20771

All requests from foreign researchers must be specifically addressed to:

Director, World Data Center A for Rockets and Satellites
Code 601
NASA/Goddard Space Flight Center
Greenbelt, Maryland 20771

When ordering data from either NSSDC or the World Data Center, a user should specify why the data are needed, the subject of his work, the name of the organization with which he is connected, and any government contracts he may have for performing his study. Each request should specify the experiment data desired, the time period of interest, plus any other information that would facilitate the handling of the data request.

A user requesting data on magnetic tapes should provide additional information concerning the plans for using the data, i.e., what computers and operating systems will be used. In this context, the NSSDC is compiling a library of routines that can unpack or transform the contents of many of the data sets into formats that are appropriate for the user's computer. NSSDC will provide, upon request, information concerning its services.

When requesting data on magnetic tape, the user must specify whether he will supply new tapes prior to the processing, or return the original NSSDC tapes after the data have been copied.

Data product order forms may be obtained from NSSDC/World Data Center A.

B.2 Documentation

Documents relating to ERB tapes are available through NSSDC. These documents are shown for each product in Figure 1.2. Some documents are not completed at this time, and others are updated periodically as new information becomes available. If data is requested prior to complete documentation being available, it is the responsibility of the user to request updates from NSSDC.

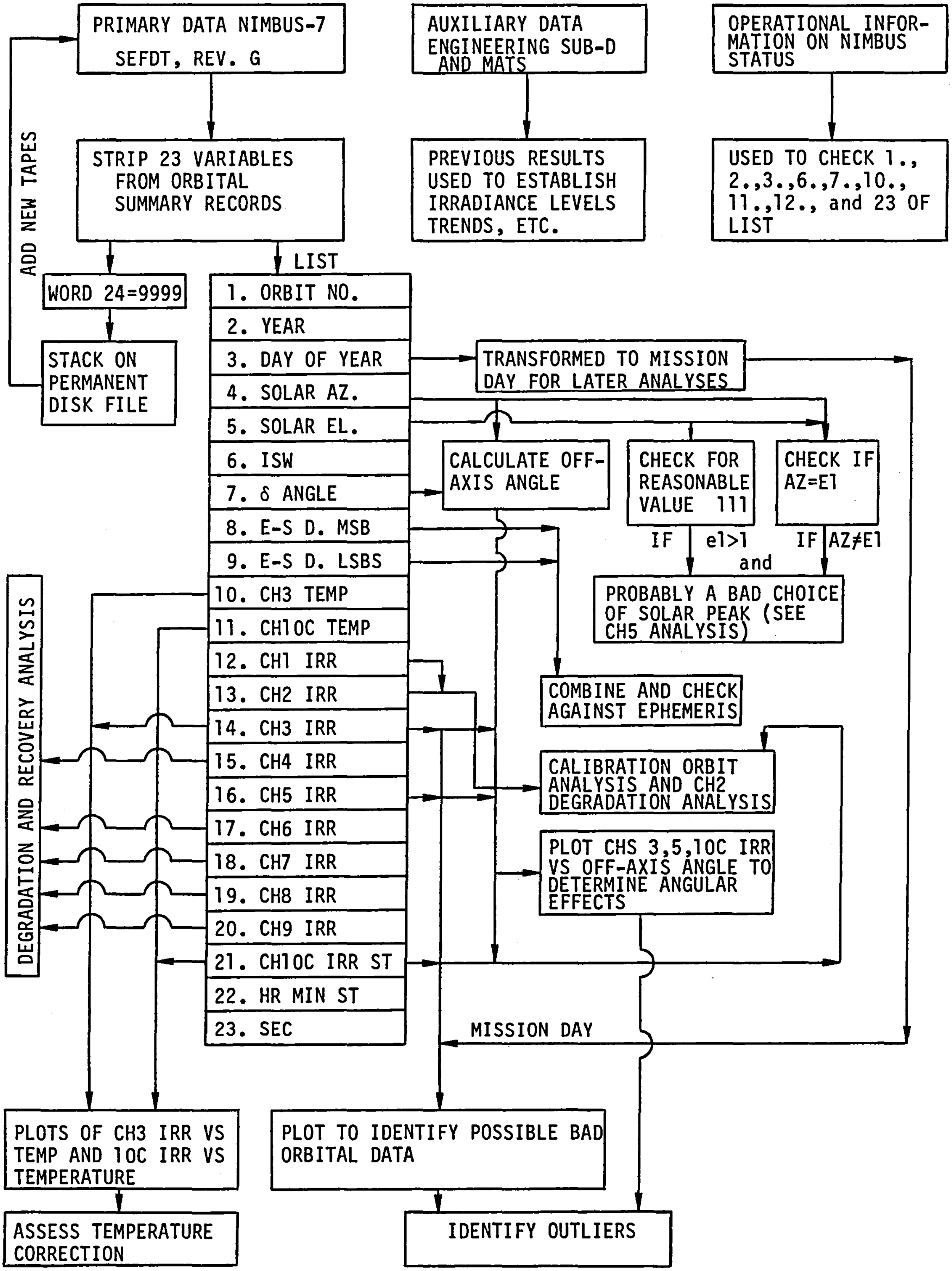
APPENDIX C.

Nimbus-7 Year-1 SEFDT Tape Sequence Numbers

MONTH	SEQUENCE	GENERATION DATE
NOV 78	AD83051-1	82/175
DEC 78	AD83351-1	82/175
JAN 79	AD90011-1	82/176
FEB 79	AD90330-1	82/175
MAR 79	AD90601-1	82/175
APR 79	AD90911-1	82/175
MAY 79	AD91211-1	82/179
JUN 79	AD91521-1	82/175
JUL 79	AD91821-1	82/176
AUG 79	AD92131-1	82/176
SEP 79	AD92441-1	82/176
OCT 79	AD92741-1	82/176

APPENDIX D.

Checking Procedure for SEFDT Solar Data at EPPLEY Laboratory



REFERENCES

1. Jacobowitz, H. (NOAA/National Environmental Satellite Data and Information Service, Washington D.C., 20233), Harold V. Soule, H. Lee Kyle, Frederick House and the Nimbus-7 ERB Experiment Team: "The Earth Radiation Budget (ERB) Experiment - An Overview", accepted for publication by J. Geophy. Res., (1984).

2. Kyle, H.L., F.B. House, P.E. Ardanuy, H. Jacobowitz, R.H. Maschhoff and J.R. Hickey: "New Inflight Calibration Adjustment of the Nimbus-6 and -7 Earth Radiation Budget Wide Field of View Radiometers", submitted for publication by J. Geophys. Res.

3. Soule, H.: "Earth Radiation Budget Bibliography", NASA Contractor Report, Contract No. NAS5-26123 (to be published).

4. Hickey, J.R. and B.M. Alton: "Extraterrestrial Solar Irradiance - Results from the ERB Experiment of Nimbus-7", 5th Conference on Atmospheric Radiation; Baltimore, Maryland, October 31 - November 4, 1983; 444-447 (1983).

5. Hickey, J.R., B.M. Alton, H. Jacobowitz, P. Pellegrino, E.A. Smith, T.H. Vonder Haar and R.H. Maschhoff: "Extra-terrestrail Solar Irradiance - Four Years of Data from Nimbus-7", submitted for publication by J. Geophys. Res.

6. Taylor, V.R., J.M. Vilardo, L.L. Stowe and S.K. Vemury: "Nimbus-7 ERB Emission Models for ERBE Processing", 5th Conference on Atmospheric Radiation; Baltimore, Maryland; October 31 - November 4, 1983; 433-435 (1983).

7. Taylor, V.R. and L.L. Stowe: "Reflectance Characteristics of Uniform Earth and Cloud Surface Derived from Nimbus-7 ERB", submitted for publication by J. Geophys. Res.

8. Research and Data Systems, Inc., "Nimbus-7 ERB MATGEN Science Document", NASA Technical Memorandum 84985, Goddard Space Flight Center, Greenbelt, Maryland 20771, April 1983.

9. Groveman, Brian: "User's Guide for ERB-7 MAT and First Year Quality Control", Contractor Report CR-170514, Contract No. NAS5-26123, April 1984.

10. Ardanuy, P.E.: "DELMAT User's Guide", NASA Contractor Report, in press, May 1984.

11. Ray, Surendra N. and K.L. Vasanth: "ERB-7 MATRIX User's Guide", Volume II, NASA CR-170620, Contract No. NAS5-28063, April 1984.

12. Tighe, R.J.: "Nimbus-7 ERB MATRIX Scientific Algorithms", NASA Contract No. NAS5-26773, Goddard Space Flight Center, Greenbelt, Maryland 20771, 1982.

13. Vasanth, K.L: "ERB ZMT Data User's Guide", (to be published).

14. Nutter Jr., S.T.: "ERB SAVER Data User's Guide", (to be published).

15. Predmore, R.E., H. Jacobowitz and J.R. Hickey: "Exospheric Cleaning of the Earth Radiation Budget Solar Radiometer During Solar Maximum", proceeding of SPIE, vol. 338, p. 104-113, May 6, 1982.

16. Hickey, J.R. and A.R. Karoli: "Radiometric Calibration for the ERB Experiment", Applied Optics, March 1974.

NIMBUS-7

SCIENCE QUALITY CONTROL PROGRAM

EARTH RADIATION BUDGET (ERB)
SOLAR AND EARTH FLUX DATA TAPE (SEFDT)

DATA USER'S GUIDE

VOLUME II

APRIL, 1984

PREPARED BY: Richard J. Tighe
Dr. Richard J. Tighe/SASC (04/20/84)

REVIEWED BY: Robert D Farquhar
Mr. Robert D. Farquhar (04/20/84)
SASC/Project Manager

APPROVED BY:
Mr. Lonnie H. Bowlin (04/20/84)
SASC/Program Manager

Prepared For:

National Aeronautics and Space Administration
Goddard Space Flight Center
Greenbelt, Maryland 20771

Prepared By:

Systems and Applied Sciences Corporation
5809 Annapolis Road, Suite 414
Hyattsville, Maryland 20784

Contract No. NAS5-28063
Task Assignment 03

Document No. SASC-T-5-5100-005-84

PREFACE

This document will provide specific details regarding the scientific validity of the Nimbus-7 ERB Solar and Earth Flux Data Tapes (SEFDT) to the scientific user. The SEFDT data analysed in this report covers the period from November 16, 1978 to October 31, 1979. The information given in this document was compiled from various sources, but primarily through the results of checking each SEFDT with the Nimbus-7 ERB SEFDT Science QC (SQC) program. An additional source of data were the results of NET Member Mr. John Hickey's analysis of the solar data.

This document will appear as Volume II of the Nimbus-7 ERB SEFDT Data User's Guide. When combined with Volume I and the SEFDT Tape Specification, it will provide users with complete information on use of the Nimbus-7 SEFDT data.

The authors would like to acknowledge Dr. H. Lee Kyle, Technical Monitor, for useful comments and guidance while preparing this document. Our thanks are also due to the Science and Applications Computing Center (SACC) of Goddard Space Flight Center for assistance in data processing. This work was supported by the NASA Contract No. NAS5-28063, Task 03.

Nimbus Experimenters Team (NET) Members

Dr. Albert Arking**
NASA/Goddard Space Flight Center
Code 915.0
Greenbelt, MD 20771
(301) 344-7208

Dr. Garrett Campbell**
c/o CRIA
Department of Atmospheric Sciences
Colorado State University
Fort Collins, CO 80523
(303) 491-8566

Mr. John R. Hickey
EPPLEY Laboratory, Inc.
12 Sheffield Avenue
Newport, RI 02840
(401) 847-1020

Dr. Frederick B. House
Department of Physics and Atmospheric Science
Drexel University
32 & Chestnut Streets
Philadelphia, PA 19104
(215) 895-2725

Dr. Andrew Ingersoll
Department of Geological and Planetary Science
170-25
California Institute of Technology
Pasadena, CA 91125

Dr. Herbert Jacobowitz*
E/RA-11
National Oceanic and Atmospheric Administration
National Environmental Satellite Service
Suitland Professional Center
5001 Silver Hill Road
Stop L
Washington, D.C. 20233
(301) 763-4290

Dr. H. Lee Kyle*
NASA/Goddard Space Flight Center
Code 910.2
Greenbelt, MD 20771
(301) 344-9140

---

*Dr. Jacobowitz was elected team leader in 1976. He was succeeded by Dr. Kyle in 1983.
**Elected members.

Mr. Robert Maschhoff**
Gulton Data Systems Division
Albuquerque, NM 87190

Dr. G. Louis Smith
Mail Stop 420
Langley Research Center
Hampton, VA 23665
(804) 865-2977

Dr. Larry L. Stowe
E/RA-11
National Oceanic and Atmospheric Administration
National Environmental Satellite Service
Suitland Professional Center
5001 Silver Hill Road
Stop L
Washington, D.C. 20233
(301) 763-4290

Dr. Thomas H. Vonder Haar
Department of Atmospheric Sciences
Colorado State University
Fort Collins, CO 80523
(303) 491-8566

ABBREVIATIONS

CAT - Calibration Adjustment Table
DSAS - Digital Solar Aspect Sensor
ERB - Earth Radiation Budget
GSFC - Goddard Space Flight Center
ILT - Image Location Tape
MAT - Master Archival Tape
MSE - Minimum Solar Elevation
NASA - National Aeronautics and Space Administration
NET - Nimbus Experiment Team
PTM - Platinum Temperature Monitor
SEFDT - Solar and Earth Flux Data Tape
SQC - Science Quality Control
WFOV - Wide Field of View

TABLE OF CONTENTS

PAGE

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

SECTION 1. INTRODUCTION

1.1 OBJECTIVE OF SCIENCE QUALITY CONTROL

Before the Nimbus-7 ERB climate product data sets were archived for use by the scientific community, two levels of validation were performed by the Nimbus Experiment Team (NET). First, the NET validated the scientific processing algorithms employed to produce the data sets. This step was completed early in 1982. After the algorithms were validated, the data were scientifically validated to assure that it is physically reasonable and useful for scientific research. This second validation step was the objective of the Science Quality Control (SQC) task.

The approach employed in the SQC task was to establish criteria by which the climate product data sets could be tested for reasonableness and scientific validity. These criteria were used in the analysis of each monthly Solar and Earth Flux Data Tape (SEFDT). An important function of SQC is the identification, definition, and categorization of the exceptions to these reasonableness criteria. This document will provide that function. Problems found in the SQC analysis of the SEFDT will be discussed here. An overview of SEFDT problems also appears in Volume I of this document, the ERB SEFDT Data User's Guide. Known problems in the MAT Level I data (used as input data to the SEFDT processing) are briefly described in Subsection 1.2 below. Discussions of the problems found in the SQC analysis of SEFDT follow in the other sections of this document. This information should prove helpful to users in the following ways:

1) Users will be able to determine which types of problems might impact specific scientific investigations.

2) Scientific users will be able to determine if they need to perform any special processing of the SEFDT data in order to work around problems described here.

1.2 SUMMARY OF KNOWN PROBLEMS ON THE MAT

In this subsection, several problems inherent in the Level I MAT data set are discussed. These problems were not screened from SEFDT processing. Users of SEFDT must consider these problems for their possible influence on the scientific use of the data.

For a more detailed discussion of the scientific quality of MAT data see the ERB MAT Data User's Guide (Reference 1).

1.2.1 Solar Channel Degradation/Recovery

Immediately after launch, the ERB solar channels began to degrade. All channels, except Channels 1 and 10C, were affected. The ultraviolet channels (Channels 6 through 9) were the most strongly affected. This degradation, and subsequent recovery, has been explained in a paper by Predmore, et al (Reference 2). The degradation was probably due to deposition of an organic thin film on the ERB instrument optics during spacecraft outgassing. The recovery of the solar channels, as explained by Predmore, was due to a cleaning action caused by upper atmospheric oxygen ions. The rate of cleaning was related to the density of the oxygen ions which in turn was related to increased solar activity. The onset of the recovery of the solar channels was well correlated with the burst of solar activity occurring in January and February of 1979. The degradation/recovery is illustrated in Figures 3-1 through 3-9. Some users will find it necessary to perform special processing to "unfold" the degradation effects from the solar data. Others who may be interested in relative changes in solar activity on short time scales will not need any special processing.

1.2.2 Degradation of Channel 13

The Wide Field of View (WFOV) Channel 13 has been shown to degrade with time at a rate of about 5% over the first year (see Reference 3). Among the reasons given for this degradation are: (1) thin film deposition as mentioned above, and (2) radiation damage (aging) of the ERB instrument optical surfaces. A recalibration of the Channel 13 irradiances was performed by the application of the Channel 13 Calibration Adjustment Table (CAT). A major goal of the CAT was to correct this degradation. However, analysis of albedo parameters from MATRIX for Year-1 (see Reference 3) indicates that a degradation persists in the Year-1 Channel 13 irradiances after application of the CAT. This problem was still under study at the time of this writing. Subsequent updates to this document will provide users with information on how this degradation may be handled.

1.2.3 ERB Instrument Duty Cycle - Thermal Effects

During Nimbus Year-1, the ERB instrument was operated in a one day off - three days on duty cycle. This duty cycle was imposed on ERB by considerations of limited spacecraft power. At some time, the duty cycle was different but the important thing is that periodically the ERB instrument was powered off. When the instrument was turned on, a warmup period followed where the electronics approached an operating temperature. Users of SEFDT data need to be aware of this problem and will probably need to consider rejecting both solar and Earth flux data taken below some temperature threshold (see Subsection 3.2.6).

It has been pointed out (Ardanauy, Philip: "Report to the ERB Processing Team Meeting", June 1982) that following this warmup period, the ERB instrument temperature does not remain stabilized. The thermal environment of ERB (other sensors, motors, other experiments, etc.) causes variations in the ERB instrument temperature which impact the measured irradiances. This will affect both solar and Earth flux data, but Channel 13 appears to be the most heavily impacted ERB channel. The impact to users of the SEFDT data is that the measured irradiances show a cyclic behavior which follows the ERB duty cycle. A method has been suggested for removing this effect from the Channel 13 and 14 irradiances. This approach would add a variable offset to these irradiances which will force their values at satellite midnight to be identically zero.

Another study (see Reference 4) indicates that the Channel 13 and 14 irradiances are impacted by thermal transients within the ERB instrument. These thermal transients have been shown to be due to a time-delayed response to both Long Wave and Short Wave heating by the Sun and the WFOV scene. At the time of this writing, software was being developed to create a special calibration tape (DELMAT) which will contain irradiance corrections for the above effects.

1.2.4 ERB PTM Coefficient Error

In the MATGEN program, the set of engineering coefficients were used in the calibration equations for the Platinum Temperature Monitors (PTM). The use of these coefficients in place of the laboratory calibration coefficients causes an error in ERB Channel 11 and 12 irradiances on the SEFDT. However, (see Reference 5) the application of the Channel 13 CAT propagates this error to all of the Earth flux irradiances on SEFDT. In the above reference, the errors induced are estimated to be approximately .25% for Channels 11 and 12, and approximately 1.5% for Channels 13 and 14.

1.3 OVERVIEW OF SEFDT DATA FOR YEAR-1

A brief general description of the SEFDT data set is presented here. This will cover important features of the solar and Earth flux data quality.

1.3.1 Solar Data Overview

There are three areas of solar data quality in the SEFDT Year-1 data set of which users of the data must be made aware. The most important of these is the degradation and recovery of the solar channels which dominated the first few months of the Year-1 solar data. This effect will impact the use of the data for scientific investigations of solar variability over both short and long time periods. As mentioned above, some users will wish to remove the effects of degradation before processing the solar data. A second area of solar data quality, which is important for high resolution solar studies, is the problem of solar channel assembly misalignment. Periods of misalignment have been defined by Hickey as having a solar channel off-axis angle greater than 0.5 degree (this is covered in more detail in a later section). Isolated periods of misalignment occur throughout Year-1 but three major periods have been found. These are as follows:

MONTH	DAYS	ORBITS
November, 1978	321-322	329-351
December, 1978 January, 1979	348-8	702-1056
August, 1979 September, 1979	225-251	4052-4418

Not all orbits during these periods were impacted by spacecraft misalignment. Detailed tables later in this document present the orbits which were affected. Solar data users may recover the precision of the solar orbital irradiances by developing an off-axis correction algorithm which may be applied to the affected orbits. A third general area of solar data quality of importance to the user covers a range of problems (data gaps, algorithm error, etc.) which are described in detail in the later sections of this document. Many of these data glitches are amenable to recovery by the user. Data gaps around the solar peak are the primary example of an unrecoverable problem.

1.3.2 Earth Flux Data Overview

The Earth flux data on the SEFDT have been examined to assure consistency with the MATRIX product. The two products were found to show close agreement. Operational constraints were encountered in this study which will be important to users of SEFDT Earth flux data. An important consideration for users is the appropriate handling of data rejection for the various data acceptability criteria as employed in MATRIX processing algorithms. This data rejection removes Earth flux data which may be contaminated by:

1) sun blip

2) data values out of limits

3) instrument warmup

4) instrument special calibration modes

For a discussion of MATRIX processing and data rejection algorithms, see Reference 6. Another constraint which may be important to Earth flux users is the scarcity of subsatellite point location data (one subpoint location per Major Frame) on the SEFDT. Some users may wish to interpolate between Major Frames to provide a subsatellite point location for each irradiance observation (as is provided on the MAT). Special processing was required to handle these two constraints before close agreement between SEFDT and MATRIX was achieved.

Another important note on Earth flux data quality is the apparent remaining degradation found in the irradiances even though a calibration adjustment has been applied (this was discussed earlier).

SECTION 2. SUMMARY OF ITEMS CHECKED BY THE SEFDT SCIENCE QC PROGRAM

A brief description of the items checked by the SEFDT SQC program will be presented here. A list of these items is presented in Table 2-1.

2.1 TAPE FORMATTING AND READABILITY CHECKS

2.1.1 Logical and Physical Record Checks

Logical and physical records are checked to assure that they have proper record lengths and legal record IDs, and that their record numbers advance properly.

2.1.2 Calibration Adjustment Table Checks

The CATs on the SEFDT are checked against disk data sets. The integrity of these disk data sets is checked during production runs for the SEFDT.

2.1.3 Trailing Documentation File Checks

The TDF is dumped to give a record of the tapes used in production of the SEFDT.

2.1.4 Earth Flux Format Checks

The ordering of Earth flux data records in the data file is checked. Counts of missing and duplicated Earth flux frames are maintained.

2.1.5 Solar Record Format Checks

The solar records and solar orbital summary records are checked to assure proper ordering. Counts of missing or duplicated solar frames are maintained. The solar calibration record is checked to assure that it is the last logical record in the data file.

TABLE 2-1.

List of Items Checked By ERB-7 SEFDT SQC Program

Tape Formatting and Readability Checks:

- Logical and Physical Record Checks
- Calibration Adjustment Table (CAT) Checks
- Trailing Documentation File (TDF) Checks
- Earth Flux Format Checks
- Solar Record Format Checks

Earth Flux Data Quality Checks:

- Limit Checks
- Statistics on Earth Flux Irradiances
- Quality Checks on Adjusted Irradiances
- Periods of ERB Special Modes

Solar Data Quality Checks:

- Limit Checks
- Quality Checks on Solar Counts

Solar Orbital Summary Data Quality Checks:

- Limit Checks
- Statistics on Mean Solar Counts and Irradiances
- Statistics on Mean Counts: Off-Axis
- T_0 Time Tests
- Sun-Earth Distance Calculation Check

2.2 EARTH FLUX DATA QUALITY CHECKS

2.2.1 Limit Checks

Solar azimuth angle, solar zenith angle, latitude, and longitude are checked against their tape specification limits and are also checked for reasonable change from frame to frame. Temperatures in the Earth flux record are checked to assure that they are reasonable.

2.2.2 Quality Checks on Adjusted Irradiances

Limit checking is performed on the calibration adjusted irradiances for Channels 11 through 14. Latitude band averages are computed for SEFDT quantities which correspond to MATRIX scientific parameters. These band-averaged quantities are then compared to their MATRIX counterparts. Finally, whenever Channel 11 is determined to be open, Channel 11 and 12 irradiances are averaged and compared.

2.2.3 Periods of ERB Special Modes

Start and stop times are recorded for the ERB special calibration modes.

2.3 SOLAR DATA QUALITY CHECKS

2.3.1 Limit Checks

All angles appearing in the solar data records are checked against their tape specification limits and are checked for reasonable change from frame to frame. Temperatures in the solar records are checked to assure that they are reasonable. The DSAS azimuth and elevation angles are flagged whenever they are equal. Channels 1 and 3 are flagged if their shutter status changes in the solar data.

2.3.2 Quality Checks on Solar Counts

Limit checking is performed on the raw counts data for solar Channels 1 through 10C.

2.4 SOLAR ORBITAL SUMMARY DATA QUALITY CHECKS

2.4.1 Limit Checks

The angles appearing in the solar orbital summary are checked against their tape specification limits. Temperatures are checked for reasonableness.

2.4.2 Statistics on Mean Solar Counts and Irradiances

The computed mean solar counts and mean irradiances are checked against limits to assure reasonableness. Output statistics also include daily means and standard deviations for both counts and irradiances.

2.4.3 Statistics on Mean Counts: Off-Axis

The computed mean pre- and post-peak solar counts are limit checked to assure reasonableness. Output statsitics include daily means and standard deviations.

2.4.4 T_0 Time Checks

The pre- and post-peak times are checked to assure that they are 13 minutes away from T_0. The T_0 time is checked to

assure that it is found close to the middle of the solar data records. The T_0 time is flagged if it falls more than 16 seconds away from the Southern Terminator time. Data records around the solar peak are checked for data gaps.

2.4.5 Sun-Earth Distance Calculation Check

The Sun-Earth distance is recomputed and compared with the value found on the SEFDT.

SECTION 3. SCIENCE QC DATA ANALYSIS REPORT

3.1 FORMAT CHECKS

No problems in tape format were found. However, an error in the Channel 13 CAT was discovered after several months had been processed. This problem is discussed below.

3.1.1 Channel 13 CAT Correction

The Channel 13 CAT was computed improperly with the following minor defects:

1) The calibration values (slopes and intercepts) from -15 degrees to +15 degrees in solar zenith angle were interpolated for 31 points instead of 30.

2) The further effect of the above interpolation was that the calibration values for solar zenith angles were shifted by one degree up from the range 15 degrees to 74 degrees.

The maximum error was less that 0.1% for the Channel 13 irradiances.

The following months used the uncorrected Channel 13 CAT: November, December, January, February, June, July, August, and September.

The following months had the uncorrected Channel 13 CAT written on the SEFDT: November, December, February, and June.

3.2 EARTH FLUX CHECKS

3.2.1 Solar Zenith Angle

The Solar Zenith Angle (SZA) of each Earth flux record is checked for physical reasonableness with SEFDT tape specification limits and for proper incrementation between frames ($< 2^o$). Although most of the angles were within limits, a few frames have solar zenith angles which slightly exceeded the upper limit. This problem was caused by a roundoff error in the MATGEN code. The irradiances were not affected by this problem. The dates when this problem occurred are below and the affected orbits are in Appendix A.

JULIAN DAYS

3, 4, 5, 7, 8, 9, 267, 268, 269, 271

3.2.2 Solar Azimuth Angle

The solar azimuth angle was within the tape specification limits ($\pm$ 180°) for all of Year-1. However, during the month of October, a change of sign occurred during successive frames which was physically unreasonable. The irradiances were not affected by this problem. A list of the orbits in which the sign change occurred is given in Appendix B.

3.2.3 Latitude and Longitude

The latitudes and longitudes were checked to be within physically reasonable limits and for proper incrementation between frames. The only occurence of out-of-limit latitudes and longitudes was during periods when a mislocation problem occurred on the MAT which was subsequently filled (22222). The dates of occurrences are below and the specific orbits are listed in Appendix C.

JULIAN DAYS

97, 116, 156, 220, 252, 295

3.2.4 Temperatures

The temperatures are limit checked to be within reasonable values as specified in the SEFDT Tape Spefifications. A number of temperatures were out-of-limits during ERB warmup. This phenomenon occurs after an "ERB-OFF" day when the instruments are heating up.

3.2.5 Limit Checking of Channels 11-14 Counts and Irradiances

Results of limit checking for Channels 11-14 counts and irradiances were compiled for categories within 10% of the lower and upper limits, less than 10% of the lower limit and exceeding 10% of the upper limit. Though there were occasions where some unreasonable values occurred, most of these out-of-limits values were caused by data quality losses, which were not properly handled for all months.

Following are the months in which the VIP Data Quality Flags were not used: November, December, January, February, June, July, August, September, and October.

3.2.6 Latitude Band Average - MATRIX Comparison

Latitude band averages of SEFDT Earth flux quantities were computed for comparison with the corresponding MATRIX parameters. In order to make a reliable comparison data rejection criteria, as employed in MATRIX, are also applied to the SEFDT data in this study. The results and a more detailed discussion are given in Appendix D. Several computational constraints were encountered, of which at least two will be important to users of the SEFDT Earth flux data. The first involves the approach used to reject data during instrument warmup. This study used Channel 12 temperature, whereas MATRIX processing uses Channel 2. The second constraint is the scarcity of subsatellite point location data on the SEFDT (see Appendix D). Analysis indicates that the comparison is quite close and could be made even closer if users wishes to overcome the computational constraints mentioned above.

3.2.7 Channels 11 and 12 Comparison

Whenever Channels 11 and 12 were both OPEN, straight averages of their irradiances and of the Channel 11/12 difference were computed. Special mode activity (ECAL, GO/NOGO, Channel 12 Narrow, etc.) was screened before the averaging was performed. The results of this check are given in Appendix Q. The most striking result of this study comes with occurrences of small sample counts (typically four or eight samples in a day). On these occassions, the comparison yields anomalous results. The cause of this anomaly is not known. Possible causes include:

1) spacecraft anomaly

2) status word anomaly

3) VIP data quality loss

Because of this anomaly, users who intend to make Channel 11/12 comparison studies should reject samples having large Channel 11/12 differences.

3.2.8 Periods of Occurrence of ERB Special Modes

To aid in the analysis, start and stop times of special mode activity were recorded for the following ERB special modes:

1) electronic calibration

2) GO/NOGO heater

3) Channel 12 shuttered

4) Channel 12 narrow

Due to its large volume, this data will not be presented here.

3.3 SOLAR FLUX CHECKS

3.3.1 DSAS Elevation (Alpha) and Azimuth (Beta)

The DSAS alpha and beta angles were checked for physically reasonable values and realistic incrementation between frames. One of the problems that did occur was alpha being set equal to beta near the solar peak. This was an ILT product problem and a list of the affected orbits is in Appendix E. Also, the beta angle was out of limits for the following dates. A list of the affected orbits is in Appendix F.

JULIAN DAYS

1, 3, 4, 5, 7, 8, 267, 268, 269, 271, 272

There were also some occurrences of rapid beta angle incrementation for the orbits which are listed in Appendix G.

3.3.2 Thermopile Base Temperatures

There were a few occurrences of solar channel temperatures out-of-limits (10° - 32°C). These occurred during instrument warmup. It is important that the user remember no solar data is rejected during instrument warmup period. This means that the solar irradiances computed and written into the solar orbital summary record are contaminated by the warmup orbital data.

3.3.3 Limit Checking of Solar Counts

Results of limit checking for the solar counts were compiled for categories within 10% of the lower and upper limits, less than 10% of the lower limit and exceeding 10% of the upper limit. As in the Earth flux limit checking, most of the out-of-limit counts occurred when the VIP data quality flags were not used. See the Earth flux limit checking (3.2.5) for a list of the months in which the VIP quality flags were not used.

3.3.4 Data Gaps in the Solar Data

The SEFDT normally will contain 110 solar data records for each orbit of data. Data gaps in the solar data are handled by taking adjacent frames of data around the data gap up to a maximum of 110 records. Some orbits may have gross data gaps such that the total amount of data available for the orbit will not produce the required 110 solar data records. These orbits are listed in Appendix M. Users should reject these orbits from use in any scientific investigations.

3.4 SOLAR ORBITAL SUMMARY CHECKS

The solar orbital summary record was checked for various parameters, specifically for the proper choice of MSE time. Listed below are some of the items the user should be aware of in regard to the solar orbital summary records:

1) If NO valid time of MSE has been found for an orbit, T_0 will be set to the Southern Terminator time and the orbital summary record will have the following data set to a fill value (-10,000):

    (a) hours/minutes
    (b) seconds
    (c) thermopile base temperatures
    (d) mean counts
    (e) Channels 1-10 net irradiances

2) If NO valid MSE or Southern Terminator time was found, no solar data records were written and the orbital summary record was filled, except for orbit number.

3) During orbits in which Channel 1 was open, Channel 3 picked up a solar count value which was within limits. This resulted as an incorrect irradiance for Channel 3. Listed in Appendix H are the orbits in which the Channel 1 and Channel 3 shutter status changed. The user should be advised that not all of the orbits listed were affected, depending on when Channel 1 was open.

3.4.1 DSAS Alpha and Beta

The alpha angle was occassionally set to equal to the beta angle near MSE time. Since the orbital summary record was extracted from the solar data records, some of the orbits listed in Appendix E could have affected the solar orbital summary record.

3.4.2 Limit Checking on Counts

The on- and off-axis solar counts were checked for proper limits. One problem that the user should be aware of is a software problem which resulted in some counts being set equal to an IBM fill value (-4062). This problem occurred in the following months: November, December, January, June, July, August, September, and October.

3.4.3 T_0 Time Checks

There were a variety of problems which occurred with the selection of MSE time. Below is a summary of those problems for the users information:

1) Due to a flaw in the MSE algorithm, the electronic calibration spike was occasionally picked as the solar peak. The affected orbits are listed below:

JULIAN DAY	ORBIT
342	629
365	946
12	1112
235	4198
288	4918
301	5098

2) The times in the T_0-13 solar frames were more than 13 minutes away from the solar peak due to a data gap. This could slightly affect the irradiance calculation. The affected orbits are listed in Appendix I.

3) The times in the T_0+13 solar frames were more than 13 minutes away from the solar peak due to a data gap. This could slightly affect the irradiance calculation. The affected orbits are listed in Appendix J.

4) The solar irradiance calculation may have been affected by data gaps occurring within ±3 minutes of the solar peak for the orbits listed in Appendix K.

5) The difference between the Southern Terminator Time and the time selected by the solar peak algorithm was greater than 16 seconds from the orbits listed in Appendix L. The main reason for this discrepancy was the misalignment of the solar channel assembly so that a well-defined solar peak could not be determined.

3.4.4 Daily Averaged Solar Irradiances

Daily averaged solar irradiances were computed for all channels across Year-1. These are plotted for all but Channel 1 in Figures 3-1 through 3-9. The most striking feature of the plots is the degradation and recovery, discussed in Subsection 1.2.1. Note that all channels, except Channel 10C, were strongly affected. The ultraviolet channels (6-9) show significant recovery. Over the year, however, a long time degradation process is noticeable. No data was screened from these plots. This means that anomalous orbits are allowed to contribute. In general, the sharp spikes seen in these curves are due to anomalous orbits. The two prominent spikes occurring on all plots, except for Channel 10, are due to ECAL spikes that were erroneously picked as the solar peak for Orbits 4918 (Julian day 288) and 5098 (Julian day 301).

A careful analysis of the plots reveals a number of anomalies which are not noted in the other tables of this report. These are:

Julian Day	Orbit
5 (050)	1007
83 (128)	2090
124 (169)	2652
221 (266)	4004
256 (301)	4485

Mission day is given in parenthesis. Not all channels are affected by these anomalies. Analysis of the raw counts data for these orbits reveals, in each case, anomalous raw counts data around the solar peak. The cause of this problem is not known. In several of these cases, data quality loss problems were the most probable cause. These orbits should be rejected from any scientific investigations.

FIGURE 3-1.

Year-1 Daily Averaged Solar Irradiances - Channel 2

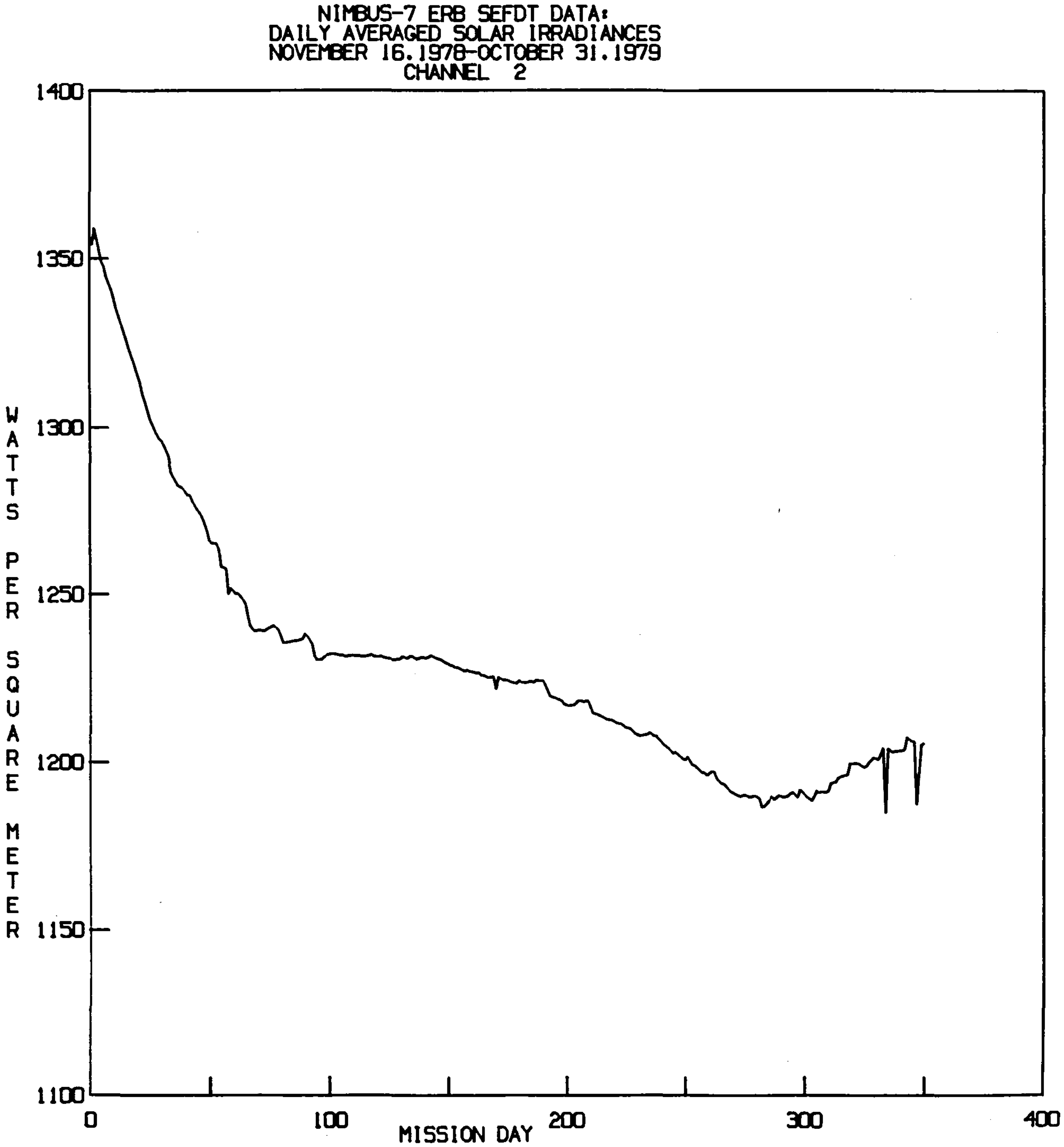


FIGURE 3-2

Year-1 Daily Averaged Solar Irradiances - Channel 3

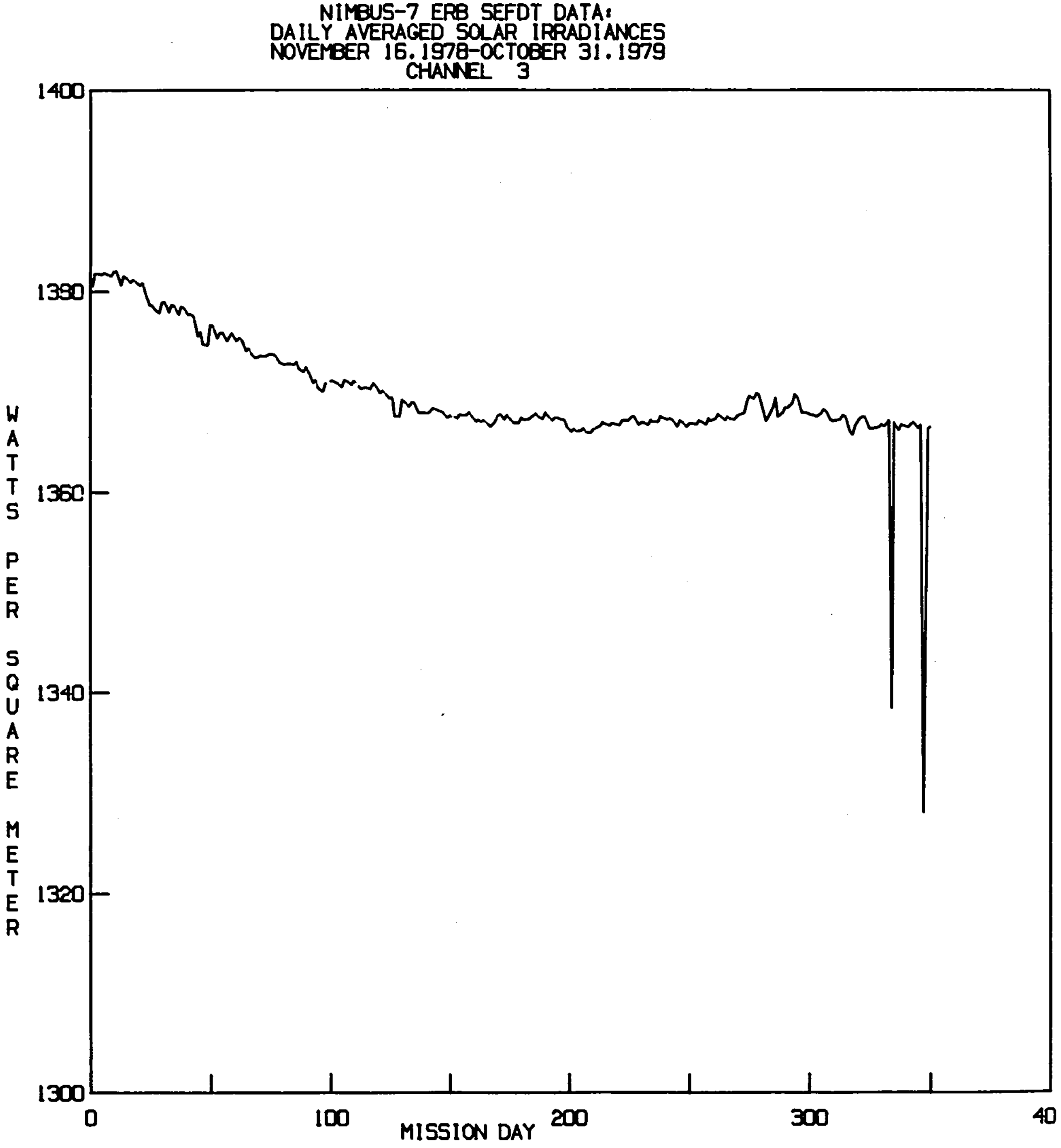


FIGURE 3-3

Year-1 Daily Averaged Solar Irradiances - Channel 4

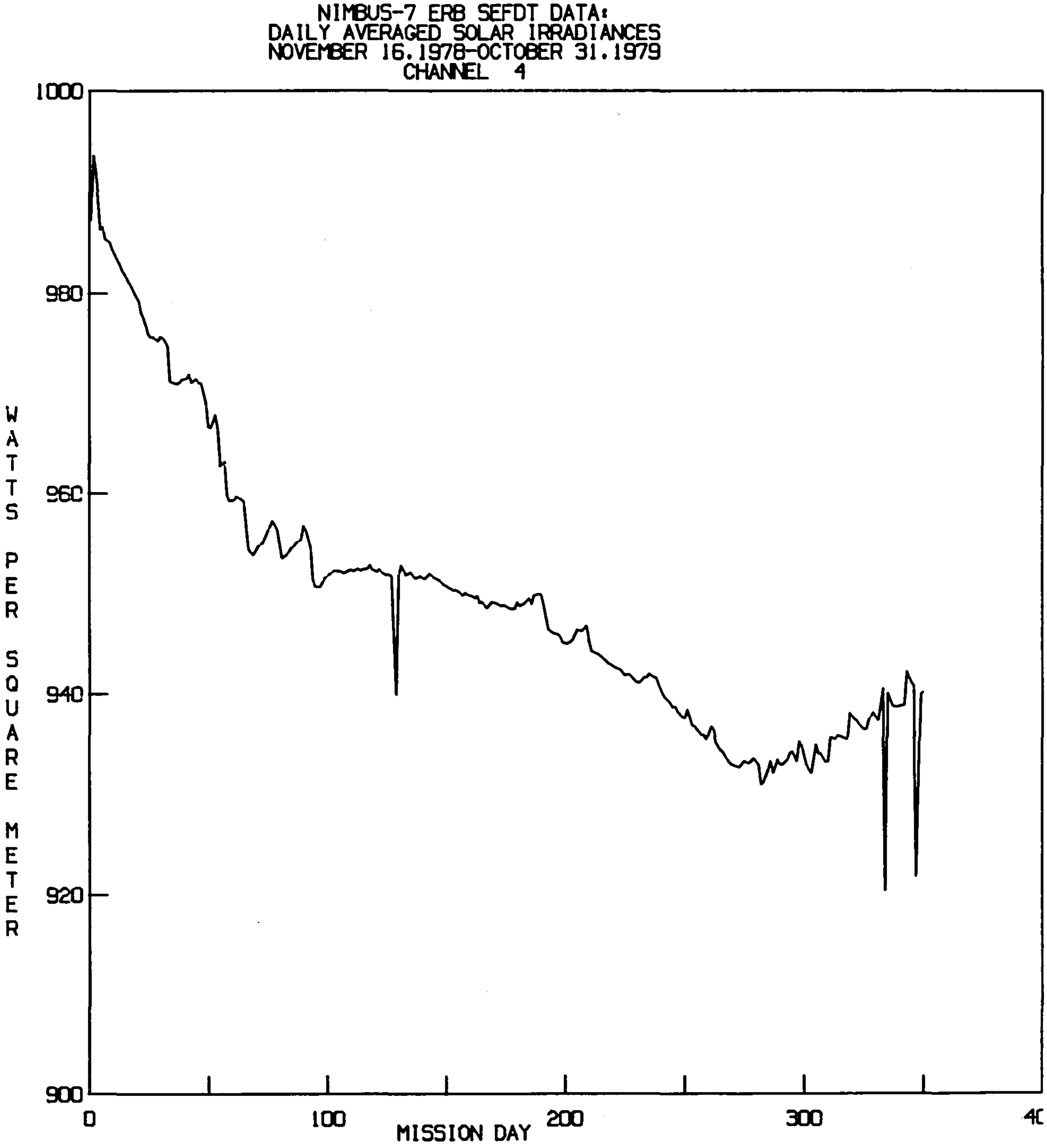


FIGURE 3-4

Year-1 Daily Averaged Solar Irradiances - Channel 5

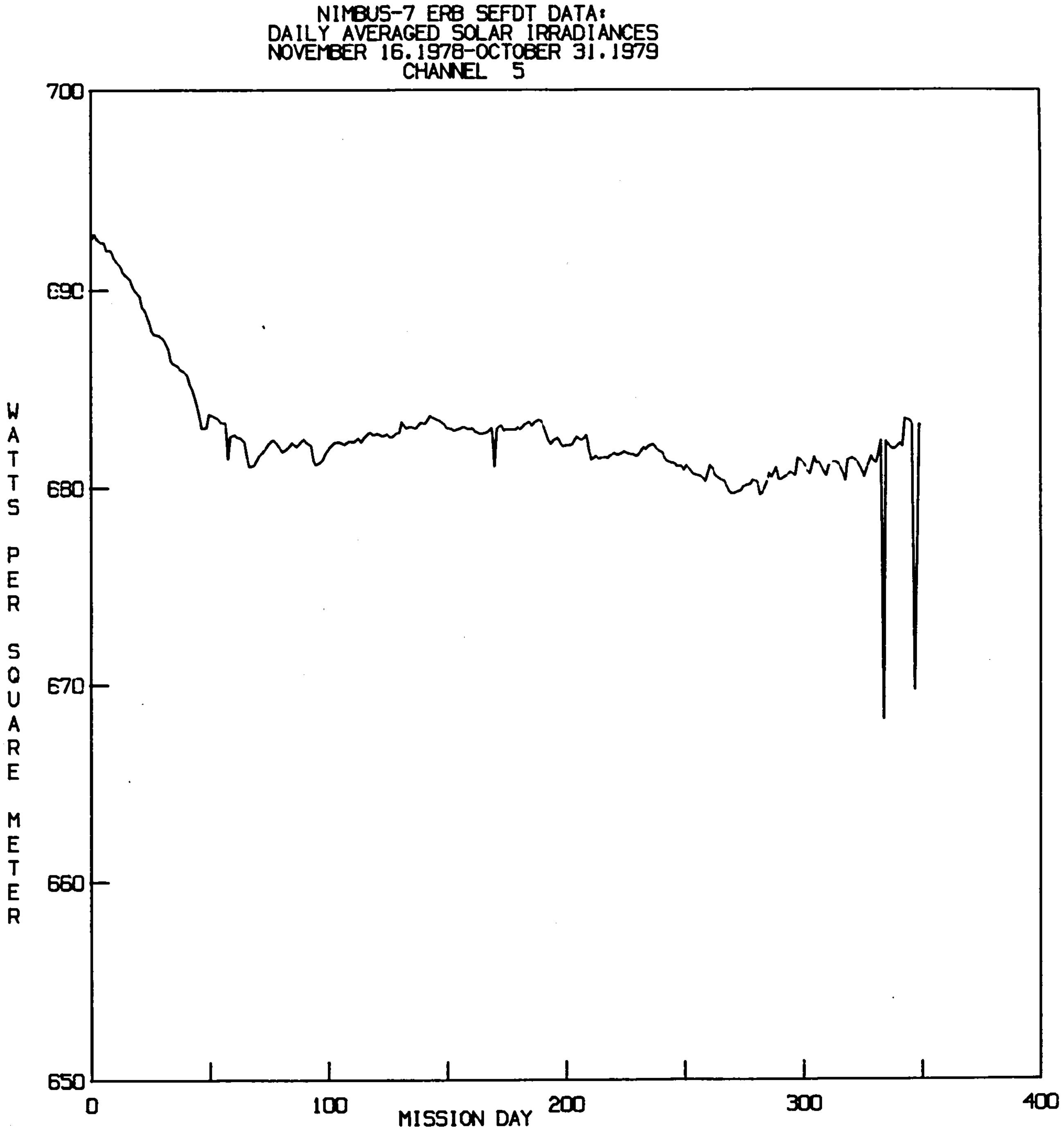


FIGURE 3-5

Year-1 Daily Averaged Solar Irradiances - Channel 6

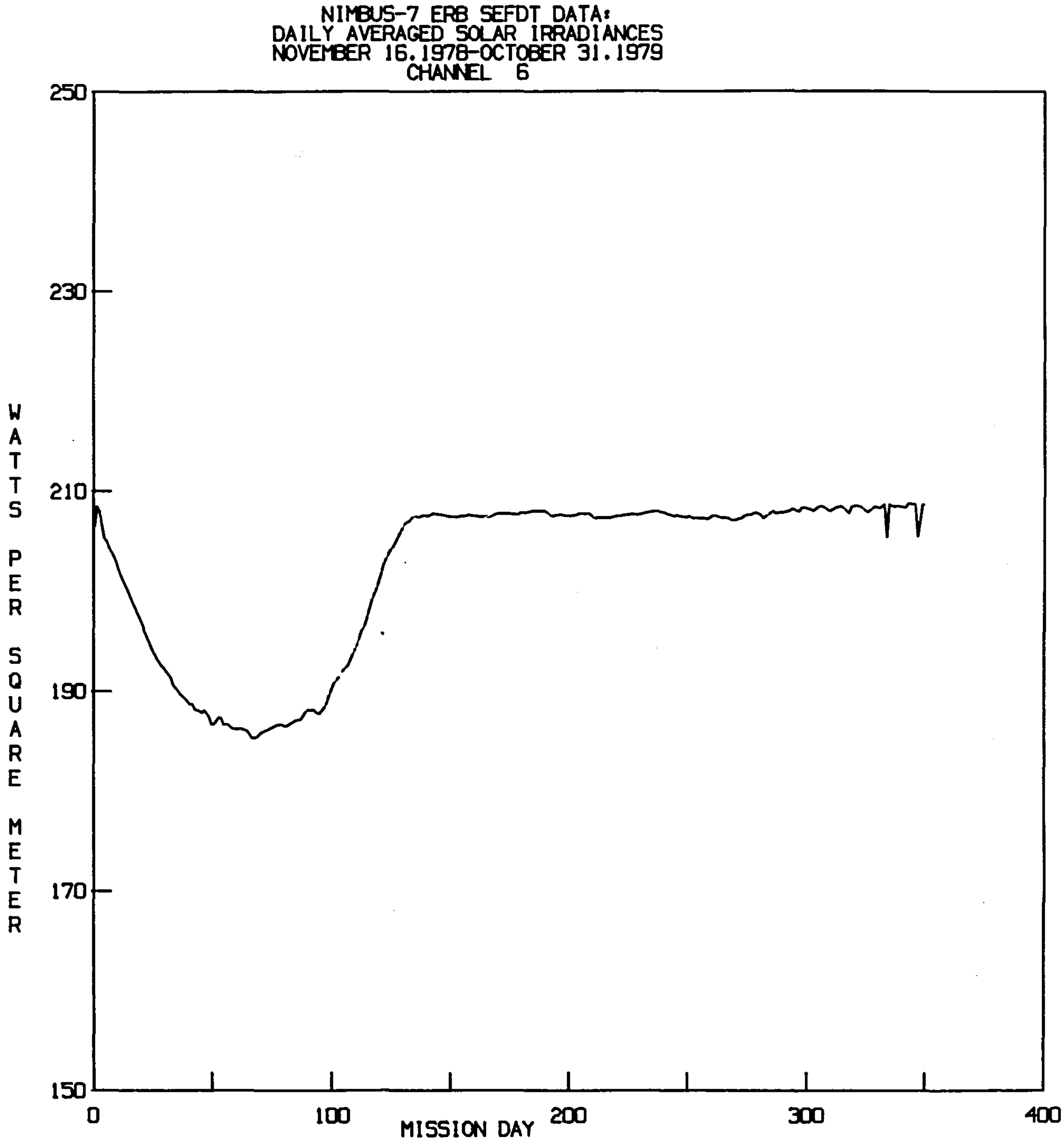


FIGURE 3-6

Year-1 Daily Averaged Solar Irradiances - Channel 7

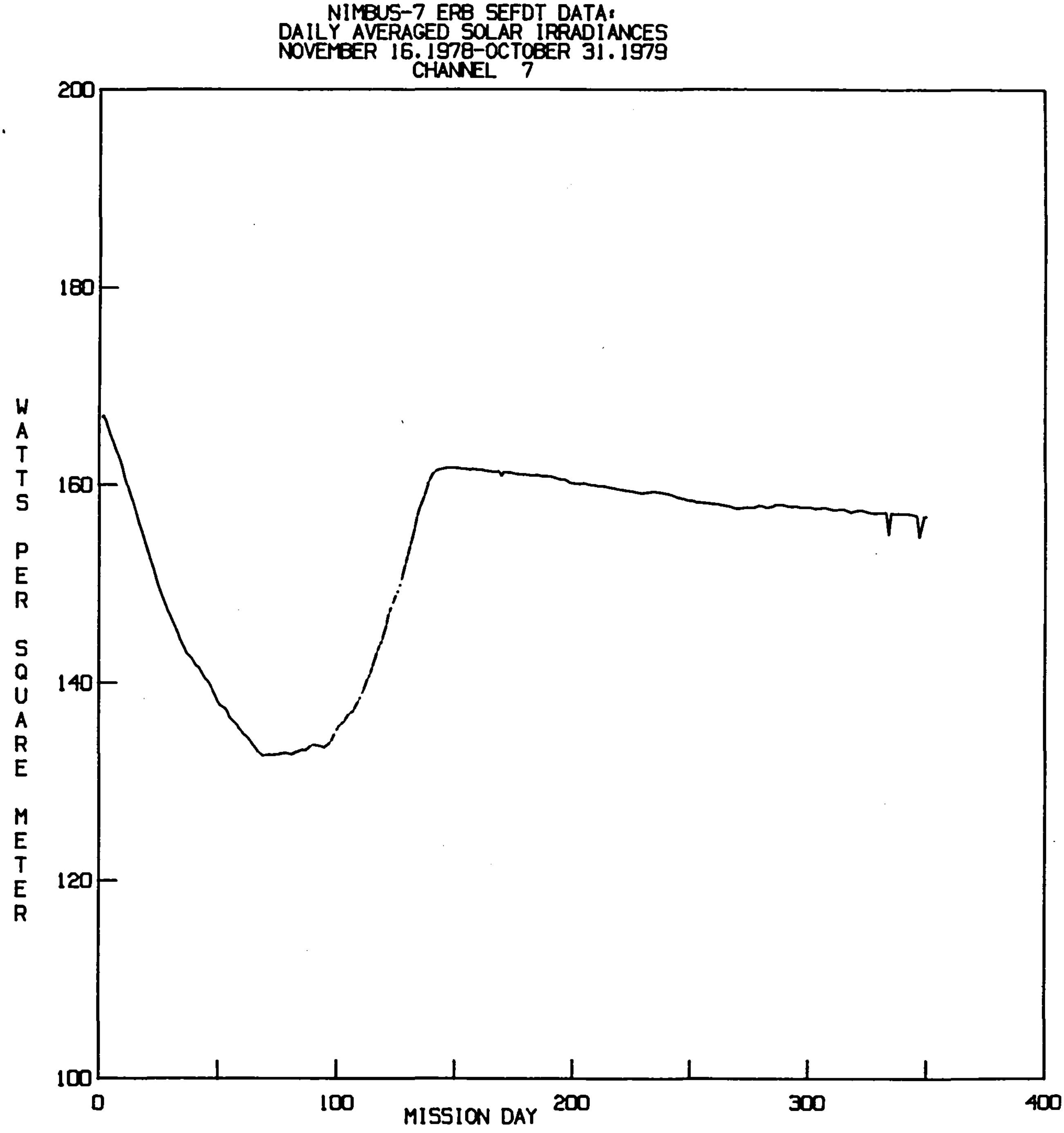


FIGURE 3-7

Year-1 Daily Averaged Solar Irradiances - Channel 8

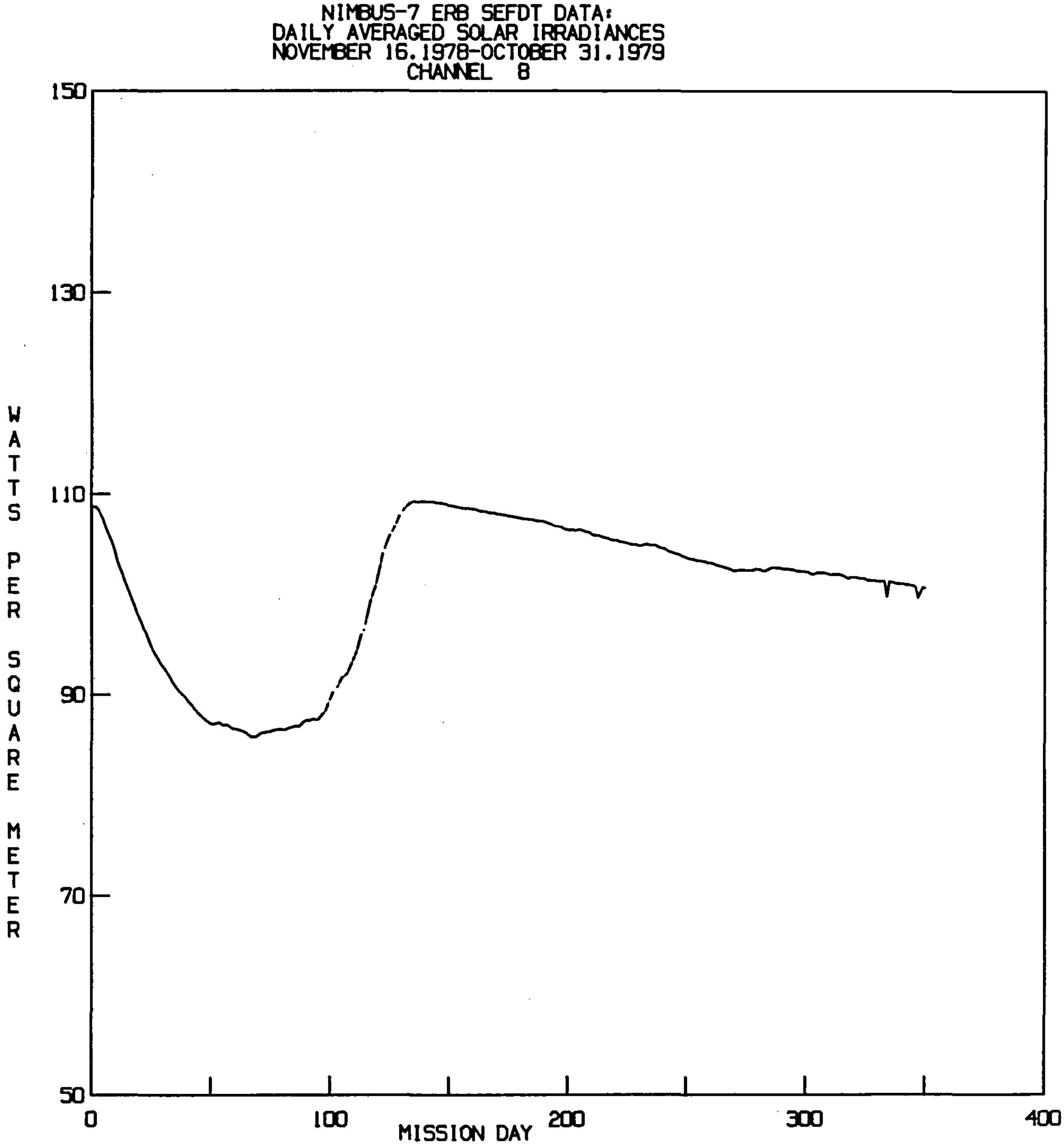


FIGURE 3-8

Year-1 Daily Averaged Solar Irradiances - Channel 9

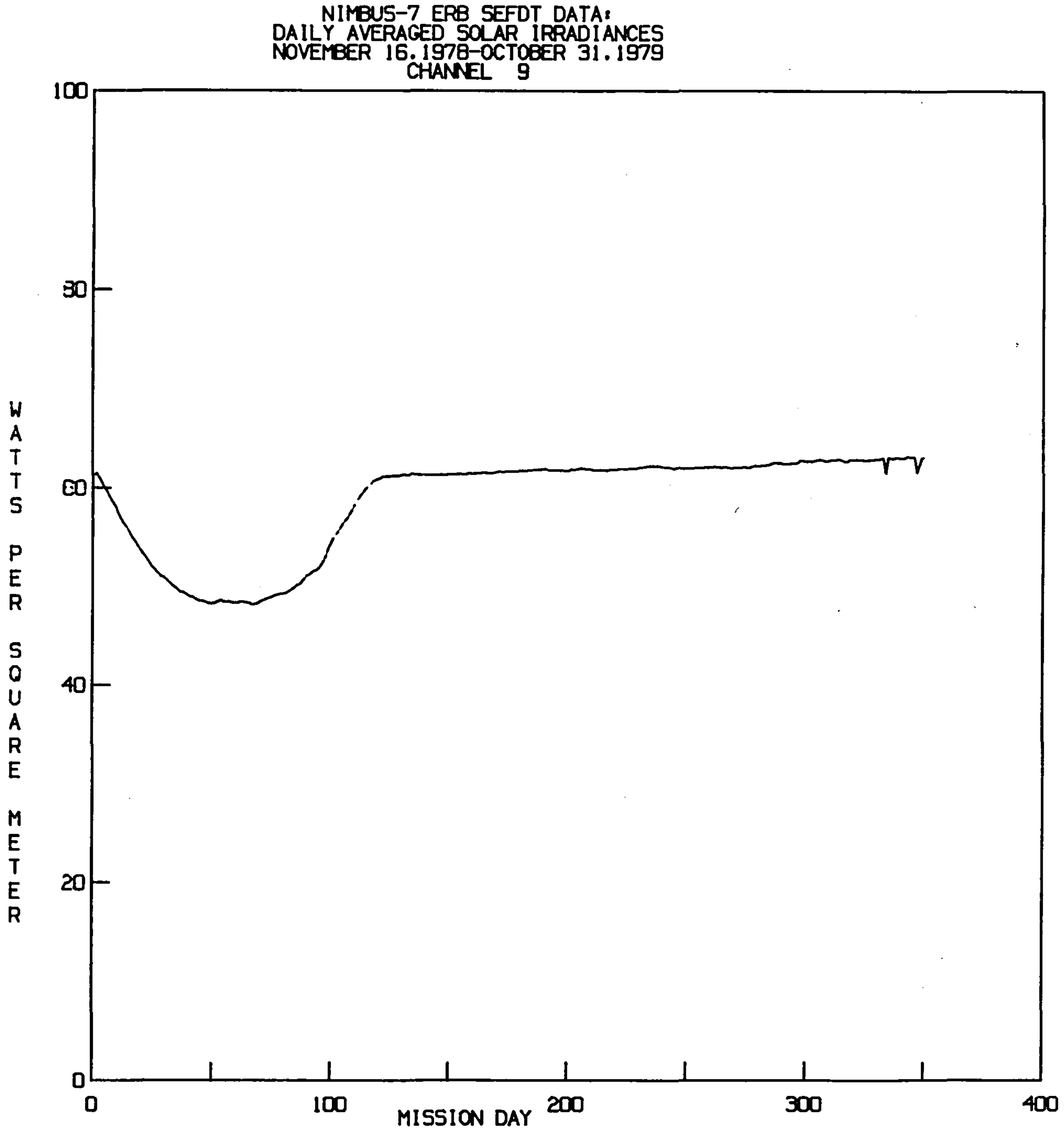
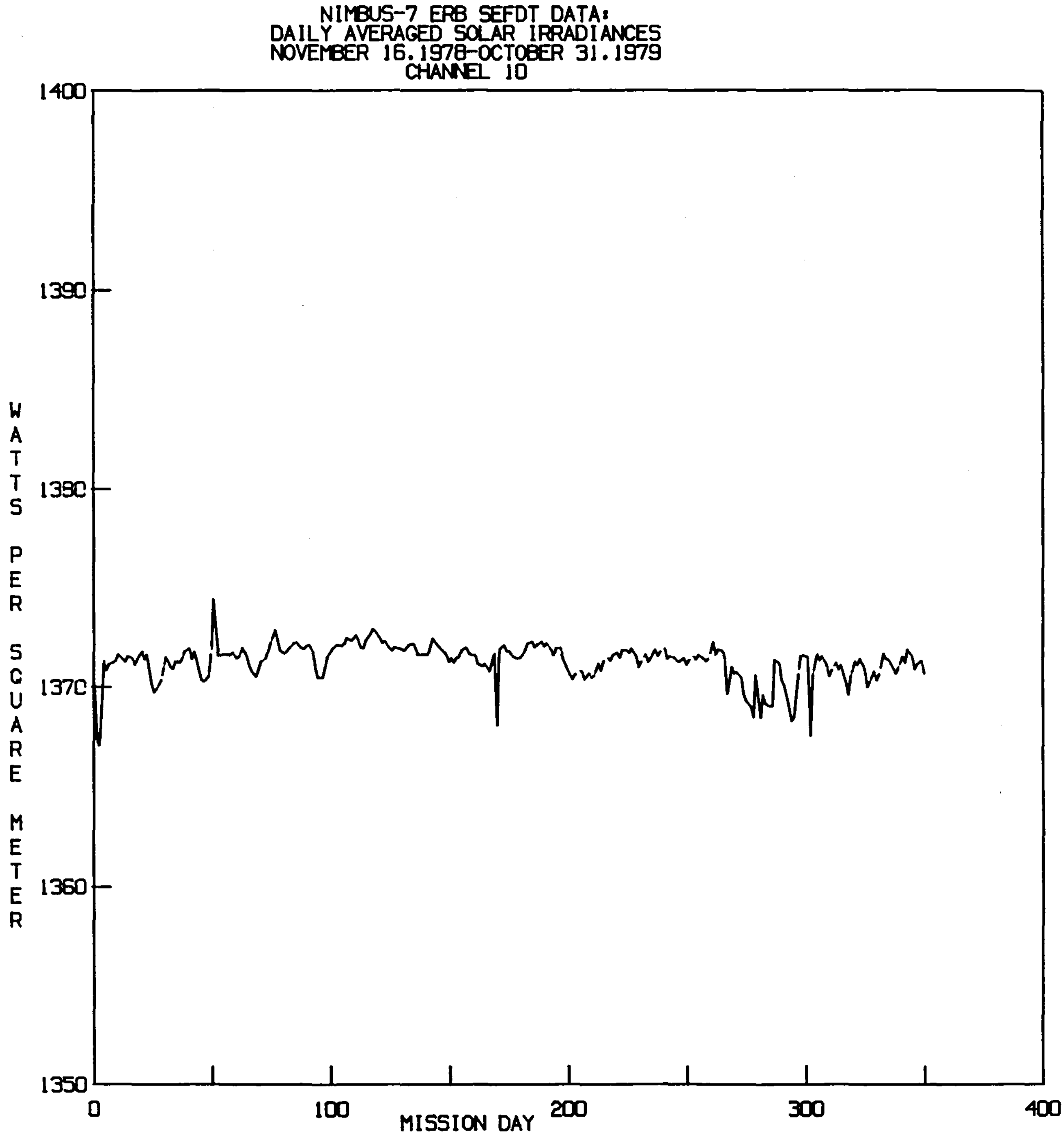


FIGURE 3-9

Year-1 Daily Averaged Solar Irradiances - Channel 10



3.4.5 Off-Axis Angle Checks*

The off-axis angle measures the angular deviation of the pointing vector of the solar channel assembly from the position of the Sun (see Figure 3-10). The γ angle is adjusted by ground commands in order to account for changes in the DSAS (solar azimuth) angle. Thus, at the time of MSE, the off-axis angle is just the difference in these two angles. Because of scaling and sign conventions within the SEFDT, this becomes:

$$\gamma_{off\text{-}axis} = \gamma + 0.1 * \beta_{DSAS}$$

The operational goal was to adjust the γ angle in order to keep the computed off-axis angle less than 0.5 degree. This was not always accomplished. If the off-axis angle exceeds 0.5 degree, users requiring high precision solar data must consider correcting the data for off-axis effects. These corrections are beyond the scope of this document. Users should probably reject orbital data for which the off-axis angle exceeds 1 degree.

Important periods of solar channel assembly misalignment are:

1) Days 321-22 (Orbits 329-51). This misalignment was due to γ angle step testing.

2) Days 348-8 (orbits ranging from 702 to 1056). This misalignment was due to failure to adjust the γ angle.

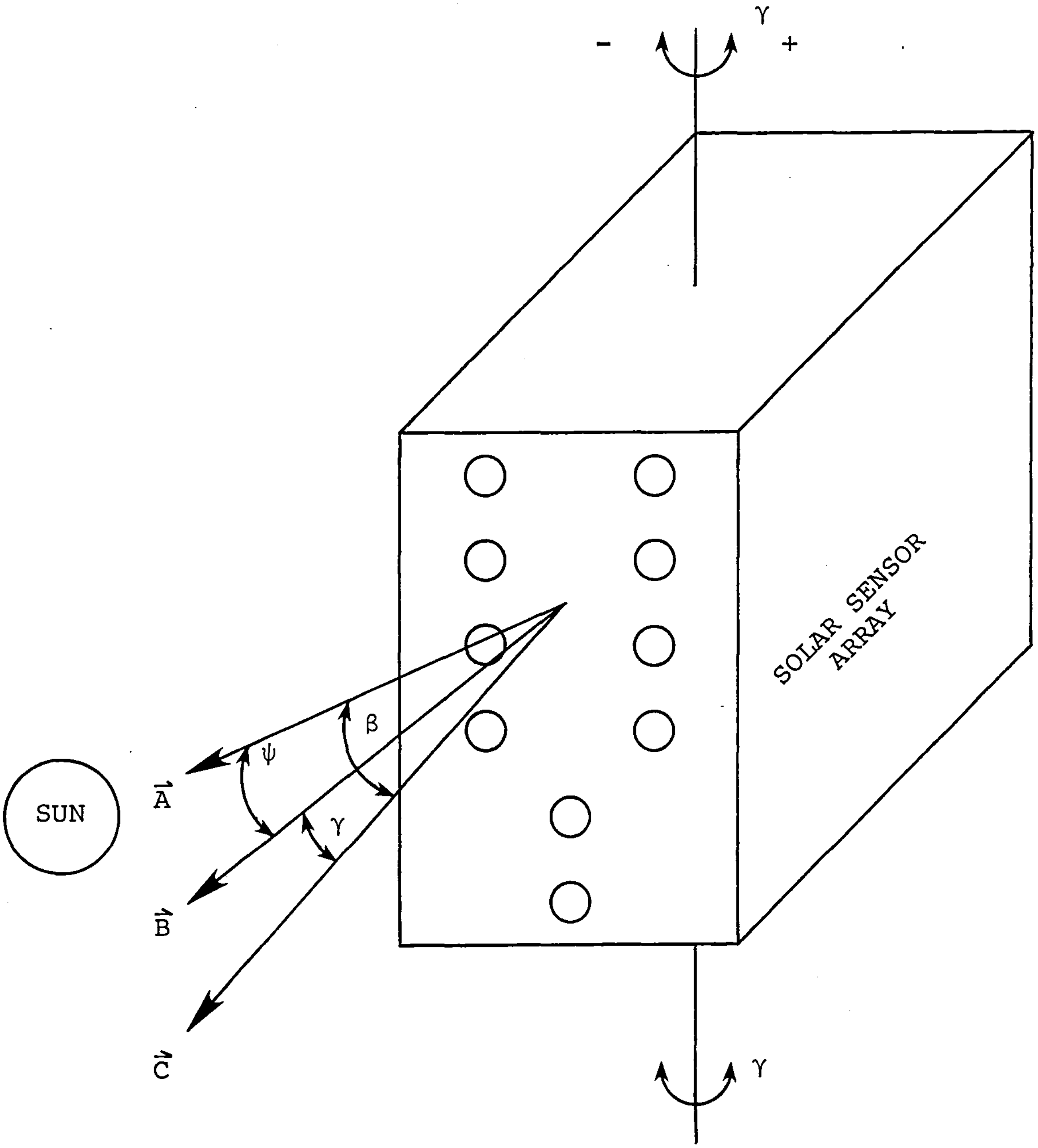
3) Days 225-51 (orbits ranging from 4052 to 4418). This misalignment was due to failure to adjust the angle.

Periods of misalignment usually ended when angle adjustments were performed. Appendix N contains a detailed listing of orbits which had off-axis angle greater than 0.5 degree. Appendix O contains a list of orbits which had off-axis angles greater than one degree. Appendix O contains a list of orbits which had off-axis angles greater than one degree.

---

*The writers wish to thank NET member Mr. John R. Hickey for important discussions and data appearing in this and the following subsections.

FIGURE 3-10. Definition of the Off-Axis Angle



$\vec{A}$ is a vector pointing from the Solar Sensor Array to the Sun.

$\vec{B}$ is a vector perpendicular to the face of the Solar Sensor Array and defines the pointing direction of the array.

$\vec{C}$ is a vector which lies along the direction of flight of the Spacecraft.

3.4.6 Invalid Solar Azimuth or Solar Elevation

The following orbits had either an invalid DSAS azimuth or elevation angle:

DAY	ORBIT(S)
4	994
139	2867
153	3064, 3065
201	3725
268	4650
269	4660-4662

These were probably due to losses in data quality which were not correctly flagged on the MAT. Users may recover this data by the same scheme proposed for handling the DSAS $\alpha = \beta$ problem.

3.4.7 DSAS Solar Elevation Checks

As pointed out by Mr. Hickey (see Reference 7), misalignment of the solar channel assembly by more than 1 degree produces off-axis effects not well understood. Appendix P presents a detailed list of orbits having DSAS solar elevation angle greater than 1 degree. This list also corresponds roughly to the major periods of off-axis angle misalignment. It is suggested that users reject this data from use in scientific investigation.

SECTION 4. CONCLUSIONS

4.1 USE OF THE EARTH FLUX DATA

The Earth flux data on the SEFDT has been shown to be consistent with the data output on the MATRIX product. Users are reminded that there are degradation and duty cycle effects (see Subsection 1.2) remaining in the data. These effects are under intense study at the time of this writing and a general calibration approach for handling them may be presented in the future. That study is outside the scope of this document. It is also important to note that no Earth flux data is rejected from the SEFDT. Each user must determine if the data rejection criteria, indicated in Subsection 1.3, are appropriate for their particular investigation. Some users may need to interpolate in order to obtain the subsatellite point location with a finer resolution than is provided on SEFDT. It is felt that the advantage of having a 12-tape data set containing the complete year of calibrated Earth flux irradiances will far outweigh the above inconveniences.

4.2 USE OF THE SOLAR DATA

Several problems in the solar data have been discussed which may require special processing by the user to: (1) reject orbits with unrecoverable data problems, and (2) recover data with minor flaws. Unrecoverable data problems include the following:

1) data gaps - (see Appendices J, K, and M)

2) shutter status change (see Appendix H)

3) misalignment greater than 1^o (see Appendices O and P)

4) ECAL spikes (see Subsection 3.4.3)

5) known data anomalies (see Subsection 3.4.4)

Minor flaws which are amendable to recovery by user processing include:

1) warmup data rejection

2) DSAS azimuth and elevation angles equal

3) invalid DSAS angles

4) solar channel assembly misalignment

5) solar channel degradation and recovery

All users of the solar data should reject the unrecoverable orbits as indicated above. Users requiring high precision solar data must also consider processing the recoverable items listed above. The most important of these are Items 4 and 5, the correction for off-axis effects and degradation effects.

APPENDIX A.

Solar Zenith Angle "Out of Limits"

The solar zenith angle was out of limits for at least one major frame in the orbits listed below. The angles were slightly above the upper limit of 180 degrees. This problem did not affect any irradiances.

JULIAN DAY	ORBIT(S)
3	986, 988
4	990, 992, 994, 996, 998, 1000, 1002, 1004
5	1006, 1008, 1010, 1012, 01014, 1016
7	1034-1046
8	1047-1060
9	1061, 1067, 1069, 1071, 1073
267	4628, 4629, 4631, 4632, 4633, 4635, 4636, 4637, 4638, 4639
268	4640, 4642-46, 4649, 4650, 4652, 4653
269	4654, 4656, 4659, 4660, 4661, 4662, 4663, 4664, 4665, 4666, 4667
271	4683

APPENDIX B.

Solar Azimuth Sign Change

The solar azimuth angle changed sign abruptly in at least one major frame in the following orbits. This problem did not affect any irradiances.

JULIAN DAY	ORBIT(S)
361	886-895
362	All
364	All
365	All
January, 1979	All
61	1783
80	2042
255	4472-4475
256	All
257	All
259	4520-4530
260	4535-4544
261	All
263	All
264	All
265	4600-4612
267	All
268	All
269	All
271	All
272	All
273	All
275	All
276	All
277	All
279	All
280	All
281	4821-4833

APPENDIX C.

Latitude and Longitude Filled

Due to a mislocation problem on the input MATs, the following orbits had latitudes and longitudes set to a fill value (22222) for at least one major frame.

DAY	ORBIT
97	2289
116	2551
156	3098
220	3990
252	4433
295	5025

APPENDIX D.

SEFDT and MATRIX Intercomparison Results

Latitude band averages are computed for the Earth flux quantities which have a corresponding MATRIX parameter:

1) Parameter 3 - Ascending Node Long Wave Flux
2) Parameter 4 - Descending Node Long Wave Flux
3) Parameter 9 - Ascending Node Reflected Flux from Channel 13
4) Parameter 10 - Descending Node Reflected Flux from Channel 13
5) Parameter 11 - Ascending Node Reflected Flux from Channel 14
6) Parameter 12 - Descending Node Reflected Flux from Channel 14

The long wave fluxes are computed (as in MATRIX) as the difference between Channel 12 and Channel 13. Before making the comparison with MATRIX, the latitude band averages of the MARIX parameters are computed using a population weighting scheme where the contribution of a target area to the zonal mean is weighted by its data population. This approach means that each data sample will be weighted equally (in both latitude band averages). In computing the band averages, the MATRIX program WFOV data rejection criteria were applied. Data was rejected for:*

1) instrument warmup
2) sun blip
3) irradiances out of limits
4) special modes (ECAL, GO/NOGO, Channel 12 shuttered or narrow, etc.)

Three computational constraints were encountered that will be important to users of the SEFDT Earth flux data. These will be briefly discussed

---

*See Reference 3 for a discussion of MATRIX data rejection criteria.

APPENDIX D.

SEFDT and MATRIX Intercomparison Results

(Continued)

The Channel 12 thermopile base temperature was used to test for instrument warmup (MATRIX uses Channel 2 temperature). This was necessary since SEFDT Earth flux records do not contain the Channel 2 temperature. Channel 12 was determined to run about 2°C cooler than Channel 2 during the warmup period. Instead of using a range of 17° to 30°C as in MATRIX, users may wish to determine a more appropriate warmup threshold. In this study, the comparison results improved significantly when a Channel 12 warmup data rejection threshold between 15° and 16°C was employed.

A second constraint concerns the subsatellite point location data available to the SEFDT user. This data (subpoint latitude and longitude) is provided once per major frame at two seconds into the frame. Since this data is used to bin the irradiances into latitude zones for averaging, errors will be introduced whenever a major frame spans a latitude zone boundary. Users may overcome this constraint by developing an interpolation procedure to obtain the subsatellite point location with as much resolution as is used in MATRIX processing.

The final constraint encountered involves the separation into Ascending Node (AN) and Descending Node (DN). This study used the following approach: whenever the subsatellite point latitude is incrementing in a positive sense, the spacecraft is on the AN. This suffers from the same problem discussed in the second constraint above.

The results are presented in the form of tables for each month in Year-1. The first table presents the day-to-day means of the latitude band differences between SEFDT and MATRIX. These were computed by first computing the differences for a given day for a given parameter, then averaging the differences for the forty latitude zones. The second table gives standard deviations which were computed from the differences discussed above. Thus, the two tables present means and standard deviations of the differences between SEFDT and MATRIX parameters on a day-to-day basis. All units in these tables are in Watts/m^2.

In the production of these tables, the Channel 12 temperature threshold was left at the MATRIX warmup rejection value (17°C). This causes poor agreement on the ERB warmup days. If the tables are scanned for means and standard deviations greater than 3 Watts/m^2 only six non-warmup days stand out as problems in Year-1. Analysis of these six days with test software indicated that use of an interpolation scheme for the subsatellite latitudes caused improved agreement.

APPENDIX D.

SEFDT and MATRIX Intercomparison Results

(Continued)

In summary, these results show good agreement between SEFDT and MATRIX for the Earth flux parameters. Analysis indicates that the comparison can be made arbitrarily close if the three computational constraints are carefully addressed by users of the SEFDT.

SEFDT SCIENCE QC RESULTS:

LATITUDE BAND AVERAGE INTERCOMPARISON RESULTS
POPULATION WEIGHTED MATRIX RESULTS VS.
SEFDT SCIENCE QC RESULTS: NOVEMBER, 1978

MEANS OF DIFFERENCES:

DAY	P3	P4	P9	P10	P11	P12
320	0.6	-0.1	0.5	-1.8	0.2	-0.4
321	0.7	-0.2	0.5	-2.3	0.2	-0.3
322	0.0	-0.3	0.4	-2.3	0.2	-0.4
324	0.0	-1.0	1.7	-1.8	0.9	-0.3
325	0.6	-0.1	0.6	-2.1	0.2	-0.3
326	0.6	-0.2	0.5	-2.8	0.2	-0.3
328	-0.3	0.5	2.1	-1.8	0.9	-0.3
329	0.7	0.3	0.5	-2.4	0.2	-0.4
330	0.7	-0.2	0.5	-2.3	0.2	-0.3
332	0.3	-0.2	1.4	-1.7	0.8	-0.3
333	0.7	-0.2	0.6	-3.0	0.2	-0.4
334	0.6	0.0	0.6	-2.7	0.2	-0.4

SEFDT SCIENCE QC RESULTS:

LATITUDE BAND AVERAGE INTERCOMPARISON RESULTS
POPULATION WEIGHTED MATRIX RESULTS VS.
SEFDT SCIENCE QC RESULTS: NOVEMBER, 1978

ST. DEVIATIONS OF DIFFERENCES:

DAY	P3	P4	P9	P10	P11	P12
320	0.5	1.0	1.6	2.6	0.7	0.9
321	0.8	1.0	2.2	2.5	1.0	0.8
322	1.3	1.2	1.6	2.4	0.7	0.8
324	2.7	2.1	3.9	2.8	1.6	0.9
325	0.5	0.9	1.5	2.3	0.7	0.7
326	0.4	0.9	1.5	2.5	0.6	0.8
328	2.5	2.7	4.1	2.9	1.8	0.9
329	0.4	3.1	1.5	2.6	0.7	0.8
330	0.4	0.9	1.6	2.5	0.7	0.8
332	1.6	1.7	3.5	2.7	1.6	0.9
333	0.5	1.0	1.7	2.5	0.7	0.8
334	0.5	1.3	1.7	2.2	0.7	0.8

SEFDT SCIENCE QC RESULTS:

LATITUDE BAND AVERAGE INTERCOMPARISON RESULTS
POPULATION WEIGHTED MATRIX RESULTS VS.
SEFDT SCIENCE QC RESULTS: DECEMBER, 1978

MEANS OF DIFFERENCES:

```
DAY      P3      P4      P9     P10     P11     P12

336     0.1     0.1     1.7    -2.3     1.0    -0.4
337     0.6    -0.0     0.5    -2.5     0.2    -0.4
338     0.6     0.0     0.6    -2.6     0.3    -0.4
340     0.4    -0.7     0.3    -2.3     0.1    -0.4
341     0.6    -0.1     0.6    -2.7     0.2    -0.4
342     0.6     0.0     0.7    -2.8     0.3    -0.4
344     0.4     0.8     1.1    -2.3     0.6    -0.4
345     0.6    -0.0     0.7    -2.8     0.3    -0.4
346     0.6     0.1     0.6    -2.7     0.2    -0.4
348    -0.3     1.4     2.7    -3.1     1.4    -0.4
349     0.6    -0.0     0.6    -2.8     0.2    -0.4
350     0.6     0.0     0.6    -2.9     0.2    -0.4
352     0.5     1.3    -0.2    -2.1    -0.2    -0.4
353     0.5     0.1     0.6    -2.8     0.3    -0.4
354     0.5     0.1     0.6    -2.8     0.2    -0.4
356********************************************
357********************************************
358*******      5.4*****************************
360    -0.8     1.9     3.3    -1.7     1.6    -0.3
361     0.5     0.1     0.5    -3.1     0.2    -0.5
362     0.4     0.3     0.7    -2.6     0.3    -0.4
364    -0.3     1.0     2.2    -1.9     1.1    -0.3
365     0.4     0.3     0.4    -2.1     0.1    -0.4
```

SEFDT SCIENCE QC RESULTS:

LATITUDE BAND AVERAGE INTERCOMPARISON RESULTS
POPULATION WEIGHTED MATRIX RESULTS VS.
SEFDT SCIENCE QC RESULTS: DECEMBER, 1978

ST. DEVIATIONS OF DIFFERENCES:

```
DAY      P3      P4      P9     P10     P11     P12

336     2.1     1.1     4.0     2.5     1.7     0.8
337     0.5     1.0     1.4     2.2     0.6     0.8
338     0.5     1.2     1.6     2.3     0.7     0.8
340     1.5     2.5     2.7     2.9     1.4     0.9
341     0.6     1.0     1.6     2.5     0.6     0.8
342     0.7     1.1     1.7     2.6     0.7     0.8
344     1.2     2.0     3.0     3.7     1.4     1.2
345     0.6     1.1     1.7     2.7     0.7     0.8
346     0.6     1.0     1.5     2.6     0.6     0.8
348     2.2     1.3     3.7     3.7     1.8     1.1
349     0.6     1.1     1.4     2.6     0.6     0.8
350     0.6     1.0     1.5     2.6     0.6     0.9
352     1.4     1.1     3.0     3.3     1.5     1.0
353     0.6     1.1     1.5     2.5     0.7     0.8
354     0.6     1.1     1.4     2.4     0.6     0.8
356********************************************
357********************************************
358*******      8.1*****************************
360     2.0     1.3     4.0     2.9     2.0     0.9
361     0.7     1.1     1.5     2.9     0.6     0.9
362     0.7     1.1     1.7     2.4     0.7     0.8
364     2.2     2.5     3.5     3.3     1.5     1.0
365     0.7     1.0     1.6     2.5     0.7     0.8
```

SEFDT SCIENCE QC RESULTS:

LATITUDE BAND AVERAGE INTERCOMPARISON RESULTS
POPULATION WEIGHTED MATRIX RESULTS VS.
SEFDT SCIENCE QC RESULTS: JANUARY, 1979

MEANS OF DIFFERENCES:

DAY	P3	P4	P9	P10	P11	P12
1	0.5	0.2	0.6	-2.8	0.2	-0.4
3	0.2	0.7	1.5	-2.1	0.7	-0.3
4	0.3	0.2	0.5	-2.1	0.2	-0.4
5	0.4	0.3	0.6	-3.2	0.2	-0.4
7	0.1	1.2	0.2	-1.8	0.2	-0.3
8	0.4	0.3	0.6	-2.2	0.2	-0.4
9	0.4	0.3	0.6	-3.0	0.2	-0.5
11	0.1	0.3	0.5	-1.6	0.3	-0.3
12	0.2	0.4	0.5	-1.9	0.2	-0.4
13	0.2	0.5	0.6	-2.4	0.2	-0.4
15	0.1	0.5	-0.5	-1.6	-0.3	-0.3
16	0.2	0.4	0.6	-2.2	0.3	-0.4
17	0.3	0.4	0.5	-2.7	0.2	-0.4
19	0.2	0.7	0.6	-1.5	0.2	-0.3
20	0.2	0.4	0.5	-2.2	0.2	-0.4
21	0.2	0.5	0.5	-2.3	0.2	-0.3
23	0.6	-0.1	-0.1	-1.6	0.0	-0.4
25	0.4	0.3	0.3	-1.2	0.2	-0.3
27	0.3	-0.4	0.5	-1.1	0.3	-0.3
29	0.2	-0.3	0.7	-1.0	0.3	-0.3
31	0.5	0.6	-0.3	-1.1	-0.1	-0.3

SEFDT SCIENCE QC RESULTS:

LATITUDE BAND AVERAGE INTERCOMPARISON RESULTS
POPULATION WEIGHTED MATRIX RESULTS VS.
SEFDT SCIENCE QC RESULTS: JANUARY, 1979

ST. DEVIATIONS OF DIFFERENCES:

DAY	P3	P4	P9	P10	P11	P12
1	0.7	1.0	1.5	3.1	0.6	0.9
3	1.8	1.6	3.6	3.5	1.6	1.0
4	0.7	1.0	1.3	2.5	0.5	0.9
5	0.7	1.0	1.4	3.2	0.6	1.0
7	2.4	1.6	3.3	3.8	1.4	1.1
8	0.7	1.0	1.7	3.1	0.7	1.0
9	0.8	0.9	1.7	3.4	0.7	1.0
11	2.4	1.4	3.0	2.4	1.5	0.7
12	0.9	0.9	1.9	2.3	0.8	0.8
13	0.7	1.0	1.7	2.4	0.7	0.7
15	1.4	2.1	3.4	2.4	1.6	0.8
16	0.7	0.9	1.6	2.9	0.7	0.9
17	0.7	0.9	1.6	2.7	0.7	0.9
19	0.6	1.1	1.8	2.5	0.8	0.8
20	0.7	0.9	1.5	2.7	0.7	0.9
21	0.7	0.9	1.6	2.5	0.7	0.7
23	1.0	2.3	2.2	2.8	1.1	1.0
25	1.1	1.5	2.2	2.6	1.0	0.9
27	0.8	1.9	2.8	2.2	1.4	0.8
29	0.8	2.3	2.3	2.5	1.1	0.9
31	1.0	1.3	3.0	2.7	1.6	1.0

SEFDT SCIENCE QC RESULTS:

LATITUDE BAND AVERAGE INTERCOMPARISON RESULTS
POPULATION WEIGHTED MATRIX RESULTS VS.
SEFDT SCIENCE QC RESULTS: FEBRUARY, 1979

MEANS OF DIFFERENCES:

DAY	P3	P4	P9	P10	P11	P12
33	0.0	0.5	1.0	-0.9	0.5	-0.3
35	0.2	0.8	1.6	-0.8	0.8	-0.2
37	0.5	1.3	0.6	-1.1	0.4	-0.3
39	0.3	1.0	0.4	-1.0	0.2	-0.2
40	0.2	0.5	0.4	-1.3	0.1	-0.3
41	0.3	0.4	0.4	-1.8	0.1	-0.3
43	-0.3	0.4	1.8	-0.8	0.8	-0.2
44	0.3	0.4	0.3	-1.4	0.1	-0.3
45	0.3	0.4	0.4	-1.7	0.1	-0.3
47	0.3	0.4	1.4	-0.7	0.8	-0.2
48	0.3	0.5	0.3	-1.1	0.1	-0.2
49	0.3	0.4	0.3	-1.2	0.1	-0.2
51	0.4	0.6	0.8	-0.6	0.4	-0.2
52	0.3	0.3	0.3	-1.4	0.1	-0.2
53	0.3	0.6	0.3	-1.9	0.1	-0.2
55	0.5	0.2	0.2	-0.3	0.1	-0.2
57	0.3	0.1	-0.1	-0.4	-0.0	-0.2
59	0.1	-2.2	1.7	-0.2	1.3	-0.1

SEFDT SCIENCE QC RESULTS:

LATITUDE BAND AVERAGE INTERCOMPARISON RESULTS
POPULATION WEIGHTED MATRIX RESULTS VS.
SEFDT SCIENCE QC RESULTS: FEBRUARY, 1979

ST. DEVIATIONS OF DIFFERENCES:

DAY	P3	P4	P9	P10	P11	P12
33	1.0	0.9	3.2	2.4	1.4	0.9
35	0.7	1.5	3.3	2.1	1.9	0.8
37	1.9	1.6	2.0	2.8	0.9	1.0
39	0.7	2.6	2.9	2.3	1.4	0.8
40	0.7	0.8	1.6	2.3	0.7	0.8
41	0.7	0.7	1.6	2.6	0.7	0.8
43	1.1	1.5	3.6	2.1	1.8	0.8
44	0.8	0.8	1.8	2.3	0.7	0.7
45	0.8	0.7	1.9	2.6	0.8	0.8
47	0.7	1.5	2.6	1.9	1.5	0.7
48	0.7	0.7	1.7	2.2	0.7	0.7
49	0.7	0.9	1.8	2.2	0.8	0.7
51	0.8	1.0	2.8	1.7	1.3	0.7
52	0.7	0.8	1.7	2.3	0.7	0.7
53	0.7	1.6	1.7	2.6	0.8	0.7
55	0.8	1.7	1.9	1.4	0.9	0.6
57	0.7	1.8	2.3	1.4	1.0	0.7
59	2.2	4.0	5.2	1.1	3.3	0.4

SEFDT SCIENCE QC RESULTS:

LATITUDE BAND AVERAGE INTERCOMPARISON RESULTS
POPULATION WEIGHTED MATRIX RESULTS VS.
SEFDT SCIENCE QC RESULTS: MARCH, 1979

MEANS OF DIFFERENCES:

DAY	P3	P4	P9	P10	P11	P12
60	0.5	0.3	0.2	-0.6	0.1	-0.1
61	0.5	0.3	0.2	-1.0	0.0	-0.2
63	0.4	0.3	1.0	-0.6	0.6	-0.1
64	0.5	0.4	0.2	-0.5	0.1	-0.1
65	0.5	-0.1	0.1	-0.8	0.1	-0.1
67	0.0	-0.7	1.2	-0.2	0.6	-0.1
68	0.6	0.2	0.1	-1.1	0.0	-0.2
69	0.6	0.1	0.2	-0.9	0.1	-0.1
71	0.3	-0.2	0.5	-0.2	0.3	-0.0
72	0.6	0.1	0.1	-0.4	0.1	-0.1
73	0.6	0.2	0.0	-0.7	0.0	-0.0
75	0.0	0.5	0.8	0.0	0.4	0.0
76	0.6	0.6	0.1	-0.1	0.0	0.0
77	0.7	0.4	0.1	-0.4	0.0	0.0
79	0.5	-0.7	0.1	-0.2	-0.0	-0.1
80	0.7	0.1	0.1	0.1	0.0	0.0
81	0.7	0.1	-0.0	0.0	-0.0	0.0
83	0.6	-0.1	-0.4	0.1	-0.2	0.0
84	0.7	0.1	-0.0	0.1	-0.0	0.1
85	0.7	0.0	0.0	0.2	0.0	0.1
87	0.5	0.7	-0.5	0.2	-0.1	0.1
88	0.7	0.1	-0.1	0.2	-0.0	0.1
89	0.7	0.0	-0.1	0.4	-0.0	0.1

SEFDT SCIENCE QC RESULTS:

LATITUDE BAND AVERAGE INTERCOMPARISON RESULTS
POPULATION WEIGHTED MATRIX RESULTS VS.
SEFDT SCIENCE QC RESULTS: MARCH, 1979

ST. DEVIATICNS OF DIFFERENCES:

DAY	P3	P4	P9	P10	P11	P12
60	0.6	0.7	1.7	1.7	0.8	0.5
61	0.7	0.8	1.9	2.2	0.8	0.6
63	0.8	0.7	2.6	1.6	1.4	0.5
64	0.6	1.5	1.7	1.8	0.7	0.5
65	0.7	1.7	1.7	1.9	0.7	0.5
67	1.2	1.8	3.0	1.1	1.5	0.5
68	0.7	0.6	1.7	1.8	0.7	0.6
69	0.7	0.7	1.9	2.1	0.8	0.5
71	0.9	1.5	2.7	1.2	1.5	0.5
72	0.6	0.8	1.7	1.3	0.7	0.4
73	0.7	0.8	2.0	1.7	0.9	0.5
75	1.9	1.4	3.4	0.8	1.7	0.4
76	0.5	3.0	1.7	1.1	0.7	0.4
77	0.6	1.5	1.6	1.6	0.7	0.4
79	0.7	2.1	1.8	1.2	0.8	0.5
80	0.6	0.7	1.8	0.9	0.8	0.3
81	0.6	0.8	1.7	0.6	0.8	0.3
83	0.9	1.5	3.3	0.5	1.5	0.2
84	0.5	0.8	1.5	1.0	0.7	0.4
85	0.5	0.8	1.6	1.4	0.7	0.4
87	1.4	1.3	2.3	0.6	1.2	0.4
88	0.5	1.0	1.7	1.1	0.7	0.5
89	0.5	0.9	1.6	1.5	0.7	0.4

SEFDT SCIENCE QC RESULTS:

LATITUDE BAND AVERAGE INTERCOMPARISON RESULTS
POPULATION WEIGHTED MATRIX RESULTS VS.
SEFDT SCIENCE QC RESULTS: APRIL, 1979

MEANS OF DIFFERENCES:

DAY	P3	P4	P9	P10	P11	P12
91	1.1	-0.5	-0.9	0.2	-0.4	0.2
93	0.8	-0.1	0.0	0.3	-0.0	0.1
95	0.4	-0.6	0.1	0.3	-0.1	0.1
97	-0.7	0.0	2.8	0.3	1.4	0.2
99	0.5	0.5	0.7	0.3	0.3	0.2
101	0.4	1.0	-0.1	0.4	-0.1	0.2
103	0.0	0.2	0.4	0.6	0.2	-0.6
104	0.7	0.5	-0.2	0.6	-0.1	0.2
105	0.7	0.2	-0.1	1.5	-0.0	0.3
106	0.7	0.2	-0.2	0.9	-0.1	0.2
107	0.7	0.3	-0.2	1.2	-0.1	0.3
108	0.7	0.2	-0.2	1.0	-0.1	0.2
109	0.7	0.2	-0.2	1.1	-0.1	0.3
111	-0.1	0.4	0.6	0.7	0.4	0.3
112	0.7	0.3	-0.3	0.8	-0.1	0.3
113	0.6	0.3	-0.2	1.4	-0.1	0.3
115	0.4	-0.3	0.0	0.5	-0.0	0.3
116	0.6	0.4	-0.3	0.7	-0.1	0.3
117	0.7	0.4	-0.4	1.7	-0.2	0.3
118	0.6	0.4	-0.3	1.5	-0.1	0.3
119	0.6	0.4	-0.3	1.6	-0.1	0.3

SEFDT SCIENCE QC RESULTS:

LATITUDE BAND AVERAGE INTERCOMPARISON RESULTS
POPULATION WEIGHTED MATRIX RESULTS VS.
SEFDT SCIENCE QC RESULTS: APRIL, 1979

ST. DEVIATIONS OF DIFFERENCES:

DAY	P3	P4	P9	P10	P11	P12
91	0.8	2.1	2.6	0.7	1.4	0.4
93	1.1	1.8	2.7	0.9	1.3	0.4
95	1.2	1.7	3.4	0.7	1.6	0.4
97	1.5	1.7	4.6	0.8	2.3	0.4
99	1.0	1.2	2.7	0.9	1.3	0.5
101	0.8	1.5	2.6	1.0	1.1	0.6
103	1.3	1.4	2.6	1.4	1.5	3.1
104	0.4	2.1	1.6	1.4	0.7	0.6
105	0.5	0.9	1.7	2.3	0.7	0.6
106	0.4	0.9	1.6	1.6	0.7	0.6
107	0.5	1.0	1.6	2.1	0.7	0.6
108	0.5	1.0	1.5	1.6	0.7	0.5
109	0.6	1.0	1.5	1.9	0.6	0.6
111	1.3	1.3	2.9	1.3	1.5	0.5
112	0.4	1.0	1.5	1.6	0.6	0.6
113	0.5	1.0	1.5	2.1	0.7	0.6
115	0.9	2.0	3.2	1.3	1.6	0.6
116	0.5	1.1	1.5	1.7	0.6	0.7
117	0.5	1.1	1.6	2.5	0.7	0.7
118	0.6	1.0	1.8	2.1	0.8	0.6
119	0.5	1.0	1.6	2.2	0.7	0.6

SEFDT SCIENCE QC RESULTS:

LATITUDE BAND AVERAGE INTERCOMPARISON RESULTS
POPULATION WEIGHTED MATRIX RESULTS VS.
SEFDT SCIENCE QC RESULTS: MAY, 1979

MEANS OF DIFFERENCES:

DAY	P3	P4	P9	P10	P11	P12
121	-0.2	0.0	0.8	0.5	0.4	0.3
123	-0.0	0.6	0.2	0.4	0.1	0.3
124	0.5	0.6	-0.3	0.9	-0.1	0.3
125	0.5	0.6	-0.3	1.1	-0.1	0.3
127	-0.1	0.2	0.2	0.4	0.1	0.3
128	0.5	0.6	-0.3	1.0	-0.1	0.3
129	0.4	0.7	-0.4	1.7	-0.2	0.4
131	-0.6	0.9	1.1	0.5	0.6	0.3
133	-1.0	0.9	2.7	0.8	1.2	0.4
134	0.3	0.8	-0.4	1.4	-0.2	0.4
135	0.4	0.8	-0.4	1.6	-0.2	0.3
137	-0.6	1.3	0.4	0.6	0.3	0.3
139	-0.4	0.9	0.6	0.7	0.2	0.3
140	0.2	0.6	-0.3	1.2	-0.1	0.3
141	0.3	0.9	-0.3	1.8	-0.1	0.4
143	-0.4	1.1	-0.1	1.0	-0.0	0.4
144	0.2	0.8	-0.4	1.1	-0.2	0.3
145	0.2	0.8	-0.4	1.3	-0.2	0.3
147	-0.2	1.1	0.4	1.0	0.2	0.4
148	0.2	0.9	-0.4	1.4	-0.2	0.4
149	0.2	1.0	-0.4	2.0	-0.2	0.4
151	0.1	1.0	-0.7	1.1	-0.3	0.4

SEFDT SCIENCE QC RESULTS:

LATITUDE BAND AVERAGE INTERCOMPARISON RESULTS
POPULATION WEIGHTED MATRIX RESULTS VS.
SEFDT SCIENCE QC RESULTS: MAY, 1979

ST. DEVIATIONS OF DIFFERENCES:

DAY	P3	P4	P9	P10	P11	P12
121	1.4	1.5	3.4	1.2	1.5	0.6
123	0.9	1.1	2.3	1.2	1.1	0.5
124	0.5	1.0	1.4	1.8	0.6	0.6
125	0.6	1.0	1.5	1.9	0.6	0.6
127	1.0	1.6	2.4	1.2	1.3	0.5
128	0.6	1.0	1.5	1.9	0.6	0.6
129	0.5	1.1	1.5	2.3	0.6	0.7
131	1.3	1.4	2.3	1.4	1.2	0.6
133	2.0	1.3	5.1	1.6	2.3	0.6
134	0.6	1.0	1.3	1.9	0.6	0.6
135	0.5	1.0	1.3	2.1	0.5	0.7
137	1.5	1.7	3.6	1.3	1.8	0.5
139	1.7	1.4	3.6	1.5	1.5	0.6
140	0.5	1.6	1.4	1.8	0.6	0.6
141	0.6	1.0	1.5	2.1	0.6	0.6
143	1.0	1.3	2.0	1.8	1.1	0.7
144	0.6	1.0	1.6	2.7	0.7	0.8
145	0.6	1.3	1.5	2.5	0.6	0.7
147	0.9	1.6	2.8	1.8	1.4	0.7
148	0.5	1.0	1.5	2.1	0.6	0.6
149	0.7	0.9	1.3	2.1	0.5	0.7
151	0.7	1.1	2.2	1.7	1.2	0.6

SEFDT SCIENCE QC RESULTS:

LATITUDE BAND AVERAGE INTERCOMPARISON RESULTS
POPULATION WEIGHTED MATRIX RESULTS VS.
SEFDT SCIENCE QC RESULTS: JUNE, 1979

MEANS OF DIFFERENCES:

DAY	P3	P4	P9	P10	P11	P12
152	0.2	1.0	-0.5	1.6	-0.2	0.4
153	0.2	1.0	-0.5	2.0	-0.2	0.4
155	-0.3	1.1	0.3	1.2	0.3	0.4
156	0.1	1.0	-0.5	1.8	-0.2	0.4
157	0.1	1.1	-0.4	2.0	-0.2	0.4
159	-0.1	1.2	-0.4	1.2	-0.2	0.2
160	0.2	1.0	-0.6	1.6	-0.2	0.4
161	0.1	1.1	-0.5	1.7	-0.2	0.4
163	-0.3	1.2	0.5	0.8	0.3	0.4
164	0.1	1.1	-0.2	1.6	-0.1	0.4
165	0.2	1.1	-0.3	1.8	-0.1	0.4
167	-0.2	1.0	-0.9	0.6	-0.5	0.3
168	0.1	1.0	-0.4	1.1	-0.2	0.4
169	0.1	1.1	-0.5	1.7	-0.2	0.4
171	-0.2	1.0	0.5	0.7	0.4	0.3
172	0.1	1.1	-0.4	1.2	-0.2	0.4
173	0.2	1.1	-0.4	1.5	-0.2	0.3
175	-0.2	1.1	0.3	0.6	0.1	0.3
176	0.2	1.1	-0.3	1.2	-0.1	0.2
177	0.2	1.1	-0.5	1.6	-0.2	0.3
179	-0.1	1.1	0.1	0.5	0.0	0.3
180	0.2	1.0	-0.4	1.1	-0.2	0.3
181	0.2	1.0	-0.4	1.6	-0.1	0.4

SEFDT SCIENCE QC RESULTS:

LATITUDE BAND AVERAGE INTERCOMPARISON RESULTS
POPULATION WEIGHTED MATRIX RESULTS VS.
SEFDT SCIENCE QC RESULTS: JUNE, 1979

ST. DEVIATIONS OF DIFFERENCES:

DAY	P3	P4	P9	P10	P11	P12
152	0.7	0.9	1.3	2.0	0.6	0.6
153	0.6	0.9	1.5	2.0	0.7	0.6
155	0.9	1.0	1.7	1.9	0.9	0.7
156	0.7	1.0	1.4	1.9	0.6	0.6
157	0.6	0.9	1.4	2.0	0.6	0.6
159	0.7	1.2	1.3	1.8	0.6	1.0
160	0.6	0.9	1.2	2.1	0.5	0.7
161	0.7	0.8	1.3	1.8	0.6	0.6
163	1.3	0.9	2.8	1.5	1.2	0.6
164	0.7	0.7	2.1	1.8	0.9	0.6
165	0.6	0.8	1.4	1.8	0.6	0.6
167	1.0	0.8	2.1	1.3	1.1	0.5
168	0.7	0.9	1.3	1.5	0.5	0.5
169	0.7	0.7	1.4	1.8	0.6	0.5
171	1.2	0.9	2.0	1.3	1.0	0.5
172	0.7	0.8	1.4	1.6	0.7	0.5
173	0.8	0.7	1.4	1.8	0.6	0.5
175	1.0	0.9	2.1	1.1	0.9	0.4
176	0.8	0.7	1.3	1.7	0.6	0.8
177	0.7	0.8	1.2	1.6	0.5	0.5
179	1.1	0.8	1.5	1.3	0.6	0.5
180	0.7	0.7	1.0	1.5	0.5	0.5
181	0.7	0.8	1.0	1.7	0.4	0.5

SEFDT SCIENCE QC RESULTS:

LATITUDE BAND AVERAGE INTERCOMPARISON RESULTS
POPULATION WEIGHTED MATRIX RESULTS VS.
SEFDT SCIENCE QC RESULTS: JULY, 1979

MEANS OF DIFFERENCES:

DAY	P3	P4	P9	P10	P11	P12
183	0.1	1.0	-0.7	0.4	-0.3	0.2
184	0.3	0.9	-0.5	1.2	-0.2	0.3
185	0.3	0.9	-0.4	1.5	-0.1	0.3
187	0.1	1.0	-0.4	0.6	-0.0	0.2
188	0.3	0.9	-0.4	1.2	-0.1	0.3
189	0.3	0.9	-0.4	1.6	-0.2	0.3
191	0.3	0.9	-0.4	0.5	-0.2	0.3
192	0.4	0.9	-0.4	1.1	-0.1	0.3
193	0.4	0.9	-0.4	1.4	-0.1	0.3
195	0.7	0.8	-1.2	0.6	-0.5	0.3
196	0.5	0.8	-0.3	1.1	-0.1	0.3
197	0.5	0.8	-0.4	0.9	-0.1	0.2
199	0.5	0.8	-0.4	1.0	-0.2	0.3
200	0.5	0.8	-0.3	1.0	-0.1	0.3
201	0.5	0.7	-0.3	1.2	-0.1	0.3
203	0.7	0.8	-0.5	0.2	-0.1	0.1
204	0.6	0.7	-0.3	0.9	-0.1	0.3
205	0.5	0.6	-0.3	0.8	-0.1	0.2
207	0.3	0.7	-0.1	0.5	-0.0	0.3
208	0.6	0.7	-0.3	1.1	-0.1	0.3
209	0.6	0.6	-0.3	1.4	-0.1	0.3
211	0.5	0.7	-0.3	0.6	-0.0	0.3
212	0.6	0.6	-0.3	1.2	-0.1	0.3

SEFDT SCIENCE QC RESULTS:

LATITUDE BAND AVERAGE INTERCOMPARISON RESULTS
POPULATION WEIGHTED MATRIX RESULTS VS.
SEFDT SCIENCE QC RESULTS: JULY, 1979

ST. DEVIATIONS OF DIFFERENCES:

DAY	P3	P4	P9	P10	P11	P12
183	1.2	1.0	1.9	2.0	0.9	0.9
184	0.7	0.8	1.0	1.6	0.4	0.5
185	0.8	0.7	1.2	1.6	0.5	0.4
187	0.9	0.9	1.1	1.2	0.6	0.7
188	0.7	0.8	1.3	1.8	0.6	0.7
189	0.7	0.7	1.0	1.7	0.4	0.5
191	0.7	0.7	1.0	1.1	0.5	0.4
192	0.7	0.7	1.2	1.6	0.6	0.5
193	0.7	0.8	1.4	1.7	0.6	0.5
195	0.9	0.7	2.0	1.2	0.9	0.5
196	0.7	0.7	1.1	1.4	0.6	0.4
197	0.7	0.8	1.0	2.1	0.5	0.6
199	0.6	1.0	1.3	1.6	0.6	0.5
200	0.7	0.8	1.0	1.4	0.5	0.4
201	0.7	0.7	1.1	1.6	0.6	0.5
203	0.7	1.1	1.7	2.0	1.0	1.2
204	0.8	0.8	1.3	1.4	0.6	0.4
205	0.7	1.1	1.2	2.2	0.5	0.6
207	1.2	0.9	1.9	1.2	0.8	0.5
208	0.8	0.8	1.2	1.6	0.6	0.5
209	0.8	0.9	1.4	1.7	0.6	0.5
211	0.9	0.9	1.3	1.3	0.7	0.5
212	0.7	0.9	1.2	1.8	0.5	0.5

SEFDT SCIENCE QC RESULTS:

LATITUDE BAND AVERAGE INTERCOMPARISON RESULTS
POPULATION WEIGHTED MATRIX RESULTS VS.
SEFDT SCIENCE QC RESULTS: AUGUST, 1979

MEANS OF DIFFERENCES:

DAY	P3	P4	P9	P10	P11	P12
213	0.7	0.6	-0.2	1.5	-0.1	0.3
215	0.5	0.6	-0.4	0.6	-0.1	0.3
216	0.8	0.6	-0.4	1.2	-0.1	0.3
217	0.6	0.5	-0.3	1.6	-0.1	0.2
219	0.6	0.5	-0.2	1.0	-0.1	0.3
220	0.7	0.4	-0.3	0.9	-0.1	0.2
221	0.7	0.5	-0.1	1.3	-0.0	0.3
223	0.4	0.4	-0.4	0.4	-0.1	0.2
224	0.8	0.7	-0.2	0.9	-0.1	0.2
225	0.8	0.4	-0.3	1.7	-0.1	0.3
227	0.8	0.5	-1.2	0.6	-0.5	0.2
228	0.8	0.4	-0.3	1.4	-0.1	0.3
229	0.7	0.5	-0.2	1.6	-0.1	0.1
231	0.8	0.4	-0.6	0.6	-0.2	0.2
232	0.7	0.4	-0.2	0.9	-0.1	0.3
233	0.7	0.5	-0.1	1.3	-0.1	0.2
235	0.0	-0.3	0.1	0.5	0.0	0.2
236	0.7	0.4	-0.2	0.9	-0.1	0.2
237	0.7	0.5	-0.1	1.1	-0.1	0.2
239	-0.2	-0.1	0.2	0.4	-0.1	0.2
240	0.7	0.4	-0.1	0.9	-0.0	0.2
241	0.7	0.2	-0.1	1.0	-0.0	0.2
243	-0.5	0.4	1.4	0.5	0.6	0.1

SEFDT SCIENCE QC RESULTS:

LATITUDE BAND AVERAGE INTERCOMPARISON RESULTS
POPULATION WEIGHTED MATRIX RESULTS VS.
SEFDT SCIENCE QC RESULTS: AUGUST, 1979

ST. DEVIATIONS OF DIFFERENCES:

DAY	P3	P4	P9	P10	P11	P12
213	0.7	0.8	1.3	1.8	0.6	0.5
215	0.8	0.9	1.6	1.3	0.9	0.5
216	0.7	0.8	1.4	1.7	0.6	0.5
217	0.7	0.9	1.4	2.0	0.6	0.6
219	0.7	0.9	1.3	1.5	0.5	0.5
220	0.6	0.9	1.4	1.5	0.6	0.5
221	0.6	0.8	1.6	1.8	0.7	0.5
223	0.9	0.8	1.4	1.0	0.7	0.4
224	0.5	1.4	1.3	1.6	0.6	0.5
225	0.6	0.9	1.4	1.9	0.6	0.5
227	0.7	1.0	2.2	1.4	1.1	0.6
228	0.5	0.9	1.2	1.8	0.5	0.5
229	0.5	0.9	1.3	2.0	0.6	0.9
231	0.8	1.2	1.8	1.3	0.9	0.5
232	0.5	0.9	1.2	1.6	0.5	0.5
233	0.5	1.0	1.4	1.8	0.6	0.5
235	1.7	2.1	2.8	1.2	1.2	0.4
236	0.4	0.9	1.2	1.7	0.5	0.5
237	0.4	1.2	1.2	1.7	0.5	0.4
239	1.3	1.8	3.2	1.2	1.7	0.5
240	0.5	1.0	1.5	1.6	0.7	0.5
241	0.5	1.2	1.4	2.0	0.6	0.5
243	1.1	0.9	3.2	1.4	1.6	0.5

SEFDT SCIENCE QC RESULTS:

LATITUDE BAND AVERAGE INTERCOMPARISON RESULTS
POPULATION WEIGHTED MATRIX RESULTS VS.
SEFDT SCIENCE QC RESULTS: SEPTEMBER, 1979

MEANS OF DIFFERENCES:

DAY	P3	P4	P9	P10	P11	P12
244	0.6	0.6	-0.1	0.6	-0.1	0.2
245	0.1	0.1	0.7	0.4	0.4	0.1
247	0.3	-0.4	-0.7	0.4	-0.4	0.1
248	0.7	0.4	-0.1	0.4	-0.0	0.2
249	0.6	0.4	-0.1	0.6	-0.0	0.1
251	1.6	0.2	-2.1	0.7	-0.4	0.1
252	0.6	0.5	-0.1	0.4	-0.0	0.2
253	0.6	0.5	-0.0	0.4	-0.0	0.1
255	-0.1	-0.1	0.5	0.3	0.4	0.1
256	0.6	0.4	-0.0	0.4	0.0	0.1
257	0.6	0.5	-0.0	0.5	-0.0	0.1
259	0.5	0.6	0.2	0.2	0.1	0.1
260	0.5	0.5	-0.0	0.2	-0.0	0.1
261	0.5	0.5	0.0	0.4	0.0	0.1
263	0.0	-0.0	0.6	0.3	0.3	0.1
264	0.5	0.6	-0.0	0.1	0.0	0.0
265	0.5	0.5	-0.0	0.1	0.0	0.1
267	-1.1	0.5	2.9	0.3	1.3	0.1
268	0.4	0.6	0.1	0.1	0.0	-0.1
269	0.4	0.7	0.0	-0.0	0.0	0.0
271	-0.2	0.5	1.9	-0.1	1.1	0.0
272	0.4	0.6	0.0	-0.3	0.0	0.0
273	0.4	0.6	0.0	-0.3	0.0	-0.0

SEFDT SCIENCE QC RESULTS:

LATITUDE BAND AVERAGE INTERCOMPARISON RESULTS
POPULATION WEIGHTED MATRIX RESULTS VS.
SEFDT SCIENCE QC RESULTS: SEPTEMBER, 1979

ST. DEVIATIONS OF DIFFERENCES:

DAY	P3	P4	P9	P10	P11	P12
244	0.6	1.2	1.6	1.2	0.7	0.4
245	1.1	2.6	2.4	1.1	1.2	0.4
247	1.0	1.9	2.9	1.1	1.7	0.4
248	0.4	0.9	1.4	1.4	0.6	0.4
249	0.4	0.9	1.3	1.6	0.6	0.4
251	3.0	2.2	3.8	0.9	1.7	0.3
252	0.4	1.0	1.4	1.4	0.6	0.4
253	0.4	1.1	1.5	1.4	0.6	0.4
255	1.7	2.2	3.5	1.0	1.6	0.4
256	0.5	1.0	1.5	1.5	0.7	0.4
257	0.5	1.1	1.5	1.8	0.7	0.4
259	0.6	1.1	1.8	1.0	0.8	0.4
260	0.5	1.0	1.7	1.4	0.8	0.4
261	0.4	0.9	1.4	1.6	0.6	0.4
263	1.4	1.0	2.9	0.9	1.6	0.3
264	0.5	0.9	1.5	1.1	0.6	0.4
265	0.5	1.0	1.6	1.3	0.7	0.3
267	2.5	1.2	4.3	0.9	1.8	0.4
268	0.6	0.9	1.6	1.1	0.7	0.7
269	0.5	1.1	1.5	1.4	0.6	0.3
271	1.7	1.2	3.8	1.1	1.7	0.4
272	0.6	0.9	1.8	1.1	0.8	0.3
273	0.6	1.2	1.7	1.3	0.7	0.4

SEFDT SCIENCE QC RESULTS:

LATITUDE BAND AVERAGE INTERCOMPARISON RESULTS
POPULATION WEIGHTED MATRIX RESULTS VS.
SEFDT SCIENCE QC RESULTS: OCTOBER, 1979

MEANS OF DIFFERENCES:

DAY	P3	P4	P9	P10	P11	P12
275	0.3	0.6	0.2	-0.3	0.1	-0.0
276	0.3	0.6	0.1	-0.3	0.0	-0.0
277	0.3	0.7	0.1	-0.6	0.1	-0.0
279	-0.1	0.7	0.2	-1.0	0.0	-0.3
280	0.3	0.7	0.2	-0.5	0.1	-0.0
281	0.3	0.7	0.2	-1.4	0.1	-0.1
283	-0.8	0.7	0.4	-0.4	0.1	-0.1
284	0.3	0.7	0.1	-0.9	0.1	-0.1
285	0.3	0.7	0.2	-1.2	0.1	-0.1
287	0.2	0.6	-1.1	-0.4	-0.3	-0.1
288	0.3	0.7	0.2	-0.9	0.1	-0.2
289	0.3	0.7	0.2	-1.3	0.1	-0.1
291	*******	*******	*******	*******	*******	*******
292	*******	*******	*******	*******	*******	*******
293	*******	0.7	*******	*******	*******	*******
295	0.6	-0.1	-2.6	-0.5	-1.3	-0.2
296	0.2	0.8	0.3	-1.7	0.1	-0.2
297	0.3	0.7	0.3	-2.5	0.1	-0.2
299	0.4	0.3	-0.8	-1.0	-0.3	-0.2
300	0.3	0.8	0.4	-1.2	0.1	-0.2
301	0.3	0.9	0.3	-1.6	0.1	-0.2
303	0.5	0.5	-0.8	-1.1	-0.3	-0.2
304	0.2	0.8	0.4	-1.6	0.2	-0.3

SEFDT SCIENCE QC RESULTS:

LATITUDE BAND AVERAGE INTERCOMPARISON RESULTS
POPULATION WEIGHTED MATRIX RESULTS VS.
SEFDT SCIENCE QC RESULTS: OCTOBER, 1979

ST. DEVIATIONS OF DIFFERENCES:

DAY	P3	P4	P9	P10	P11	P12
275	0.6	0.9	1.8	1.2	0.8	0.4
276	0.5	0.9	1.7	1.4	0.7	0.4
277	0.5	0.9	1.6	1.8	0.7	0.5
279	2.6	1.5	4.5	2.7	1.7	1.0
280	0.6	0.9	1.8	1.6	0.8	0.5
281	0.6	0.9	1.8	2.5	0.8	0.5
283	2.4	1.1	5.0	1.9	2.1	0.6
284	0.6	1.0	1.8	2.0	0.8	0.6
285	0.6	1.1	1.6	2.3	0.7	0.5
287	2.4	1.0	3.4	1.6	1.3	0.5
288	0.6	0.8	1.8	2.2	0.8	0.7
289	0.6	0.8	1.8	2.5	0.8	0.6
291	*******	*******	*******	*******	*******	*******
292	*******	*******	*******	*******	*******	*******
293	*******	*******	*******	*******	*******	*******
295	1.6	1.9	3.8	1.9	1.9	0.8
296	0.6	0.7	1.9	2.7	0.8	0.8
297	0.6	0.7	1.7	2.8	0.7	0.7
299	1.6	2.0	2.5	2.3	1.1	0.8
300	0.6	0.9	1.7	2.2	0.7	0.7
301	0.6	1.1	1.7	2.7	0.7	0.7
303	1.7	1.8	2.6	2.6	1.3	0.8
304	0.5	0.7	1.7	2.7	0.7	0.8

APPENDIX E.

DSAS Alpha and Beta Angles Having Equal Values

The DSAS alpha angle was equal to the beta angle in at least one major frame in each of the orbits listed below. This was due to a problem in the Level 0 product (ILT). This problem did not affect any solar irradiances.

JULIAN DAY	ORBIT(S)
320	316, 319, 323, 327
321	332, 336, 337, 339
322	342, 346, 351, 355
324	372, 376, 377, 383
325	391
326	403, 404, 408
328	430
329	439, 445, 451
330	454, 458, 460, 461, 463
332	481, 485, 487, 492, 493
333	495, 497, 502, 507
334	510, 512, 519
336	537
337	555, 562
338	569, 572
340	600
341	612, 618
342	620, 626, 627
344	654, 656, 659
345	671, 673
346	675, 686
348	703, 711, 715
349	722
350	734, 735
352	757, 761, 770
353	774, 783
354	789, 796
356	813, 820
357	827, 828, 830
358	842, 845
360	881
361	885, 889, 893, 895
362	901, 908
364	926
365	939, 945
1	952, 959
3	979, 981, 983, 985
4	993, 997, 1001, 1003, 1005
5	1006, 1007, 1013, 1017
7	1039, 1041, 1043
8	1048, 1053, 1055, 1056, 1058, 1059
9	1063, 1065, 1066, 1067, 1069
11	1091

APPENDIX E. DSAS Alpha and Beta Equal

(Continued)

JULIAN DAY	ORBIT(S)
12	1103, 1114
13	1120, 1122, 1124, 1126, 1128, 1130
15	1146, 1149, 1151
16	1162
19	1200
20	1216, 1218, 1222
21	1235
23	1257, 1261, 1266, 1268
25	1293, 1295
27	1315, 1319, 1320
29	1340, 1342, 1351
31	1369, 1374
33	1401, 1406
35	1429, 1432, 1434
37	1453
39	1480, 1482, 1485, 1487
40	1491, 1503
41	1513
43	1535, 1542, 1544
44	1549
45	1561, 1567
47	1587, 1589, 1596, 1597, 1599, 1600
48	1606, 1611, 1614
49	1615, 1621
51	1646, 1649, 1653, 1655
52	1657, 1664
55	1698
57	1728, 1736
59	1761, 1764
60	1778
61	1780, 1784, 1785, 1791, 1793
63	1809, 1812, 1813, 1816
64	1828, 1834
65	1837, 1845, 1846, 1848
67	1867, 1875
68	1881, 1883
69	1892, 1895, 1901, 1903
71	1920, 1925, 1929
72	1934, 1943
73	1952
75	1977, 1978, 1983, 1986
76	1989, 1993, 1994, 1996
77	2003, 2006
79	2035
80	2045, 2050
81	2060, 2062
83	2089
84	2101, 2104

APPENDIX E. DSAS Alpha and Beta Equal

(Continued)

JULIAN DAY	ORBIT(S)
85	2118, 2119, 2123, 2124
87	2149
88	2156, 2158, 2161, 2163
89	2169, 2170, 2173
93	2223, 2225, 2228, 2232, 2233, 2235, 2336
95	2251, 2253, 2256, 2261
97	2285, 2286
99	2309, 2311, 2315, 2317
100	2319
101	2342, 2344
104	2382, 2386, 2387
107	2426
108	2430, 2432, 2436, 2439
109	2447, 2456
111	2472
112	2488, 2499
113	2501, 2502, 2503, 2505, 2506, 2507, 2511, 2512
115	2531, 2534
116	2545, 2550
117	2555, 2257, 2560, 2564
118	2574, 2580
119	2586, 2588, 2589, 2594
121	2615, 2619, 2621
123	2639, 2640, 2641, 2650
124	2652, 2653, 2656, 2659, 2660
125	2666, 2668, 2677
127	2694, 2700, 2702, 2703, 2704
128	2706, 2716, 2717, 2718
129	2728, 2729, 2731, 2733
131	2748, 2749, 2756, 2761
133	2779, 2780
134	2791, 2792, 2795, 2797, 2801
135	2803, 2807, 2810, 2811, 2816
137	2832, 2839, 2840
139	2863, 2864
140	2875, 2876, 2879
141	2887, 2892
143	2916, 2925
144	2930, 2933, 2938
145	2953
147	2971, 2972, 2981, 2982
148	2988
149	2998, 3001, 3006
152	3048, 3049
153	3058, 3062
155	3091, 3092

APPENDIX E. DSAS Alpha and Beta Equal

(Continued)

JULIAN DAY	ORBIT(S)
156	3100, 3103
157	3108
159	3146
160	3149, 3150
161	3164, 3169, 3170, 3171, 3172
163	3202
164	3211
165	3218, 3221, 3224
167	3246, 3250
168	3262, 3263, 3266, 3267
169	3276, 3279, 3284
171	3301
172	3320, 3321
173	3329, 3339
175	3367, 3369
176	3370, 3374, 3379, 3383
177	3395
179	3412, 3415, 3416, 3420
180	3426, 3431, 3437
181	3441, 3443, 3448
183	3471, 3476, 3477
184	3482, 3485, 3486, 3487, 3488
185	3494
187	3523, 3526
188	3540, 3542
189	3552
191	3589
192	3597
193	3608, 3609, 3610
196	3649, 3658
197	3671, 3673
199	3690, 3694, 3697
200	3702, 3707
201	3715, 3718, 3719, 3720, 3722, 3724, 3728
203	3743, 3747
204	3762, 3764
205	3778, 3779
207	3799, 3800, 3805, 3809
208	3812, 3813, 3814, 3821, 3823
209	3828, 3831, 3834, 3835, 3837
211	3856, 3859, 3865
212	3871, 3874, 3875, 3876
213	3882, 3887, 3888
215	3910, 3911, 3912, 3914, 3916, 3920
216	3926, 3932, 3933
217	3936, 3942, 3944, 3949
219	3968, 3972, 3974, 3976

APPENDIX E. DSAS Alpha and Beta Equal

(Continued)

JULIAN DAY	ORBIT(S)
220	3978, 3982, 3985, 3989
221	3992, 3993, 4001, 4002
223	4023, 4027
224	4035, 4037, 4046
225	4047, 4048, 4050
227	4075, 4076, 4077, 4081, 4086
228	4089, 4090, 4098
229	4102, 4110
231	4131, 4136, 4138, 4140, 4142
232	4147, 4149, 4150, 4156
233	4159, 4160, 4161, 4165, 4167
235	4188, 4196, 4197
236	4202, 4203, 4207, 4211
237	4223
239	4247
240	4263, 4265
241	4269, 4270, 4273, 4278, 4279
243	4298, 4301, 4303, 4304, 4305
244	4313
245	4326, 4330
248	4369, 4370, 4373
249	4382, 4383, 4386, 4390
251	4417
252	4420
253	4437, 4446
255	4462, 4464, 4465, 4467, 4468
256	4475, 4481, 4485
257	4490, 4494, 4497, 4501
259	4524, 4528
260	4535, 4537
261	4551
263	4581, 4585
264	4590
265	4603, 4611
267	4629, 4630, 4632, 4633, 4634, 4639
268	4747, 4651, 4654
269	4656, 4661, 4662, 4664, 4667
271	4686, 4687, 4694
272	4698, 4700, 4702, 4704
275	4741, 4748, 4750
276	4760, 4765
277	4774
279	4795, 4802
280	4807, 4810, 4814, 4815, 4818
281	4823, 4828, 4832, 4833
283	4850
284	4862, 4871, 4872
285	4880, 4888

APPENDIX E. DSAS Alpha and Beta Equal

(Continued)

JULIAN DAY	ORBIT(S)
287	4913
288	4922, 4925, 4929
289	4932, 4934, 4938, 4942
291	4968
292	4986
293	4994, 4999
295	5016, 5018, 5020, 5028
296	5035, 5036
297	5042, 5049, 5054
299	5071, 5075, 5079, 5080
300	5083, 5092
301	5101, 5105
303	5126, 5130, 5134, 5135
304	5139, 5143, 5149
305	5152

APPENDIX F.

DSAS Beta Angle Out of Limits

The DSAS beta angle was out of limits ($\pm 180^\circ$) for at least one major frame in the following orbits. The origin of the error is the Level 0 product (ILT). Solar irradiances were not affected.

JULIAN DAY	ORBIT(S)
1	963
3	980, 989, 990, 991
4	992, 994, 995, 1002, 1004
5	1009, 1010, 1012, 1015
7	1038, 1040, 1043
8	1053
267	4631
268	4646, 4648, 4650, 4651
269	4657, 4660-4666
271	4684, 4695
272	4697
273	4710

APPENDIX G.

DSAS Beta Angle Incrementing Rapidly

The DSAS beta angle changed too rapidly (2^o/major frame) for at least one major frame in the following orbits. The origin of the error is the Level 0 product. Solar irradiances were not affected.

JULIAN DAY	ORBIT(S)
1	963
3	989, 990, 991
4	992, 993, 994, 995, 1002, 1004
5	1009, 1010, 1012, 1015
7	1040, 1043
8	1053, 1056
9	1067
267	4631, 4632, 4634, 4638
268	4646, 4648, 4650, 4651
269	4660-4666
271	4684, 4695
272	4697
273	4710

APPENDIX H.

Channels 1 and 3 Shutter Status Change

The Channel 1/Channel 3 shutter status changed in the solar data for the orbits listed below. This can cause a problem because irradiance data from the shuttered channel may have contributed to the computed mean irradiances in the solar orbital summary records.

JULIAN DAY	ORBIT(S)
320	322, 326, 327
332	490
342	632
12	1115, 1116
41	1517
44	1556
84	2109
106	2415
118	2573
144	2932
168	3263
173	3328
192	3595
216	3927, 3928
240	4528
264	4590
299	5075
301	5101
304	5152

APPENDIX I.

Times in T_0-13 Frames > 13 Minutes from the Solar Peak

The time in the T_0-13 frames was more than 13 minutes from the solar peak due to a data gap for the following orbits. This could have slightly affected the irradiance calculation.

JULIAN DAY	ORBIT(S)
329	439
337	550, 551
356	819
15	1145
21	1228
27	1320
29	1345
40	1501
57	1726
103	2367
115	2534
139	2867
201	3725
212	3875
237	4221
245	4330
252	4423
264	4598
291	4959
301	5099

APPENDIX J.

Times in T_0+13 Frames > 13 Minutes from the Solar Peak

The time in the T_0+13 frames were more than 13 minutes from the solar peak due to a data gap for the following orbits. This could have slightly affected the irradiance calculation.

JULIAN DAY	ORBIT(S)
342	620
1	952
11	1089
16	1165
17	1173
48	1602
55	1703
57	1726
71	1928
72	1934
125	2666
134	2799
140	2877
156	3094, 3095
160	3150
165	3219
167	3247
175	3357
176	3371
177	3385
179	3412
181	3440
191	3578
193	3606
201	3718
207	3799
209	3827
212	3872
233	4158
279	4794
292	4974

APPENDIX K.

Data Gap at T_0

The following orbits had a data gap within ±3 minutes of the solar peak which could have affected the irradiance calculation:

JULIAN DAY	ORBIT(S)
325	388, 389
326	405
328	430
329	448
333	505
336	539
340	592, 596
345	662, 664, 667
348	715
349	725
350	742
352	769
354	792
358	841
364	936
3	981
4	992
8	1049, 1055
17	1173, 1179, 1185
21	1240
27	1312, 1313
29	1341
40	1502
43	1544
49	1616
53	1683
57	1726
61	1783, 1789
65	1837
67	1866, 1868
75	1981
83	2087
85	2121, 2122
99	2307
100	2319
111	2477, 2479
113	2509
123	2638
127	2694
128	2706
133	2780
134	2790
135	2816

APPENDIX K. Data Gap at T_0

(Continued)

JULIAN DAY	ORBIT(S)
137	2836
161	3164
165	3222
169	3274, 3282
172	3316
176	3378
177	3385
180	3426, 3430
188	3541
189	3552
197	3666
201	3723
203	3743
204	3759, 3766
205	3777
209	3826
212	3874
219	3970
223	4025
233	4169
243	4304
245	4330
247	4357
259	4528, 4530
271	4689
293	4996
303	5135

APPENDIX L.

Southern Terminator/MSE Time Difference > 16 Seconds

The difference between the Southern Terminator time and the MSE time was greater than 16 seconds for the orbits listed below. Some possible explanations are:

1) gamma angle testing (Days 321 - 322).

2) misalignment of the spacecraft.

JULIAN DAY	ORBIT(S)
321	329, 330, 333, 334, 336, 337, 338, 339, 340, 341
322	342, 343, 344, 345, 346, 347, 348, 349, 350, 351
342	629
352	757, 758
354	788
360	871, 879, 881
361	882, 888, 894, 895
362	896, 898, 908
364	924, 925, 927, 929, 930, 932, 934, 935, 936
365	937, 938, 939, 941, 944, 946, 947, 948, 949
1	951-964
3	979-988
4	992, 994, 1005
5	1006
7	1034, 1035, 1041, 1044, 1045, 1046, 1047
8	1048, 1049, 1051, 1056
12	1112
32	1394
45	1572
85	2121
235	4198
243	4304
288	4918
301	5098

APPENDIX M.

Orbits Missing Solar Data

Orbits which have less than 110 solar data records are listed below. There is a possibility that these orbits are severely impacted by data gaps. It is reccommended that they be rejected from use in any scientific investigation.

DAY	ORBIT	RECORD COUNT
332	490	104
44	1552	90
60	1773	106
84	2105	90
85	2121	106
106	2411	90
118	2568	90
144	2928	90
168	3259	104
216	3923	90
240	4254	90
249	4387	106
264	4586	104

APPENDIX N.

Orbits with Off-Axis Angle > 0.5°

The orbits listed below had off-axis angles greater than 0.5°. The accuracy of the solar irradiances was severely impacted by solar channel assembly misalignment. It is recommended that users perform corrections for these off-axis effects before using this data.

JULIAN DAY	ORBIT(S)
320	315-320
321	329-341
322	342-351
332	481, 493, 494
334	508, 519-521
336	536, 537, 546-549
337	550-552, 560-563
338	564-567, 573-576
340	591-595, 599
345	672
346	675
348	702, 703, 712-715
349	716-719, 726-729
350	731-735, 739-743
352	757-766
356	813, 826
357	827, 828, 838, 839
358	840-843, 851-853
360	868-873, 876-881
361-8	882-1056, 1061
9	1074
11	1089-1092, 1100, 1101
12	1109, 1110
19	1210-1213
20	1215, 1220-1222
21	1231, 1233, 1235
29	1339-1340, 1348-1351
31	1366-1369, 1375-1378
33	1394-1401
40	1502
41	1505, 1516, 1517
43	1533, 1543-1545
44	1547, 1556, 1557
45	1559-1561, 1569-1572
47	1587-1589, 1596, 1597
101	2340
104	2381
106	2410
107	2423
108	2436, 2438
109	2449

APPENDIX N. Orbits with Off-Axis Angle > 0.5°

(Continued)

JULIAN DAY	ORBIT(S)
111	2474
116	2547
117	2563
139	2872
141	2886, 2887, 2898
143	2914-2916, 2927
144	2930, 2939, 2941
145	2942, 2943, 2950, 2952
147	2973, 2975-2978
148	2989-2991
157	3120
159	3147
160	3162
161	3164
163	3191, 3192
164	3207
165	3221-3224, 3226
177	3397
179	3412
180	3427, 3437, 3438
181	3439-3441, 3451, 3452
183	3467, 3468, 3478-3480
184	3481, 3483
185	3494-3497, 3506, 3507
187	3522-3524, 3526, 3533-3535
188	3536-3539, 3547-3549
189	3550, 3551, 3562, 3563
191	3577-3580, 3585, 3588-3590
192	3593-3595, 3602-3604
193	3605-3608, 3611, 3612
196	3654
199	3691, 3693, 3696-3699
201	3721, 3723
204	3764
205	3777, 3779
207	3805-3808
208	3820
209	3831, 3833-3836
211	3858-3863
212	3869-3877
213	3884-3892
215	3911-3916, 3922
224	4039-4043
225	4052, 4054-4057
227	4079-4084
228	4090-4099
229-235	4104-4193
236	4203-4207

APPENDIX N. Orbits with Off-Axis Angle > 0.5°

(Continued)

JULIAN DAY	ORBIT(S)
237	4215-4222, 4224
239	4242-4252
240	4256-4264
243	4300-4303
244	4313-4316
245	4327-4334
247	4351-4362, 4364
248-249	4365-4391
251	4412-4416, 4418
252	4420, 4421, 4433
253	4434, 4435
257	4494, 4496
259	4529, 4530
264	4593
265	4603, 4604, 4609, 4610, 4612
272	4701, 4702, 4704-4707
273	4712, 4722
279	4800, 4802
280	4812-4816
281	4824-4828
287	4908, 4910, 4915-4917
288	4919, 4929, 4930
289	4932, 4933, 4943
296	5033, 5034, 5036
297	5043-5045, 5052-5055
299	5070, 5071, 5082
300	5085, 5096
301	5097, 5110

APPENDIX O.

Orbits with Off-Axis Angle > 1.0°

The orbits listed below had off-axis angles greater than 1°. These orbits are judged to be unrecoverable. Users should reject them from any scientific investigations.

JULIAN DAY	ORBIT(S)
321	329, 330, 333-341
322	342-351
340	591, 592
350	743
352	757-759
360	868, 879-881
361	882, 883, 893, 895
362	896-899, 905-908
364	924-936
365	937-939, 941-949
1	951-964
3	979-988
4	992, 993, 1003-1005
5	1006-1008, 1017-1019
7	1034-1047
8	1048-1056
31	1378
47	1587
187	3534
213	3888
215	3913-3916
228	4094
229	4107-4109, 4111, 4112
231	4134-4140, 4143
232	4148-4155
233	4159, 4161-4169
235	4185, 4187-4192
239	4246-4248
240	4257-4264
247	4355-4360
248	4368-4376
249	4379, 4382-4390
297	5042

APPENDIX P.

Orbits Having DSAS Elevation Angle > 1°

The orbits listed below had DSAS elevation angles greater than 1°. These orbits are judged to be unrecoverable. Users should reject them from any scientific investigation.

JULIAN DAY	ORBIT(S)
321	329, 330, 333-341
322	342-351
325	389
328	430
349	717, 726, 728
350	739, 741, 743
352	757, 758
356	826
357	838
358	849, 853
360-3	868-989
4	992, 1004, 1005
5	1006, 1014, 1018
7-8	1034-1056, 1060
11	1089, 1093, 1095, 1097
15	1145
16	1160
19	1203
20	1216
29	1349, 1351
31	1367
33	1367
39	1477, 1489
41	1506
44	1557
45	1560, 1562, 1572
65	1848
85	2121
189	3552
205	3777
243	4304

APPENDIX Q.

Channel 11/12 Comparison

This appendix contains the results of the Channel 11/12 comparison. Irradiances and differences have units of Watts/m^2.

DAY	CHANNEL 11	CHANNEL 12	DIFFERENCE	SAMPLES
320	289.1	286.7	2.4	2728
322	177.9	177.5	0.4	332
332	181.2	178.1	3.1	404
334	372.4	317.0	55.5	8
340	318.8	191.4	127.4	4
342	291.4	288.8	2.6	1360
354	359.4	358.5	1.0	904
361	356.2	153.5	202.7	4
365	292.5	290.3	2.2	2640
1	371.2	343.9	27.3	8
12	297.6	297.5	0.1	3544
19	364.2	353.3	10.9	4
35	393.1	412.6	- 19.6	4
37	372.1	424.8	- 52.7	8
41	359.7	395.9	- 36.2	4
44	299.1	296.7	2.4	2248
49	391.9	412.5	- 20.6	4
60	307.1	305.3	1.8	2292
65	388.3	413.9	- 25.6	4
73	363.6	180.0	183.5	4
84	288.9	286.3	2.6	2296
89	161.8	169.8	- 8.0	84
101	389.6	368.1	21.5	4
106	310.4	306.8	3.6	2296
117	326.5	323.5	3.0	924
118	281.6	279.1	2.5	1344
129	373.3	23.0	350.3	4
139	185.1	199.8	- 14.7	24
144	298.4	296.1	2.3	2288
148	388.1	424.0	- 35.9	4
159	16.3	-105.5	121.7	4
167	330.9	329.8	1.1	920
168	292.5	289.7	2.8	1348
172	369.6	177.3	192.4	4
192	295.1	292.5	2.6	2296
205	366.4	222.4	144.0	12
209	-307.2	-239.0	- 68.2	4
216	299.7	296.6	3.1	2244
235	321.2	296.7	24.5	8
237	398.3	430.0	- 31.7	4
239	304.9	302.1	2.8	936
240	285.4	282.5	2.9	1360
257	360.4	364.0	- 3.6	4

APPENDIX Q. Channel 11/12 Comparison

(Continued)

DAY	CHANNEL 11	CHANNEL 12	DIFFERENCE	SAMPLES
264	299.1	296.1	3.0	2304
265	352.2	201.8	150.4	4
268	378.0	498.1	-120.1	4
280	348.5	192.5	156.0	4
283	345.9	185.8	160.1	4
284	347.7	208.5	139.2	4
299	353.2	381.3	- 28.1	4
301	295.9	292.9	3.0	2412
304	281.0	278.1	2.9	1212

References

1) Groveman, Brian S.: "User's Guide for ERB-7 MAT", NASA CR-170514, Contract No. NAS5-26123, Goddard Space Flight Center, Greenbelt Maryland 20771, April 1984.

2) Predmore, R.E., H. Jacobowitz and J.R. Hickey: "Exospheric Cleaning of the Earth Radiation Budget Solar Radiometer during Solar Maximum", proceedings of SPIE, vol. 338, pp. 104-13, May 6, 1982.

3) Tighe, Richard J. and Maria Y.H. Shen: "User's Guide for ERB-7 MATRIX - Volume I", NASA CR-170619, Contract No. NAS5-28063, Goddard Space Flight Center, Greenbelt Maryland 20771, April 1984.

4) Maschoff, R.H. and James Swedberg: "ERB Instrument Study", Attachment J of Reference 6, January 23, 1982.

5) Minutes of the ERB Calibration Workshop, NASA/Goddard Space Flight Center, Greenbelt Maryland 20771, August 4-5, 1982.

6) Tighe, Richard J.: "Nimbus-7 ERB MATRIX Scientific Algorithms", NASA Contract No. NAS5-26773, Goddard Space Flight Center, Greenbelt Maryland 20771, 1982.

7) Hickey, J.R.: private communication.

BIBLIOGRAPHIC DATA SHEET

1. Report No. CR 170616

2. Government Accession No.

3. Recipient's Catalog No.

4. Title and Subtitle User's Guide for ERB-7 SEFDT, Volume I - User's Guide, Volume II - Quality Control Report, Year-1

5. Report Date April 1984

6. Performing Organization Code 910

7. Author(s) Dr. Surendra N. Ray, Dr. Richard J. Tighe, and Steven A. Scherrer

8. Performing Organization Report No.

9. Performing Organization Name and Address
Systems and Applied Sciences Corporation
5809 Annapolis Road, Suite 414
Hyattsville, Maryland 20784

10. Work Unit No.

11. Contract or Grant No. NAS5-28063, Task 03

12. Sponsoring Agency Name and Address
Goddard Space Flight Center
Greenbelt, MD 20771

13. Type of Report and Period Covered Contractor Report

14. Sponsoring Agency Code NASA Goddard

15. Supplementary Notes

16. Abstract

In Volume I, the description of the ERB SEFDT data products and the Tape Specifications are given. Volume II contains the Scientific Quality Control Report along with a discussion of known errors and data problems for the period of November 16, 1978 to October 31, 1979.

17. Key Words (Selected by Author(s))
Earth Radiation Budget, ERB Users Guide, 1st year quality control.

18. Distribution Statement Unlimited

19. Security Classif. (of this report) Unclassified

20. Security Classif. (of this page) Unclassified

21. No. of Pages

22. Price*

*For sale by the National Technical Information Service, Springfield, Virginia 22161

GSFC 25-44 (10/77)