National Aeronautics and Space Administration
Goddard Earth Science
Data Information and Services Center (GES DISC)

README Document for the Nimbus-7 Limb Infrared Monitor of the Stratosphere (LIMS) Level 1 Profiles of Radiance Data

LIMSN7L1PROFILER

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Goddard Earth Sciences Data and Information Services Center (GES DISC)
https://disc.gsfc.nasa.gov
NASA Goddard Space Flight Center
Code 610.2
Greenbelt, MD 20771 USA

Prepared By:

James E. Johnson	01/11/2019
Name GES DISC GSFC Code 610.2	Date

Reviewed By:

Name	mm/dd/yyyy
Name GSFC Code xxx	Date

Name	mm/dd/yyyy
Name GSFC Code xxx	Date

Goddard Space Flight Center
Greenbelt, Maryland

Revision History

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01/11/2019	Original	James E. Johnson

Table of Contents

1. Introduction

This document provides basic information on using the Nimbus-7 Scanning Chopper Radiometer (LIMS) Level-1 Profiles of Radiance Data (Profile-R) product.

1.1 Data Product Description

The Nimbus-7 Limb Infrared Monitor of the Stratosphere (LIMS) Level-1 Profiles of Radiance Data product contains selected daily vertical profiles across the earth's atmospheric limb derived from the LIMS Level-1 Radiance Archival Tape (RAT) data product. Measurements are obtained, as a function of tangent height (or scan angle), once every 12 seconds in each of the six spectral bands (two 15-micrometer CO_2 bands (narrow and wide), an 11.3-micrometer HNO_3 band, a 9.6-micrometer O_3 band, a 6.9-micrometer H_2O band, and a 6.2-micrometer NO_2 band) from the highest pressure level to the lowest in steps of 0.1 km.

Each file contains one days worth of data (~14 orbits per day). LIMS is a limb profiler and spatial coverage is near global between latitude -64 and +84 degrees. Vertical coverage is from about 10 to 50 km (O3 channel to 65 km), with vertical resolution of about 1.5 km. The data are available for 32 selected days between 25 October 1978 and 30 May 1979. The principal investigators for the LIMS experiment were Dr. James M. Russell, III from NASA Langley and Dr. John Gille from NCAR.

This product was previously available from the NASA National Space Science Data Center (NSSDC) under the name LIMS Profiles of Radiance Data (Profile-R) with the identifier ESAC-00008 (old id 78-098A-01F).

1.1.1 The Limb Infrared Monitor of the Stratosphere

The objective of the Nimbus-7 Limb Infrared Monitor of the Stratosphere (LIMS) experiment was to map the vertical profiles of temperature and the concentration of ozone, water vapor, nitrogen dioxide, and nitric acid in the lower to middle stratosphere range, with extension to the stratopause for water vapor and into the lower mesosphere for temperature and ozone. LIMS had a six-channel infrared (IR) radiometer that incorporated Hg-Cd-Te detectors cooled by a two-stage solid cryogen cooler. The six bands were used to measure NO_2 at 6.2 microns, H_2O at 6.9 microns, O_3 at 9.6 microns, HNO_3 at 11.3 microns, and CO_2, one narrow and one wide, both centered at 15 microns. LIMS mapped vertical profiles of thermal IR emission every 12 seconds from the earth limb, scanning once in the up direction and then in the down direction.. The instrument operated successfully for about seven months. The experiment was the follow-on to the Limb Radiance Inversion Radiometer (LRIR) flown on the previous Nimbus 6 satellite.

1.1.2 Nimbus-7 Overview

The Nimbus-7 satellite was successfully launched on December 11, 1972. The primary experiments included: (1) a Temperature-Humidity Infrared Radiometer (THIR) for measuring day and night surface and cloud top temperatures, as well as the water vapor content of the upper atmosphere, (2) an Electrically Scanning Microwave Radiometer (ESMR) for mapping the microwave radiation from the Earth's surface and atmosphere, (3) an Infrared Temperature Profile Radiometer (ITPR) for obtaining vertical profiles of temperature and moisture, (4) the Nimbus-E Microwave Spectrometer (NEMS) for determining tropospheric temperature profiles, atmospheric water vapor abundances, and cloud liquid water contents, (5) a Selective Chopper Radiometer (LIMS) for observing the global temperature structure of the atmosphere, and (6) a Surface Composition Mapping Radiometer (SCMR) for measuring the differences in the thermal emission characteristics of the Earth's surface.

The orbit of the satellite can be characterized by the following:

- circular orbit at 1100 km
- inclination of 99.9 degrees
- period of an orbit is about 107.2 minutes
- orbits cross the equator at 26 degrees of longitude separation
- sun-synchronous

1.2 Algorithm Background

The Nimbus-7 LIMS data were generated from the spacecraft telemetry, attitude and orbital data. The data were originally processed on IBM 360 computers using 24-bit words, and copied to 1600 bpi 9-track tapes for archival. Further information on the LIMS instrument and data processing can be found in the Nimbus-7 Users' Guide Section 4.

1.3 Data Disclaimer

The data should be used with care and one should first read the Nimbus-7 User’s Guide, Section 4 describing the LIMS experiment. Users should cite this data product in their research.

2. Data Organization

The Nimbus-7 Limb Infrared Monitor of the Stratosphere Profile-R data span the time period from October 25, 1978 to May 30, 1979. Each file typically contains one full days worth of data (~14 orbits per day).

2.1 File Naming Convention

The data product files are named according to the following convention:

<Platform>-<Instrument>_<Level>-<Product>_<DateTime>_<TapeNumber>.<Suffix>

where:
o Platform = name of the platform or satellite (Nimbus7)
o) Instrument = name of the instrument and product (LIMS)
o) Level = process level (L1)
o) Product = radiance archive tape (ProfileR)
o) Date = Data start date and time in UTC in format <YYYY>m<MMDD>t<hhmm> where

1. YYYY = 4 digit year (1978 – 1979)
2. MM = 2 digit month (01-12)
3. DD = 2 digit day of month (01-31)

o TapeNumber = 5 digit number of tape (preceded by 'DD' - primary or 'DC' - backup)
o Suffix = the file format (always TAP, indicating tape binary data)

```
File name example: Nimbus7-LIMS_L1-ProfileR_1978m1025_DD056376.TAP
```

2.2 File Format and Structure

The data are stored as they were originally written in IBM binary (big-endian) record oriented structured files. The files were written on the original 1600 bpi 9-track tapes using a blocked FORTRAN format. The first file on the tape is the tape header file with two records containing text encoded information about the tape. This is followed by up to five daily data files. Each daily file on the tape contains a set of records with a FORTRAN record size word, the data record, and a FORTRAN record trailing size word. There are typically between about 100 and 250 records per daily file. At the end of the daily file there is an End-of-File word (the last file on the tape will end with a double End-of-File word). Each data record in a file represents two selected pairs of LIMS up and down profile scans, with each profile containing the radiances from each of the six channels: CO2N(arrow), CO2W(ide), O3, HNO3, NO2 and H2O. Each data file typically contains one full days worth of data (about 14 orbits per day). For the contents and layout of the data, see section 3.1

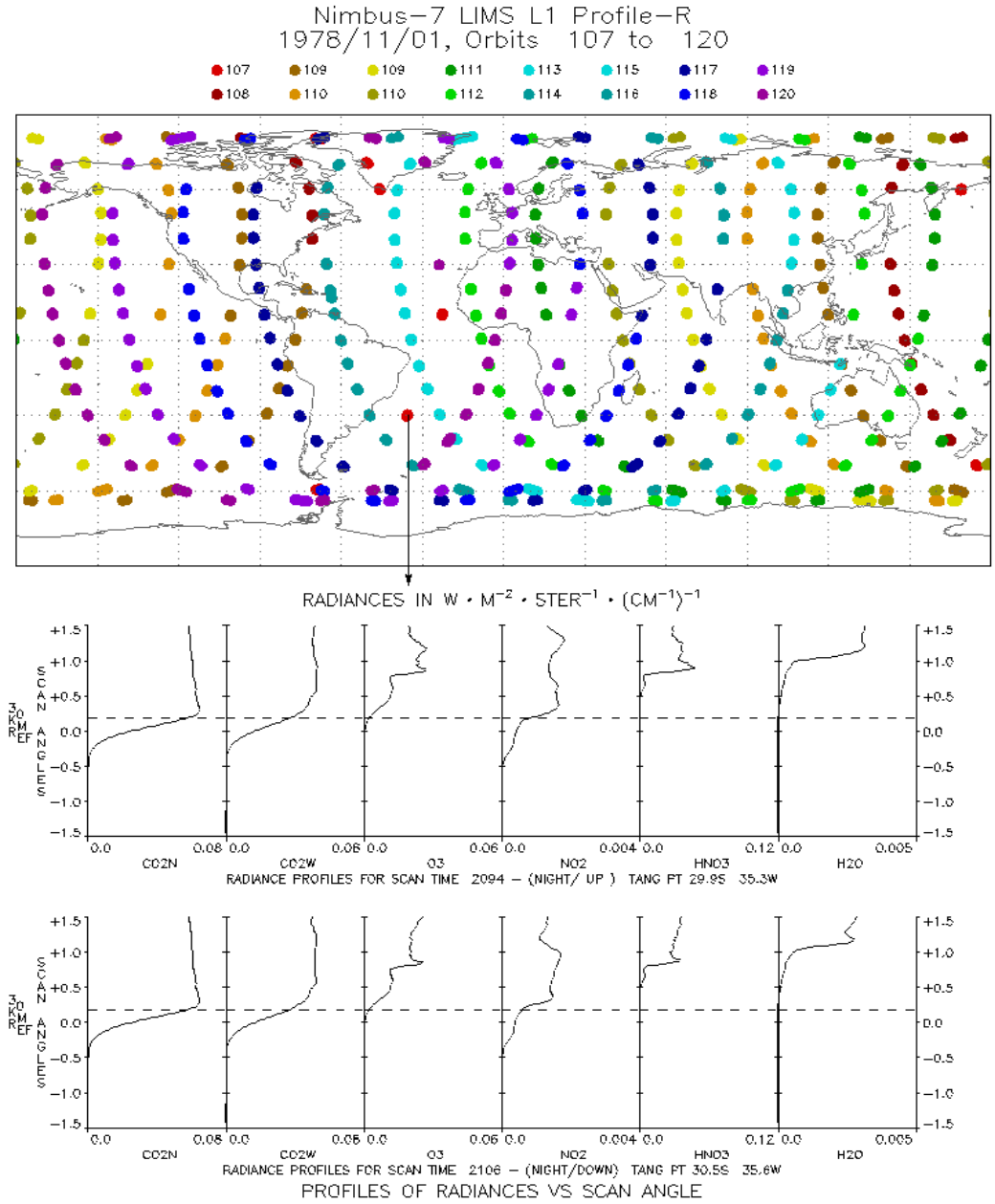
During data recovery a total of 64 daily data files were retrieved from the tapes, with 32 files from the primary DD tapes, and 32 files from the backup DC tapes. All of the files from the DC tapes were

identical copies of files from the DD tapes, so only the 32 LIMS daily files from the DD primary tapes were retrieved as part of this data collection, and are archived at the GES DISC.

2.3 Key Science Data Fields

The primary science data fields in this data product are the LIMS calibrated radiances in units of $mW/m^2/sr/cm^{-1}$ for each of the six IR channels.

Figure 1: Typical Nimbus-7 LIMS Level 1 Profile-R data file showing data coverage (top), and one pair of up-scan and down-scan radiances for each band (bottom).



3. Data Contents

The granularity of this data product is one day (with approx. 14 orbits).

3.1 Data Records

The Nimbus-7 User's Guide does not describe the layout of the file format. Refer instead to the Tape Specification, number T564011, Rev. C, titled "LIMS Radiance Archival Tape".

The original tape files each included a tape header file. These were then followed by a set of up to 15 orbit data files, which would include about 260 data records consisting of the up and down limb scan profiles. As part of the recovery, the GES DISC has extracted and archived the orbit data files from the tape. The original data were written on IBM machines using 24-bit words. During tape data recovery these words were saved as three 8-bit bytes (some words consist of two 12-bit half words). Each profile data record consists of 3360 24-bit words (see Table 3-1 below). Each profile data record starts and ends with a four byte 32-bit integer word giving the record size in bytes.

Table 3-1: Data Record (10080 bytes or 3720 24-bit words)

Word	Field Name	Units	Type	Comments
1	Physical Record No. and Record I.D.		½ word	
	Record I.D.		½ word	8 LSB bits
2	Spare		½ word	
	Records per Frame		½ word	
3	Record No. in Frame		½ word	
	Algorithm No. (Annotation)		½ word	
4	Frame No.		1 word	
5	Film Specification No.		1 word	
6	Frame's Orbit No. for Annotation		1 word	
7	Annotation Year No.		½ word	
	Annotation Day No.		½ word	
8	Profile Generation Year No.		½ word	
	Profile Generation Day No.		½ word	
9	Profile Group No.		½ word	

	Left Scale Code		½ word	
10-24	Pressure Level Thickness in 0.1 km	mbar	30 ½ word	3x10 max,min,thick
25 – 26	Scaling Coefficients for Vertical Scale		4 ½ words	Offset mantissa/exp. Scale mantissa/exp.
27	Day/Night Code		½ word	
	Up/Down Scan Code		½ word	
28	Profile Time in Seconds		1 word	GMT
29	Tangent Point Latitude	deg	½ word	x20 (North Pole= 180)
	Tangent Point Longitude	deg	½ word	x20 (0-360 westward)
30	30 km Reference Position		½ word	
	No. of Vertical Data Values		½ word	
31-155	Data Values (Pressure or Scan Angle)	mbar or deg	250 ½ words	Use Vert. Scale Coef.
156	Profile No.		½ word	
	Parameter No.		½ word	
157	Abscissa Scale (Left Side)		½ word	
	Abscissa Scale (Right Side)		½ word	
158	Units Code		½ word	
	Units Scale		½ word	
159-160	Scaling Coefficients for Data in Profile		4 ½ words	Offset mantissa/exp. Scale mantissa/exp.
161-285	Data Values for Profile/Parameter	$W/m^2/sr/cm^{-1}$ K or ppm/ppb	250 ½ words	Use Data Scale Coef.
286-935	Repeat Words 156-285 for Additional 5 Profiles			Total 6 Profiles
936–3716	Repeat Words 9-935 for Additional 3 Groups			Total 4 Groups
3717-3720	Spares		7 ½ words	
3720	Check Sum		½ words	

3.2 Metadata

The metadata are contained in a separate XML formatted file having the same name as the data file with .xml appended to it.

Table 3-2: Metadata attributes associated with the data file.

Name	Description
LongName	Long name of the data product.
ShortName	Short name of the data product.
VersionID	Product or collection version.
GranuleID	Granule identifier, i.e. the name of the file.
Format	File format of the data file.
CheckSumType	Type of checksum used.
CheckSumValue	The value of the calculated checksum.
SizeBytesDataGranule	Size of the file or granule in bytes.
InsertDateTime	Date and time when the granule was inserted into the archive. The format for date is YYYY-MM-DD and time is hh-mm-ss.
ProductionDateTime	Date and time the file was produced in format YYYY-MM-DDThh:mm:ss.ssssssZ
RangeBeginningDate	Begin date when the data was collected in YYYY-MM-DD format.
RangeBeginningTime	Begin time of the date when the data was collected in hh-mm-ss format.
RangeEndingDate	End date when the data was collected in YYYY-MM-DD format.
RangeEndingTime	End time of the date when the data was collected in hh-mm-ss format.
PlatformShortName	Short name or acronym of the platform or satellite
InstrumentShortName	Short name or acronym of the instrument
SensorShortName	Short name or acronym of the sensor
WestBounding Coordinate	The westernmost longitude of the bounding rectangle(-180.0 to +180.0)
NorthBounding Coordinate	The northernmost latitude of the bounding rectangle(-90.0 to +90.0)
EastBounding Coordinate	The easternmost longitude of the bounding rectangle(-180.0 to +180.0)
SouthBounding Coordinate	The southernmost latitude of the bounding rectangle(-90.0 to +90.0)
Orbit	Satellite orbit number range.
ElapsedMinTime	Duration in minutes of data collected during an orbit.

4. Reading the Data

The data are written in a binary record-oriented format. Using the record format specification in the section above, users can write software to read the data files. Please note that the data were originally written using a big-endian format, therefore users on little-endian machines will need to swap bytes for the words.

A sample FORTRAN program is included in the Appendix section which will read in the data records. Additionally a FORTRAN function is included to perform byte swapping.

5. Data Services

5.1 GES DISC Search

The GES DISC provides a keyword, spatial, temporal and advanced (event) searches through its unified search and download interface:

https://disc.gsfc.nasa.gov/

5.2 Documentation

The data product landing pages provide information about these data products, as well as links to download the data files and relevant documentation:

https://disc.gsfc.nasa.gov/datacollection/LIMSN7L1PROFILER_001.html

5.3 Direct Download

These data products are available for users to download directly using HTTPS:

https://acdisc.gesdisc.eosdis.nasa.gov/data/Nimbus7_LIMS_Level1/LIMSN7L1PROFILER.001/

6. More Information

6.1 Contact Information

Name: GES DISC Help Desk
URL: https://disc.gsfc.nasa.gov/
E-mail: gsfc-help-disc@lists.nasa.gov
Phone: 301-614-5224
Fax: 301-614-5228
Address: Goddard Earth Sciences Data and Information Services Center
Attn: Help Desk
Code 610.2
NASA Goddard Space Flight Center
Greenbelt, MD 20771, USA

6.2 References

"The Nimbus-7 User's Guide - Section 4: The Limb Infrared Monitor of the Stratosphere (LIMS) Experiment", NASA Goddard Space Flight Center, November 1972, Pages 71-103

Nimbus G, Nimbus Observation Processing System (NOPS) Requirements Document # NG-67, Tape Specification T564111, Rev. C, "LIMS Profile R Tape", NASA Goddard Space Flight Center, Greenbelt, MD, 1981

7. Appendices

Acknowledgments

The Nimbus data recovery task at the GES DISC is funded by NASA's Earth Science Data and Information System program.

Acronyms

BCD: Binary Coded Decimal

EOS: Earth Observing System

ESDIS: Earth Science and Data Information System

GES DISC: Goddard Earth Sciences Data and Information Services Center

GSFC: Goddard Space Flight Center

L1: Level-1 Data

LIMS: Limb Infrared Monitor of the Stratosphere

NASA: National Aeronautics and Space Administration

QA: Quality Assessment

Profile-R: Profiles of Radiance Data Tape

RAT: Radiance Archival Tape

UT: Universal Time

FORTRAN Code

```
C-----------------------------------------------------------------------
C ^NAME: READ_LIMSPROFR
C   This program will read a Nimbus 7 LIMS Profiles of Radiance Tape
C   (Profile-R) Level-1 data file.
C
C   The LIMS Profile-R files contain a days worth of a series of data
C   records. Each of the data records contains a pair of up and down
C   data profiles for each of the six LIMS bands (CO2N, CO2W, O3, HNO3,
C   H2O and NO2), along with ancillary info. This program will print
C   the contents of each data record.
C
C ^MAJOR VARIABLES:
C     FNAME  - name of input file
C     BUFF   - buffer for data record
C     TEMP   - buffer for holding temporary 4-byte word
C     WORD   - integer 4-byte word
C     IRECSZ - size of record in bytes
C     IOS    - I/O status number
C
C ^NOTES:
C     Compile: gfortran -o READ_LIMSPROFR.EXE READ_LIMSPROFR.FOR
C
C ^ORGANIZATION: NASA/GSFC, Code 610.2
C
C ^AUTHOR:  James Johnson
C
C ^ADDRESS: james.johnson@nasa.gov
C
C ^CREATED: January 9, 2019
C-----------------------------------------------------------------------

      CHARACTER          FNAME*1024    ! Filename
      CHARACTER          BUFF(11160)   ! Buffer for data record
      INTEGER*4          IRECSZ        ! Size of records
      INTEGER*4          WRDARR(3720)  ! Word array (32-bit integers)
      INTEGER*4          IWORD         ! 4-byte word
      CHARACTER          TEMP(4)       ! Buffer to hold 4-byte word
      EQUIVALENCE        (TEMP,IWORD)

C Get the name of the input data file to read
      WRITE (0, *), 'Enter the name of the input file:'
      READ (5,'(A)') FNAME
      PRINT '("File = ",A)', FNAME

C Open the specified input file
      OPEN (UNIT=1, FILE=FNAME, STATUS='OLD', ACCESS='DIRECT',
     &      FORM='UNFORMATTED', RECL=1, ERR=99, IOSTAT=IOS)

C Initialize N (record number) and IOFF (byte offset in file)
      N=0
      IOFF=0
```

```
C Loop through the file reading all records in file
    5 DO

C Read the first 4-byte word or record size header
        DO I=1,4
          READ (1, REC=IOFF+I, IOSTAT=IOS, ERR=90) TEMP(I)
        END DO
        IRECSZ = IWORD
        IOFF=IOFF+(I-1)

        IF (IRECSZ .EQ. 0) THEN
C         PRINT '("WARNING: END-OF-TAPE MARK")'
          GOTO 5
        ENDIF

C Next read the block of data
        DO I=1,IRECSZ
          READ (1, REC=IOFF+I, IOSTAT=IOS) BUFF(I)
          IF (IOS .NE. 0) THEN
            PRINT '("ERROR: BUFF ",I4,X,I4,", IOSTAT: ",I6)', N,I-1,IOS
            IRECSZ = I-1
            GOTO 20
          ENDIF
        END DO
        IOFF=IOFF+(I-1)
        N=N+1

C Convert record to array of words
        CALL W24W32(IRECSZ,BUFF,WRDARR)

C Print data record
        CALL PRDREC(IRECSZ/3,WRDARR)

C Finally read the last 4-byte word (should match first record size)
   20   DO I=1,4
          READ (1, REC=IOFF+I, IOSTAT=IOS, ERR=90) TEMP(I)
        END DO
        IF (IRECSZ .NE. IWORD) THEN
          PRINT '("WARNING: IRECSZ ",I10," != ",I10)', IWORD, IRECSZ
        ENDIF
        IOFF=IOFF+(I-1)

      END DO

C Close the input file
   90 CLOSE(1)
      GOTO 100

   99 PRINT '("ERROR: OPEN FILE, IOSTAT: ",I6)', IOS

  100 STOP
      END
```

```
C-----------------------------------------------------------------------
C     This Subroutine converts 24-bit (3-byte) words to IEEE 32-bit word
C-----------------------------------------------------------------------
      SUBROUTINE W24W32(IRECSZ,BUFF,WRDARR)

      CHARACTER          BUFF(11160)   ! Buffer for data record
      INTEGER*4          WRDARR(3720)  ! Word array
      INTEGER*4          IWORD         ! 4-byte word
      CHARACTER          TEMP(4)       ! Buffer to hold 4-byte word
      EQUIVALENCE        (TEMP,IWORD)

      J=1
      DO I=1,IRECSZ,3
        TEMP(1)=BUFF(I+2)
        TEMP(2)=BUFF(I+1)
        TEMP(3)=BUFF(I)
        TEMP(4)=CHAR(0)
C These words can be negative, check bit 23 and convert
c       IF (J.GE.3173.AND.J.LT.3298) THEN
c         IF (ISHFT(IWORD,-23).NE.0) THEN
c           IWORD = -1*(X'00FFFFFF' - IWORD)
c         ENDIF
c       ENDIF
        WRDARR(J)=IWORD
        J=J+1
      END DO

      RETURN
      END



C-----------------------------------------------------------------------
C     This Subroutine will print the Data Record
C-----------------------------------------------------------------------
      SUBROUTINE PRDREC(NWORDS,IWORD)

      INTEGER*4          IWORD(3720)    ! Word array
      INTEGER*2          IHALF(2)       ! Half words
      INTEGER*2          THICK(30)      ! Vertical Thickness array
      INTEGER*2          YSCALE(250)    ! Vertical Scale array
      INTEGER*2          XSCALE(250)    ! Data Value array
      INTEGER*2          SPARE(7)       ! Spare array
      EQUIVALENCE        (THICK,TEMP1,TEMP2)

      DO I=1,NWORDS
        IHALF(1) = ISHFT(IWORD(I),-12)
        IHALF(2) = IAND(IWORD(I),X'FFF')
        IF (I .EQ. 1) THEN
          PRINT '("RecNo   :",X,I8)',IHALF(1)
          PRINT '("RecID   :",X,I1,X,I1,X,I4)', ISHFT(IHALF(2),-7),
     +        IAND(ISHFT(IHALF(2),-6),X'01'), IAND(IHALF(2),X'3F')
        ELSE IF (I .EQ. 2) THEN
          PRINT '("Spare   :",X,I8)',IHALF(1)
          PRINT '("Rec/Frm :",X,I8)',IHALF(2)
```

```
ELSE IF (I .EQ. 3) THEN
  PRINT '("RecNoFrm:",X,I8)',IHALF(1)
  PRINT '("Algorthm:",X,I8)',IHALF(2)
ELSE IF (I .EQ. 4) THEN
  PRINT '("FrameNo :",X,I8)',IWORD(I)
ELSE IF (I .EQ. 5) THEN
  PRINT '("FilmSpNo:",X,I8)',IWORD(I)
ELSE IF (I .EQ. 6) THEN
  PRINT '("FrameOrb:",X,I8)',IWORD(I)
ELSE IF (I .EQ. 7) THEN
  PRINT '("ObsYear :",X,I8)',IHALF(1)
  PRINT '("ObsDay  :",X,I8)',IHALF(2)
ELSE IF (I .EQ. 8) THEN
  PRINT '("GenYear :",X,I8)',IHALF(1)
  PRINT '("GenDay  :",X,I8)',IHALF(2)
ELSE IF (I .GE. 9 .AND. I .LT. 3717) THEN
  J = MOD((I-9),927)+9
  IF (J .EQ. 9) THEN
    PRINT '("=================")'
    PRINT '("GroupNo :",X,I8)',IHALF(1)
    PRINT '("LeftScl :",X,I8)',IHALF(2)
  ELSE IF (J .GE. 10 .AND. J .LT. 25) THEN
    THICK(2*(J-10)+1) = IHALF(1)
    THICK(2*(J-10)+2) = IHALF(2)
    IF (J .EQ. 24) THEN
      PRINT '("VrtThick:")'
      PRINT '(8(X,I8))',THICK(1:10)
      PRINT '(8(X,I8))',THICK(11:20)
      PRINT '(8(X,I8))',THICK(21:30)
    END IF
  ELSE IF (J .EQ. 25) THEN
    IF (ISHFT(IHALF(1), -11) .EQ. 1) THEN
      IHALF(1) = IHALF(1) - 2**12
    END IF
    IF (ISHFT(IHALF(2), -11) .EQ. 1) THEN
      IHALF(2) = IHALF(2) - 2**12
    END IF
    PRINT '("VCoefOff:",2(X,I8))', IHALF(1), IHALF(2)
  ELSE IF (J .EQ. 26) THEN
    IF (ISHFT(IHALF(1), -11) .EQ. 1) THEN
      IHALF(1) = IHALF(1) - 2**12
    END IF
    IF (ISHFT(IHALF(2), -11) .EQ. 1) THEN
      IHALF(2) = IHALF(2) - 2**12
    END IF
    PRINT '("VCoefScl:",2(X,I8))', IHALF(1), IHALF(2)
  ELSE IF (J .EQ. 27) THEN
    PRINT '("DayNight:",X,I8)', IHALF(1)
    PRINT '("UpDown  :",X,I8)', IHALF(2)
  ELSE IF (J .EQ. 28) THEN
    PRINT '("Time    :",X,I8)', IWORD(I)
  ELSE IF (J .EQ. 29) THEN
    PRINT '("LatTP   :",X,I8)', IHALF(1)
    PRINT '("LonTP   :",X,I8)', IHALF(2)
  ELSE IF (J .EQ. 30) THEN
    PRINT '("Ref30km :",X,I8)', IHALF(1)
    PRINT '("NVrtData:",X,I8)', IHALF(2)
```

```
  ELSE IF (J .GE. 31 .AND. J .LT. 156) THEN
    YSCALE(2*(J-31)+1) = IHALF(1)
    YSCALE(2*(J-31)+2) = IHALF(2)
    IF (J .EQ. 155) THEN
      PRINT '("VrtScale:")'
      PRINT '(8(X,I8))', YSCALE
    END IF
  ELSE IF (J .GE. 156 .AND. J .LT. 3717) THEN
    K = MOD((J-156), 130)+156
    IF (K .EQ. 156) THEN
      PRINT '("------------------")'
      PRINT '("ProfNo  :",X,I8)', IHALF(1)
      PRINT '("ParamNo :",X,I8)', IHALF(2)
    ELSE IF (K .EQ. 157) THEN
      PRINT '("AbsScalL:",X,I8)', IHALF(1)
      PRINT '("AbsScalR:",X,I8)', IHALF(2)
    ELSE IF (K .EQ. 158) THEN
      PRINT '("UnitCode:",X,I8)', IHALF(1)
      PRINT '("UnitScal:",X,I8)', IHALF(2)
    ELSE IF (K .EQ. 159) THEN
      IF (ISHFT(IHALF(1), -11) .EQ. 1) THEN
        IHALF(1) = IHALF(1) - 2**12
      END IF
      IF (ISHFT(IHALF(2), -11) .EQ. 1) THEN
        IHALF(2) = IHALF(2) - 2**12
      END IF
      PRINT '("DCoefOff:",2(X,I8))', IHALF(1), IHALF(2)
    ELSE IF (K .EQ. 160) THEN
      IF (ISHFT(IHALF(1), -11) .EQ. 1) THEN
        IHALF(1) = IHALF(1) - 2**12
      END IF
      IF (ISHFT(IHALF(2), -11) .EQ. 1) THEN
        IHALF(2) = IHALF(2) - 2**12
      END IF
      PRINT '("DCoefScl:",2(X,I8))', IHALF(1), IHALF(2)
    ELSE
      XSCALE(2*(K-161)+1) = IHALF(1)
      XSCALE(2*(K-161)+2) = IHALF(2)
      IF (K .EQ. 285) THEN
        PRINT '("DataVal :")'
        PRINT '(8(X,I8))', XSCALE
      END IF
    END IF
  END IF
ELSE IF (I .EQ. 3717) THEN
  SPARE(1) = IHALF(1)
  SPARE(2) = IHALF(2)
ELSE IF (I .EQ. 3718) THEN
  SPARE(3) = IHALF(1)
  SPARE(4) = IHALF(2)
ELSE IF (I .EQ. 3719) THEN
  SPARE(5) = IHALF(1)
  SPARE(6) = IHALF(2)
```

```
  ELSE IF (I .EQ. 3720) THEN
    SPARE(7) = IHALF(1)
    PRINT '("=================")'
    PRINT '("Spare   :",7(X,I8))',SPARE
    PRINT '("CheckSum:",X,I8,/)',IHALF(2)
  END IF
END DO

RETURN
END
```