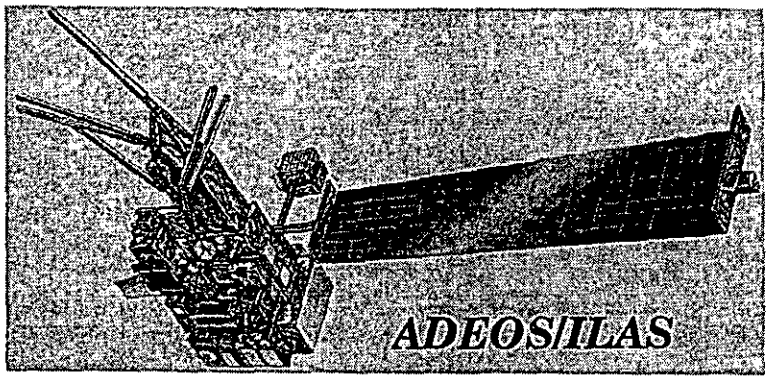
F-102-'97/NIES

ISSN 1341-3651

ILAS User's Handbook

(Version 1.0)



Edited by Y. Sasano
ILAS Project

December 1996

NATIONAL INSTITUTE FOR ENVIRONMENTAL STUDIES

Foreword

Stratospheric ozone depletion by chlorofluorocabons and other man-made chemicals is progressing, not only in the ozone hole observed over the Antarctic but also in the Arctic and the mid latitudes in both the southern and northern hemispheres. Ozone destroying chemical reactions by the chlorine contained in CFCs are presumed to be the major cause, and so a knowledge as to whether or not conditions conductive to such reactions have been established is the key to understanding this problem.

Accordingly, to understand the behavior of the stratospheric ozone layer and to forecast its variations, it is necessary to comprehensively asses the various atmospheric trace constituents, aerosols, the polar tropospheric clouds, and temperature distributions. The ILAS sensor (Improved Limb Atmospheric Spectrometer) was developed to measure these data necessary to understand the chemical and dynamic processes in the upper atmospheric layers ranging from the upper stratosphere to the whole stratosphere.

This handbook explains how to make effective use of the ILAS measurement data. The structure and the contents of respective chapter are as follows:

Chapter 1. "Satellite System": This chapter gives users general ideas on the observation and monitoring of ozone layer by ILAS, for instance the outline of ADEOS (Advanced Earth Observing Satellite: a technical satellite for Earth Observation Platform) on which ILAS is loaded and the principles of ILAS measurements.

Chapter 2. "ILAS Data Processing": This chapter explains the functions and the constitution of the installations at the ILAS RIS Data Handling Facility, the outline of the ILAS data processing and the methods for evaluation and analysis. A special attention was paid to the descriptions of the outline of processing to give information that may be of help upon using data.

Chapter 3. "Access to the ILAS Data of Standard Processing": The information on the procedures for searching and ordering the data of standard processing are presented. This handbook (The first edition) is mainly for the specific researchers (researchers registered beforehand: see the second paragraph of Chapter 3). For general users, procedures for making access to data and others will be explained in detail in the revised version to be published in the first half year period of 1997.

Chapter 4. "Contact Points": For further information about the ILAS project or the available data, please contact one of the addressees listed in this chapter.

Chapter 5. "Reference Materials": Section 5.1 lists reference literature, while section 5.2 provides a detailed list of acronyms. "Product Format Manual" and "Data Distribution

System User's Guide" included in the Appendix explains the product formats and how to use them.

August, 1996
Yasuhiro Sasano
ILAS Project Leader
National Institute for Environmental Studies

CONTENTS

Chapter 1

Satellite System

1 Satellite System

1.1 Outline of ILAS

(1) ADEOS spacecraft

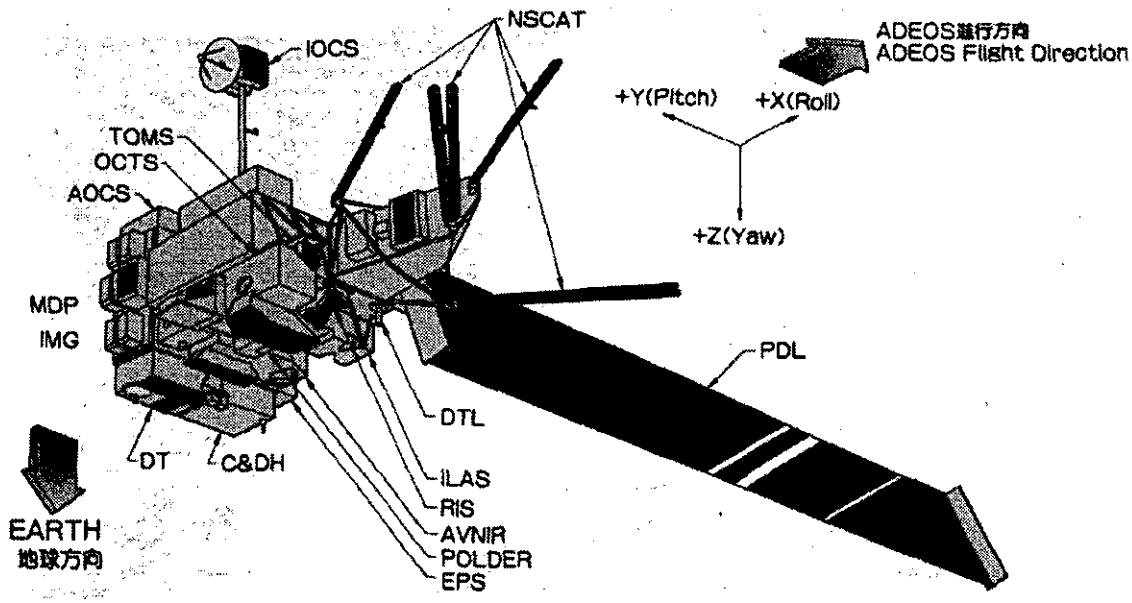


Fig. 1.1-1 External view of ADEOS spacecraft (From ADEOS pamphlet produced by the National Space Development Agency of Japan)

ADEOS with ILAS on board is an artificial satellite for developing platform-bus technologies for next-generation earth observation systems as well as for contributing to international monitoring of the global environment by collecting data on global environmental changes such as global warming, depletion of the ozone layer, tropical deforestation, changes in normal weather patterns.

ADEOS is a large size spacecraft of 4 × 4 × 5 m consisting of a mission module in the front loaded with observation instruments and a bus module in the rear loaded with basic spacecraft facilities. The tip of the mission module is fitted with antennas of scatterometers and antenna towers, and the surface area of the earth side contains the units of ILAS and other observation instruments (see Fig. 1.1-1).

(2) Orbit of ADEOS

The orbit of ADEOS is a sun-synchronous subrecurrent polar orbit that takes approximately 101 minutes per orbit at the orbital inclination angle of 98.6° and altitude of about 800 km.

Table 1.1-1 ADEOS: Main specifications

Dimensions	Modular system with single wing solar array paddle Main body: 4 × 4 × 5 (m) approx. (mission and bus modules) Solar array paddle: 3 × 26 (m) approx.	
Weight	3.5 ton approx. at lift-off	
Attitude control	Zero-momentum 3-axis strap down	
Design life span	3 years	
Rocket for launch	H-II rocket (fairing: 5 m ϕ)	
Place of launch	Tanegashima Space Center	
Time of launch	Summer of 1996	
Orbit	Type	Sun synchronized subrecurrent polar orbit (travels to east) (Number of orbits: 14+11/41 per day)
	Altitude	796.75 km
	Inclination angle	98.59°
	Orbit time	100.92 minutes
	Days for regression	41 days
	Number of orbits/regression	585
	Minimum distance between orbit tracks	68.5 km (on the equator)
	Local time of passing the descending cross point:	10h 30min. AM + or - 15 min.

1.2 Principle of ILAS and observation targets

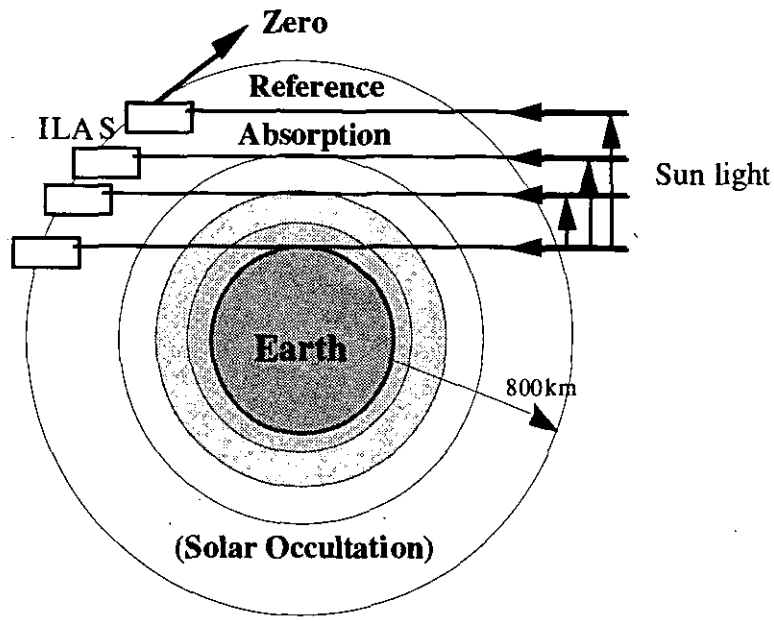


Fig. 1.2-1 Principle of ILAS observation

The ILAS sensor bases its principle on solar occultation (Fig. 1.2-1), the usefulness of which has already been well established by other satellite sensors such as SAGE-II and HALOE. This method measures the magnitude of solar light absorption that occurs when light passes through the atmospheric layer surrounding the earth and is separated into spectra. Due to the unique wavelength absorption characteristics of every atmospheric components , the componets present in the atmospheric layer can be identified and quantified. Continuous observations by tracking the sun give different altitudes of the atmospheric layer makes it possible to extract information on the altitude distribution of the light-absorbing componets. The main observation targets of ILAS are the altitude distribution of the concentration of gases such as ozone, nitric acid, nitrogen dioxide, nitrous oxide, methane and water vapor by infrared band (6.2μm-11.8μm) absorption measurement, and the altitude distribution of aerosol extinction coefficients. CFC-11 and CFC-12 are also measured although the altitude resolution and measurement accuracy are slightly inferior, and the altitude distribution of temperature, atmospheric pressure and aerosol extinction coefficients are derived from measurements of absorption by oxygen molecules in the visible band (0.753 μm

- 0.784 μm) at the same time. Further, the types of aerosols are identified from the data on the aerosol extinction coefficients in the visible and infrared bands (identifying the aerosol of sulfuric acid from the polar stratospheric clouds). The target altitude range of observation is approximately 10 km to 60 km, and the altitude resolution (the width of instantaneous field of view to the altitude direction) is 2 km.

The solar occultation method allows accurate measurement with a light source of very high intensity, the sun, and higher reliability due to the lower influence of device deterioration, as the light attenuations by atmospheric trace constituents are observed with a reference light whose light source is measured outside the atmosphere for each observation.

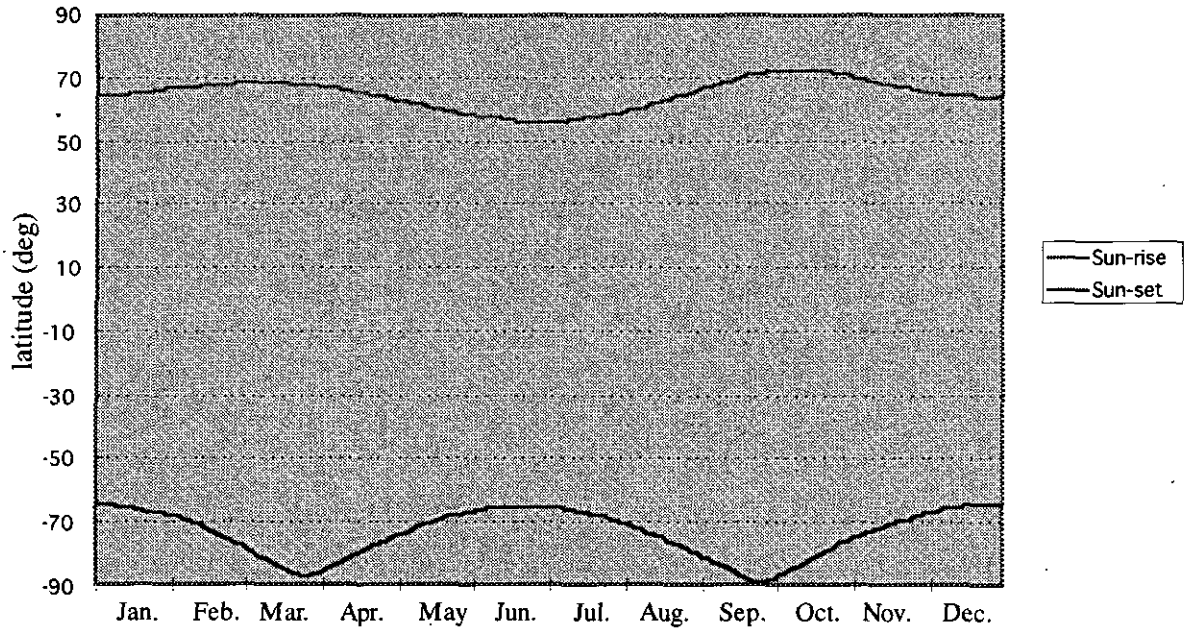
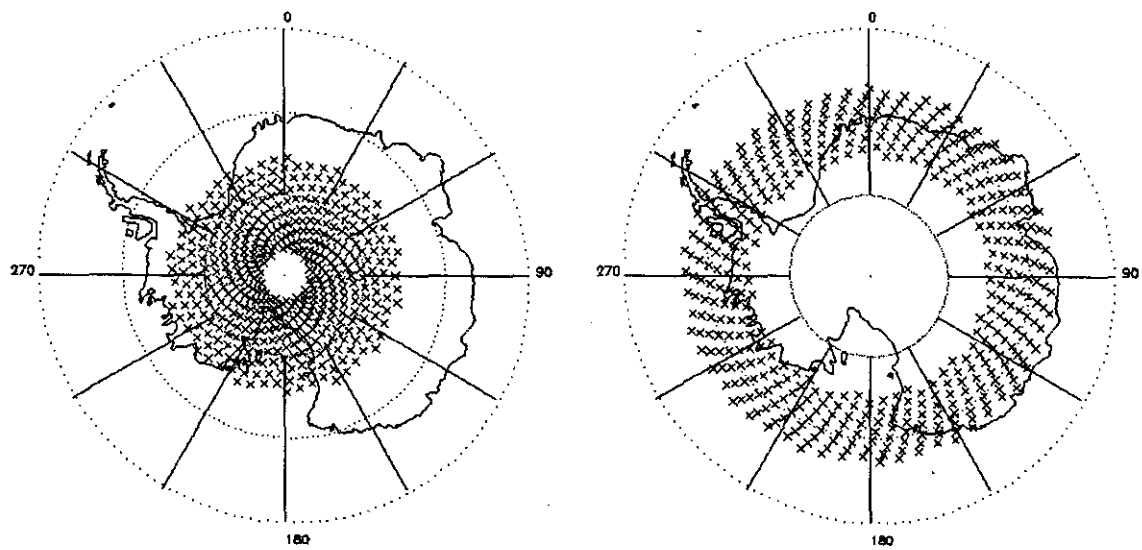


Fig. 1.2-2 Latitude range of observation

Since ADEOS flies on a sun synchronized polar orbit and ILAS uses the sun as the light source, the target areas for ILAS observation are limited to the atmospheric region above the high latitude areas in both the northern and southern hemispheres (Fig. 1.2-2). Unlike SAGE II and HALOE that are on spacecrafts which are flying on a non-sun synchronous orbit of lower inclination angle and which can therefore sweep a larger area ranging from high latitudes to the equator and also to high latitudes in opposite hemisphere, ILAS slowly sweeps areas of narrower latitudes. ADEOS makes about 14 orbits a day around the earth, conducting 14 observations in both the southern

and northern hemispheres. The observation targets for one day are thus 14 points on the circumference of about the same latitude area shifted approximately 25 degrees. Fig. 1.2-3 shows the distribution of the points for observations to be conducted by ILAS in the southern hemisphere during the two-month period of October and November, 1996 as an example. ILAS is not for global observation, but it can detect and follow changes in atmospheric environments in detail at a certain time interval. One of the merits of the system is that we can then know the timewise variation of a latitude - altitude cross section in detail. This feature allows very unique observation data to be gathered to assess variations of the chemical environment over time, which is essential to understand ozone holes and other phenomena. ILAS is expected to yield valuable data from the main observation areas in the high latitude stratosphere, which will clarify the status of ozone holes and stratospheric ozone depletion, and their relationship with variations of the chemical and meteorological environments.



Southern hemisphere in October　　Southern hemisphere in November

Fig. 1.2-3 ILAS: Points for observation (approximate values of the southern hemisphere)

1.3 Outline of ILAS sensor

(1) Structure of ILAS

The ILAS sensor is implemented with a tracking system (gimbal mirror) to track the brightness center of the sun while the spacecraft is flying, two spectro-optical systems of infrared and visible bands to collect and convert the incident solar light into spectra, a signal detection system, and a power supply system as the basic elements. The external view of the engineering model on the ground (EM) with the protection cover (casing) removed is shown in Fig. 1.3-1 and the characteristics of the main devices in Table 1.3-1. Please see references 2 and 3 for details.

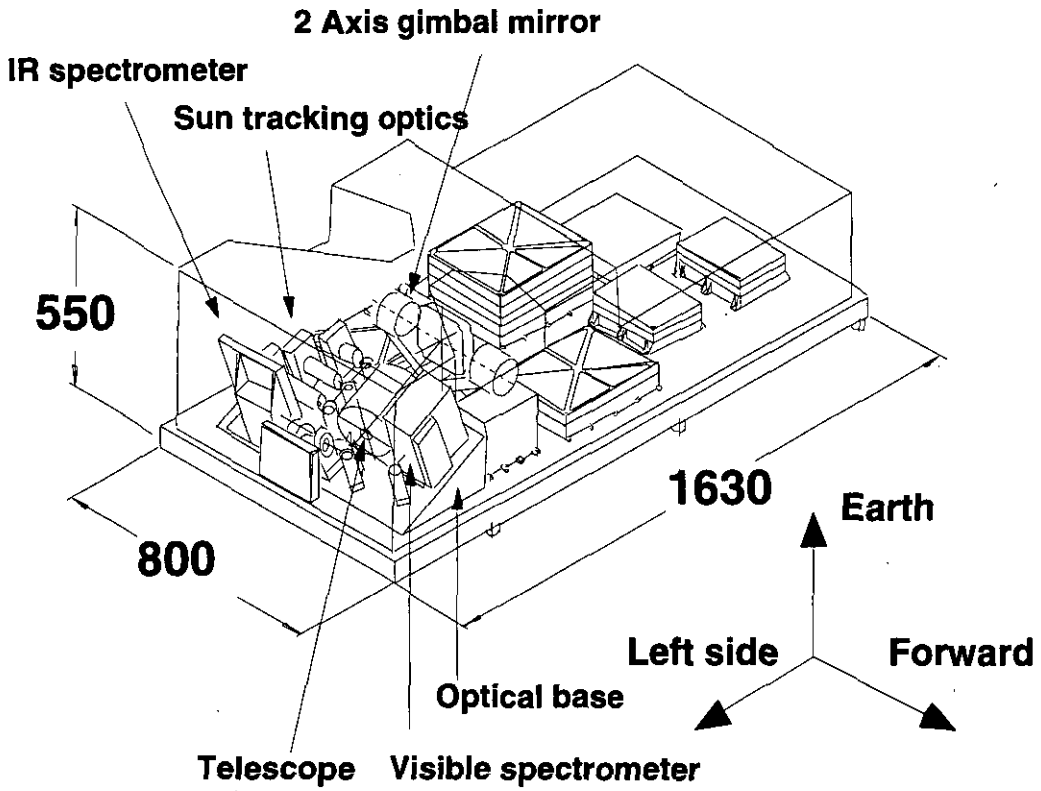


Fig. 1.3-1 External view of ILAS engineering model

Table 1.3-1 Characteristics of ILAS devices

Grating Spectrometers with Linear Array Detectors		
	IR detector	44-pixel pyro-electric detector
	Visible detector	1024-pixel MOS photo-diode array
Spectral Coverage / Resolution		
	IR	850 - 1610 cm^{-1} (6.21 - 11.77 μm)
		0.12 μm resolution (FWHM)
	Visible	753 - 784 nm
		0.15 nm resolution (FWHM)
IFOV	2 km Vertical × 13 km Horizontal in the IR channel	
	2 km Vertical × 2 km Horizontal in the visible channel	
Positioning	Tracking radiometric center of the sun, from cloud top to 200 km	
	On-board IFOV position measurement relative to the sun edge with a resolution of 10 arc sec by 1024-pixel linear array detector	
Data Rate	12 Hz, 517 kbps	
Weight	125 kg	
Power	70 W	
Size	800 × 1630 × 550 (XYZ in mm)	

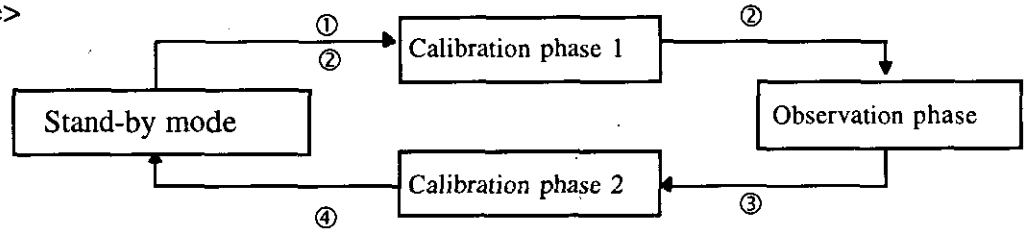
(2) Operation mode

ILAS is operated in the following 3 modes:

- ILAS Operation modes
  - Observation mode (On operation)
    - Calibration phase
    - Observation phase
    - Calibration phase 2
  - Stand-by mode (Heater is operating)
  - All-OFF mode (Off operation)

Other than the above, there is the Emergency mode that responds to the emergency observation stop command in case an abnormal operation occurs in ILAS. In such a case, the status of ILAS remains in stand-by mode, and the heater is supplied power through an electrical thermostat. During one orbit (about 101 minutes), ILAS is placed into observation mode for 20 minutes: 10 minutes at sunrise and another 10 minutes at sunset. The phase shift for sunrise in the observation mode is different from that for the sunset.

<At sunrise>



<At sunset>

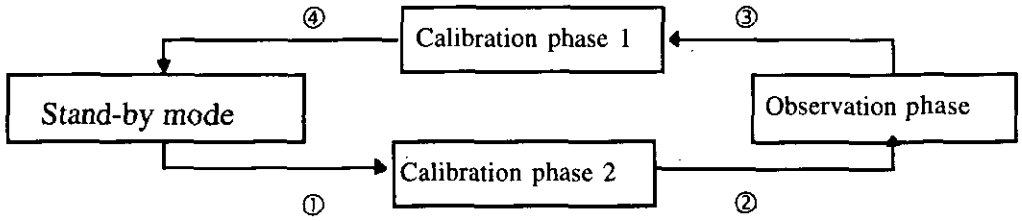


Fig. 1.3-2 ILAS: Operation mode

The sequence of the phase shift for sunrise in the observation mode is different from that for the sunset.

The calibration phase 1 determines the 0 level of the signal by observing the outer space.

The calibration phase 2 determines the 100% level of the signal by observing the sun light that is not affected by absorption in the atmosphere.

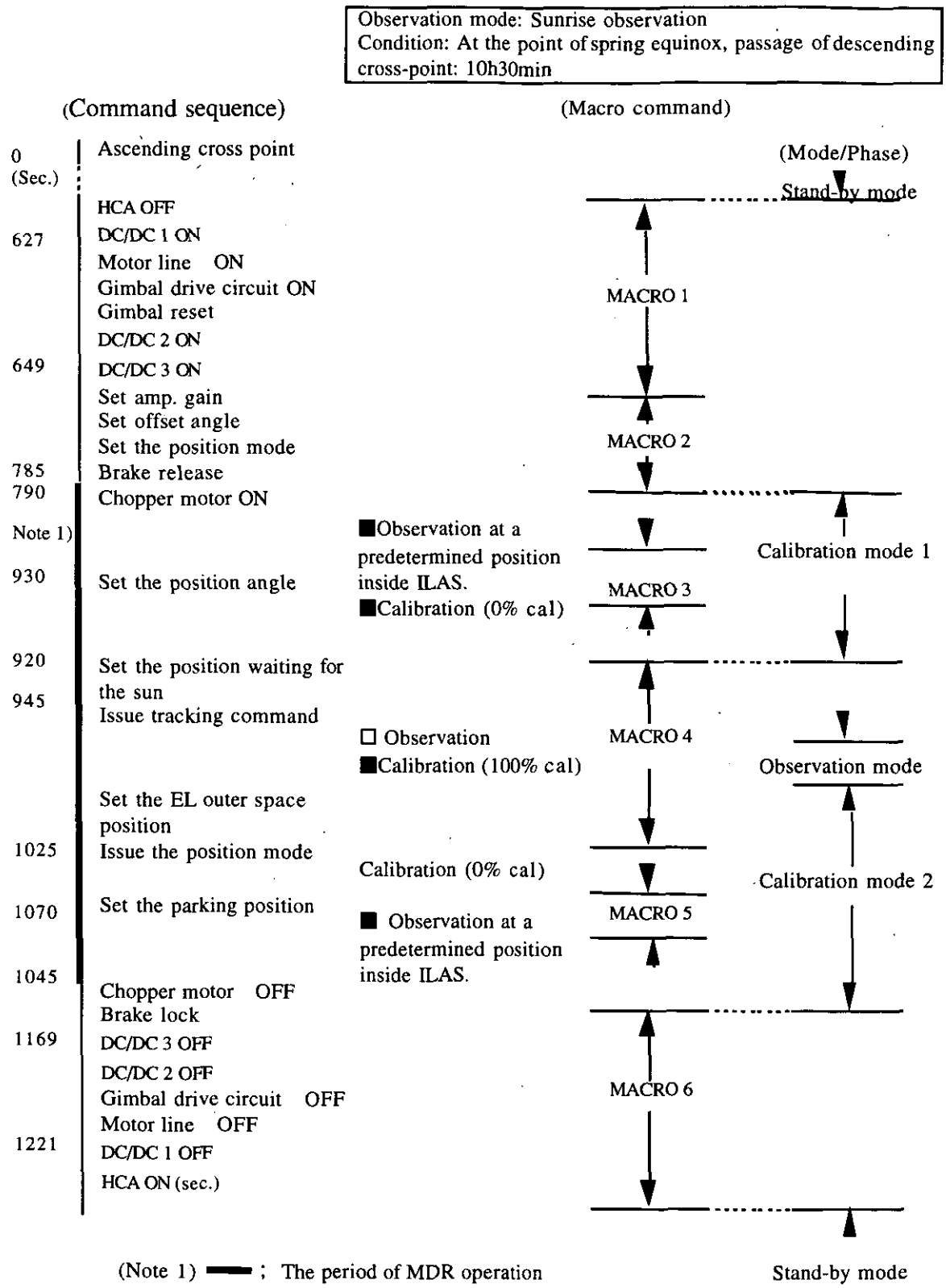


Fig. 1.3-3 Outline of command sequence 1 (for sunrise observation)

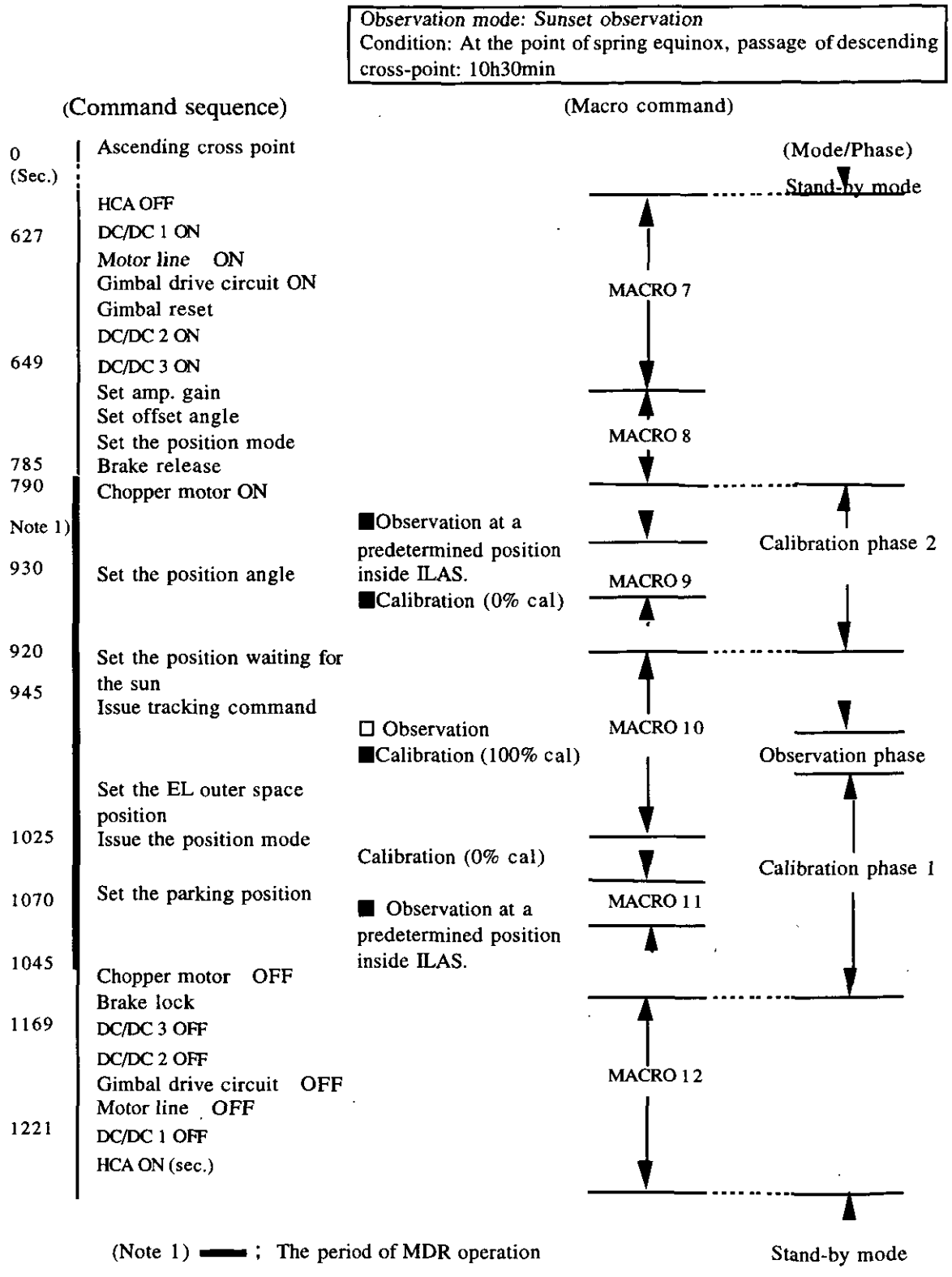


Fig. 1.3-4 Outline of command sequence 2 (for sunset observation)

Chapter 2

ILAS data processing and distribution

2. ILAS data processing and distribution

The ILAS data received and collected at the Earth Observation Center of NASDA are added with additional information such as the data on the orbiting position and transferred to the ILAS & RIS Data Handling Facility (ILAS & RIS DHF) inside the National Institute for Environmental Studies. Those data are further processed and analyzed there, and then distributed to researchers concerned with the ILAS project and users in general.

2.1 ILAS & RIS Data Handling Facility (ILAS & RIS DHF)

2.1.1 ILAS & RIS DHF functions

The ILAS & RIS DHF (hereafter called DHF) facility is in charge of handling ILAS data processing, evaluating and analyzing the data, mission control, and distributing ILAS data. DHF is established in the central research building III of the National Institute for Environmental Studies, and is linked to the Earth Observation Center of NASDA by dedicated high-speed digital channels and to the companies developing the ILAS space-borne hardware and those developing DHF system software through a digital communication network. Researchers outside the institutes and general users are connected through the Internet.

Via the Internet, DHF regularly obtains stratospheric meteorological data from the United Kingdom Meteorological Office and solar image data from the Communication Research Laboratory and an American astronomical observatory. DHF also provides a service of distributing information to specific users such as the science team and the validation experiment team, to researchers selected through the Joint Research Announcement activity and to general users. Fig. 2.1.1-1 illustrates the functional organization of DHF.

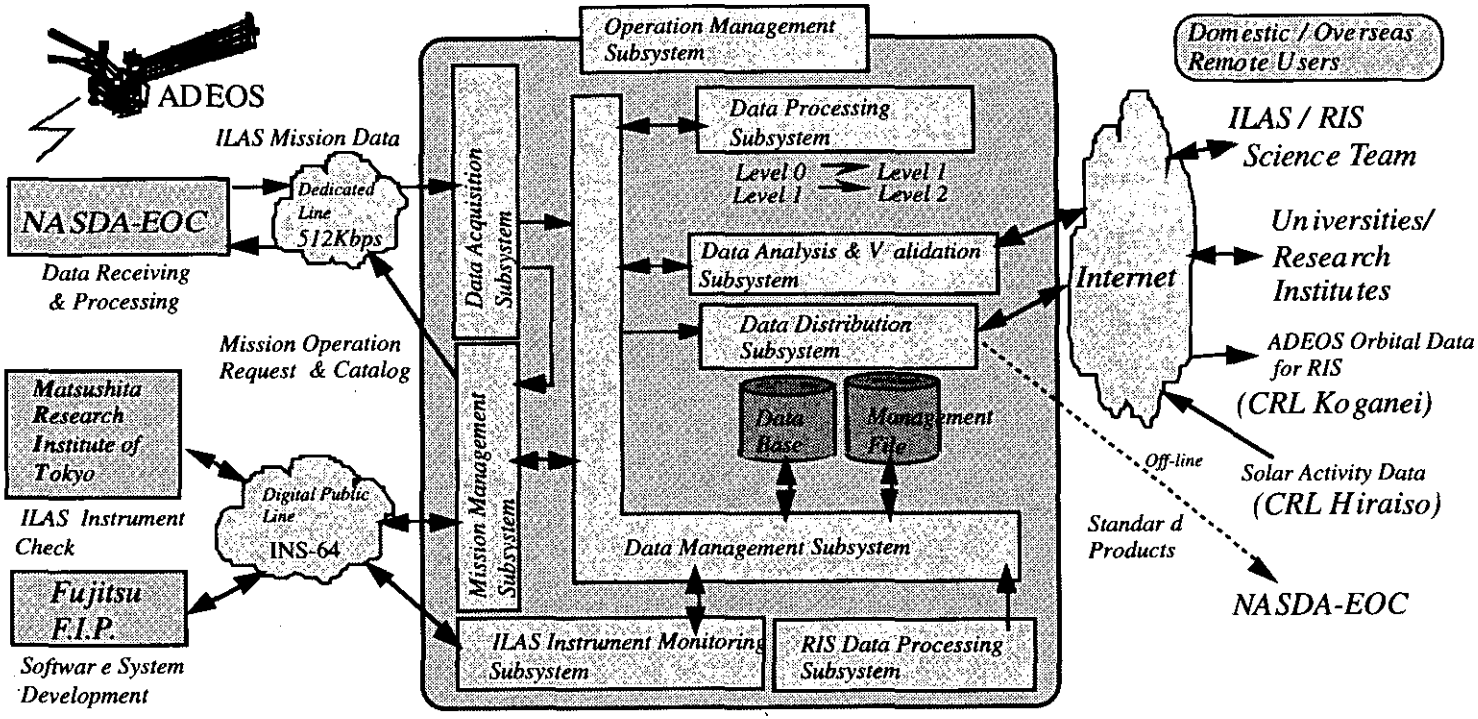


Fig. 2.1-1 the function organization of DHF

2.1.2 DHF software system

The DHF software system handles all the aspects from the planning of the ILAS mission through to the acquisition of ILAS observation data from the Earth Observation Center of NASDA, the data processing, evaluation and analysis, and the data distribution. This software system is built up of subsystems to ensure the independence of respective functions and thus improve maintainability and prevent troubles from extending to other sections. The functions of DHF software system are listed below.

(1) System management

a) System operation management subsystem

- Process management
- Network management
- File resource management
- Data processing commands, etc.

b) Data management subsystem

- Database recording and storage
- Data and catalogue management
- Search, extraction, updating, and removal of data or catalogue, etc.

(3) Retrieval

a) Data processing subsystem

- Level 0-1 data processing (data extraction and noise removal, etc.)
- Level 1-2 data processing (temperature, computations for atmospheric pressure, aerosol extinction coefficient and gas concentration, etc.)

(4) Diagnosis of devices

a) ILAS instrument monitoring subsystem

- Housekeeping telemetry data display
- Observation point display
- Orbit map display
- Data trend analysis, etc.

(5) NASDA interface

a) Data acquisition subsystem

- ILAS level 0 data acquisition
- Acceptance of D-1 medium
- Mission management data acquisition

b) Mission management subsystem

- Mission planning/request transmission
- Mission plan reception and check
- Display of information on the operational status of the mission
- Display of orbit map and information on the mission

(6) Data utilization

a) Data analysis and validation subsystem

- ILAS data validation analysis and display
- Statistical analysis / time series analysis
- Researcher support, etc.

b) Data distribution subsystem

- Provision to external users with standard products
- Preparation and revision of the information on data distribution management
- Searching, outputting and editing data to be distributed

2.1.3. DHF hardware system

In order to process the enormous amount of ILAS observation data without delay, ILAS & RIS DHF computer system uses an IBM 9076-SP2 having 24 workstations interconnected by high performance switches forming a distributed memory type of computer that functions as a parallel computer. To increase data storage capacity, two sets of digital mass-storage systems are installed for storing and searching data that exceed 1 terabytes in total, and large-capacity array disks for the database. These are accessible from the parallel computers and other workstations.

Table 2.1.3-1 ILAS & RIS DHF computer system hardware

Name of device			Parts list and specifications
Retrieval & Data server (IBM 9076-SP2)	CPU		POWER2 RISC processor (24 units)
	Computation speed (theoretical peak performance)		266 MFLOPS/unit
	High performance switch	Data transfer speed	40 MB/sec
		Waiting time	500 nsec
		Overall data transfer speed	Maximum 5.12 GB/sec
	Capacity of main memory system		Total 11 GB
	Capacity of integrated disk		Total 170 GB
	Control workstation		RS/6000
Disk alley system (IBM 7135-110 alley disk)	Capacity		Total 180 GB
	Transfer speed (SCSI)		20 MB/sec.
Digital mass-storage system (SONY DMS-24 DIR-1000L)	Capacity		30 GB× 48
Network and data communication facility	Dedicated high-speed digital channel (for NASDA)		512 Kbps HSD: High super digital (NTT)
	Digital communication network		INS-64 2B+D (NTT)
	Internet		1.5 Mbps
Validation and analysis server (Sun SPARC server 1000)	CPU		4 CPU
	Capacity of main memory		256 MB
	Capacity of integrated disk		20 GB
Other than the above, Sun SPARC stations, IBM RS/6000, Macintosh, IBM PC and printers are installed for the control console system and workstations for verification and analysis work, and diagnosis of processed data			

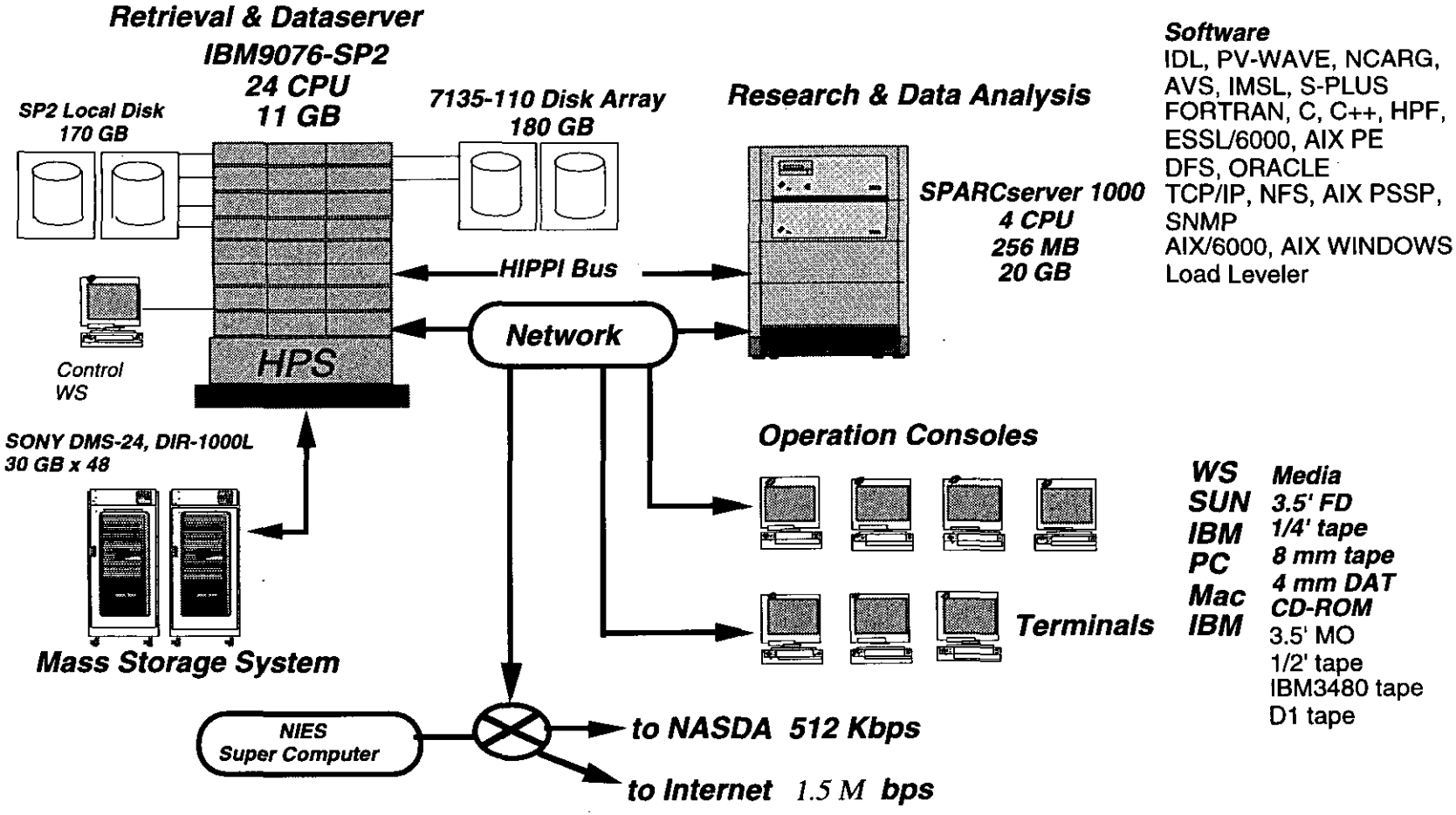
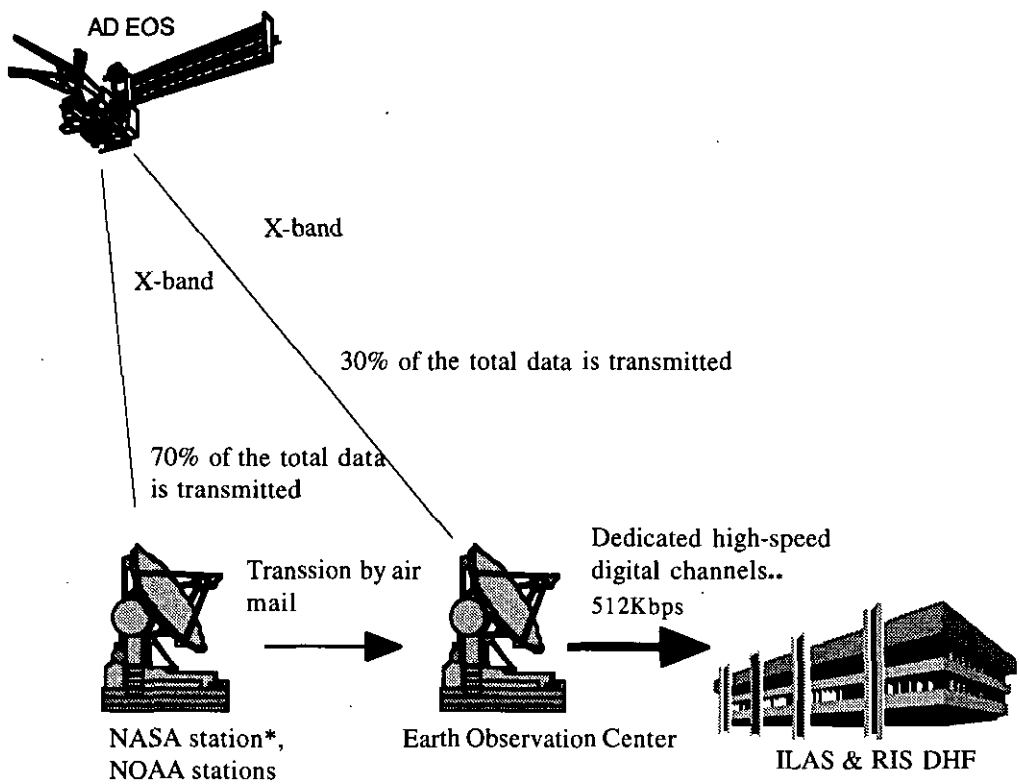


Figure 2.1-2 Configuration of Computer system for ILAS&RIS Data Handling Facility

2.2 Reception and record of ILAS data

The data observed by ILAS are transmitted in the X-band through the mission data processing system and the communication and data processing system on the ADEOS to the Earth Observation Center of NASDA, overseas receiving ground stations and the NASA stations. The data transmitted to these ground stations are collected at the Earth Observation Center and become ILAS level 0 data with the information on the satellite position added. DHF receives these level 0 data from the Earth Observation Center through dedicated channels. The reception routes are as shown in Fig. 2.2-1.



[Hirotomo1]

Fig. 2.2-1 Routes of receiving mission data from ADEOS to DHF

* The data received by the overseas ground stations become available within 11 days.

** In case of a trouble with the channels, the data are obtained from back-up media (D-1 M cartridges).

2.2.1 ILAS observation data reception

DHF obtains the data observed by ILAS from the Earth Observation Center of NASDA using dedicated high speed digital channels (512 Kbps). The data obtained by DHF include level 0 data containing ILAS data edited in time series and verified satellite orbit data, and level 0' data containing estimated orbit data on the data received by the Earth Observation Center. The data acquisition is twice a week for the level 0 data and every day for the level 0' data. The time delay from the observation on board the spacecraft to the data acquisition by DHF is a maximum of 24 hours for the level 0' data and maximum of 11 days for the level 0 data.

The interface between the Earth Observation Center and DHF is carried by e-mail to announce completion of data preparation and data acceptance, and real data acquisition by ftp. Fig. 2.2-2 shows the data handling procedures.

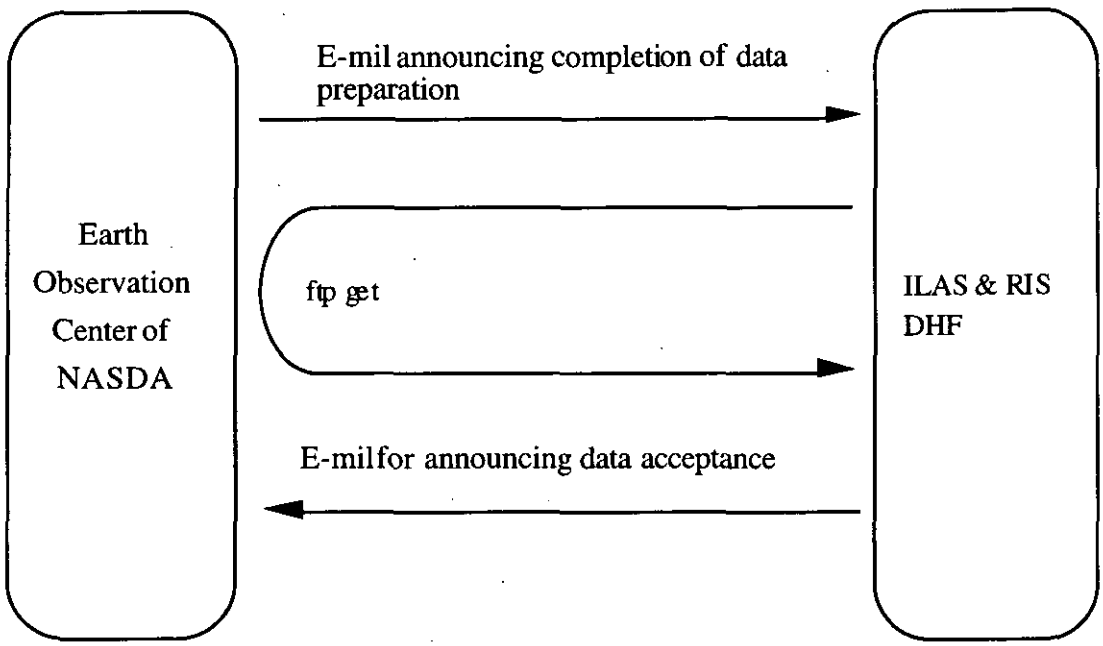


Fig. 2.2-2 Handling of ILAS observation data

2.2.2 Recording of ILAS observation data

The date of ILAS data reception, the state of reception and quality are all recorded and controlled as the reception list and results of the reception together with the ILAS observation data. The information that is recorded is shown in Table 2.2-1.

Table 2.2-1 Information recorded on ILAS observation data

Recording items	Notes
E-mail of completing preparation	E-mail itself; date and time of reception
Records on ILAS data reception	Name of data; time of commencing and completing ftp; Result of ftp
E-mail of completing acceptance	E-mail itself; e-mailing date and time
Date and time of ILAS observation	Date and time of commencing and completing measurement; RSP for commencing and completing observation; date and time of making tape; data and time of making file; effective time of commencing and completing level 0
Data on platform position	Data on flying orbit at one-minute intervals
Data on related devices	Date and time of commencing and completing data reception; type of X-band; receiving mode; receiving station; operational mode; information on errors in the time, etc.
QQC	Number of minor flame synchronization errors; level 0 data conversion ratio; missing ratio
Signal data	ILAS observation data; PCD data

2.3 ILAS Data Processing

2.3.1 Types of the ILAS Data of Standard Processing

Level 0 data, the data observed by the ILAS sensors, are processed after being transmitted from the Earth Observation Center to the ILAS & RIS Data Handling Facility. The processed data are classified into level 0a, level 0b, level 1 and level 2 by the respective processing stages. The ILAS observation data with estimated values stored as data on the orbit of the spacecraft are also sent to the facility as level 0' data (the orbit data of level 0 are definitive values). Level 0' data, exactly the same as level 0 data except the orbit data of estimated values, are preliminarily processed and used to determine the qualities earlier. Level 1' and level 2' data derived from the level 0' data are only for internal use. The types of data produced by ILAS processing are listed in Table 2.3-1. Of the ILAS processed data, level 1 data and level 2 data which can be provided to users are designated as ILAS Data of Standard Processing.

Table 2.3-1 Types of Data of ILAS Processing

Data type	Contents	Notes
Level 0 data*	ILAS observation data provided by the Earth Observation Center of NASDA (the orbit data are definitive values)	Level 0' has estimated values as the orbit data.
Level 0a data	Data parts extracted from level 0 data: 0% signal; 100% signal; atmospheric transmittance signal, necessary for later processing	Level 0a' has estimated values as the orbit data.
Level 0b data	Data after abnormal values and missing values are processed	Level 0b' has estimated values as the orbit data.
Level 1 data	Data after the relative brightness voltage is corrected (i.e. the processing to derive pseudo-transmittance by correcting drifts of respective channels and normalizing the atmospheric transmittance signals with 100% signal)	Level 1' has estimated values as the orbit data.
Level 2 data	Data on the results of retrieval processing (Vertical profile of atmospheric trace constituents including O_3、HNO_3、NO_2、N_2O、CH_4、H_2O、CFC-11、CFC-12、and N_2O_5, temperature, atmospheric pressure, aerosol extinction coefficients (visible: 1ch and IR: 4ch), and their measurement errors)	Level 2' has estimated values as the orbit data.

*)Level 0 and Level 0' data are provided by the Earth Observation Center of NASDA, and are not processed at the ILAS & RIS Data Handling Facility.(2-11)

2.3.2 Overview of Data Processing

Level 0 data, the data measured by the ILAS sensors and sent from the Earth Observation Center of NASDA, are processed by processing subsystems at the ILAS & RIS Data Handling Facility. The data processing procedure roughly consists of preliminary processing, level 0 to 1 processing, and level 1 to 2 processing. The preliminary processing includes processing to compute table data necessary for level 0 to level 1 processing and level 1 to 2 processing, and setting conditions for computation.

The stage of level 0 to 1 processing includes extraction of useful data from the observed data, processing of abnormal values and missing values, data drift in efficiency of sensor response to the light corrections and relative brightness voltage corrections to obtain values of pseudo-transmittance (level 1 data) that are relative values, and calculation to retrieve the observation position that was made from data on the position of the spacecraft. The stage of level 1 to 2 processing produces level 2 data, i.e. data on the vertical profiles of gaseous concentration of atmospheric trace constituents such as ozone, temperature, atmospheric pressure, and aerosol extinction coefficients. The functional configuration is shown in Figs. 2.3-1 and Table 2.3-2.

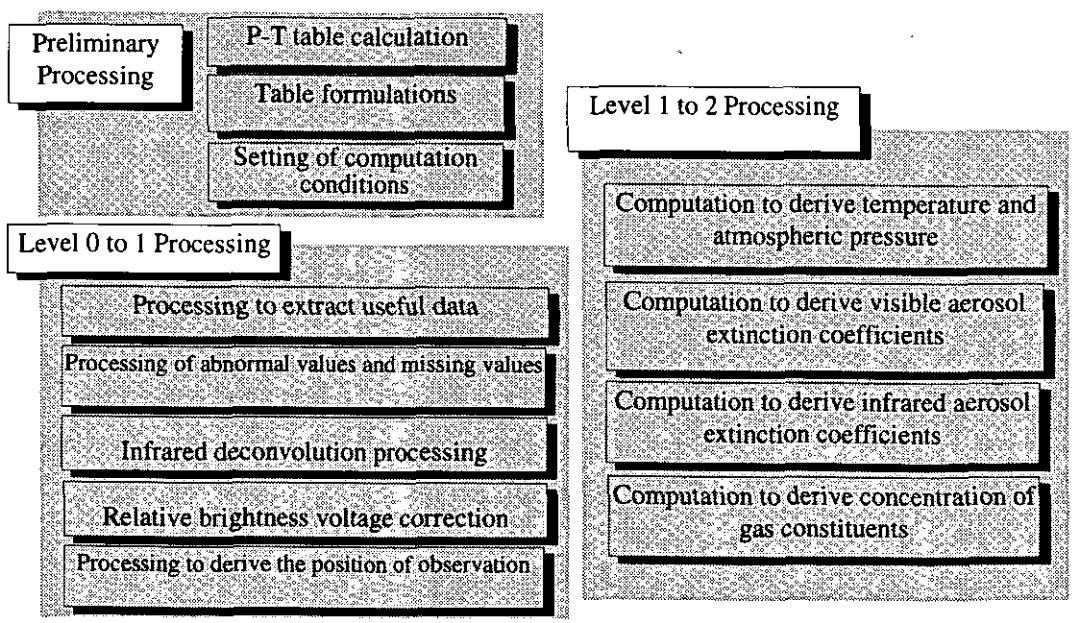


Fig. 2.3-1 Functional Structure of ILAS Data Processing

Table 2.3-2 Functional Structure of ILAS Data Processing

Function		Contents
Preliminary processing function	Function to compute and edit P-T tables	Function to produce and edit P-T tables for high-speed retrieval of absorption coefficients (cross-sectional values) of respective gases by interpolation
	Function to formulate and edit various types of tables	Function to produce and edit tables for element's device function, time series response function of the infrared lock-in amp., and the solar light source
	Function to set computation conditions	Function to set computation conditions for processing and to arrange P-T tables properly for parallel distributed processing
Function of level 0 to 1 processing	Function to extract useful data	Extracts data parts (0% signal, 100% signal, and atmospheric transmission signal) from level 0 data for data processing thereafter, and produces level 0a data.
	Function to process abnormal values and missing values	Produces level 0b data by detecting abnormal and missing data, and correcting and restoring them by interpolation
	Function of infrared channel/band data deconvolution	Removes the effects of overlapping signal components of the past due to the lock-in amp. from the data on infrared channels by deconvolution.
	Function to correct relative brightness voltage	Corrects drifts of level 0b data and converts them into relative values (pseudo-transmission ratio) with 0% signals and 100% signals, and produces level 1data.
	Function to compute positions of observation	Derives the observation points of ILAS (longitude, latitude, and tangent height) of ILAS from data on spacecraft position and by computing the solar position.
Function of level 1 to 2 processing	Function to compute temperature, and atmospheric pressure	Derives the vertical profiles of temperatures and atmospheric pressures by retrieving theoretical values of observation based on the absorption by oxygen molecules, and then computing the convergence by the non-linear least squares method with level 1 data on the visible channel.
	Function to compute visible aerosol extinction coefficients	Computes vertical profiles of aerosol extinction coefficients in the visible band with the Rayleigh scattering deducted, using data on the 0.78 μm elements of visible channel level 1 data.
	Function to compute infrared aerosol extinction coefficients	Derives aerosol extinction coefficients that correspond to 4 windows respectively from data on the 4 window channels (data on the elements with less gas absorption) in infrared channel level 1 data, and then estimates the aerosol extinction coefficients of all the infrared elements by estimating aerosol parameters from the above values.
	Function to compute concentration of gas constituents	Derives modified values of concentration of gas constituents by the non-linear least squares method, that may fit the spectra of infrared channel level 1 data to their theoretical values and make the residual sum of squares smaller. Iterates the derivation until the values converge, to obtain vertical profiles of atmospheric trace constituents. (O_3, HNO_3, NO_2, N_2O, CH_4, H_2O, CFC-11, CFC-12, N_2O_5)

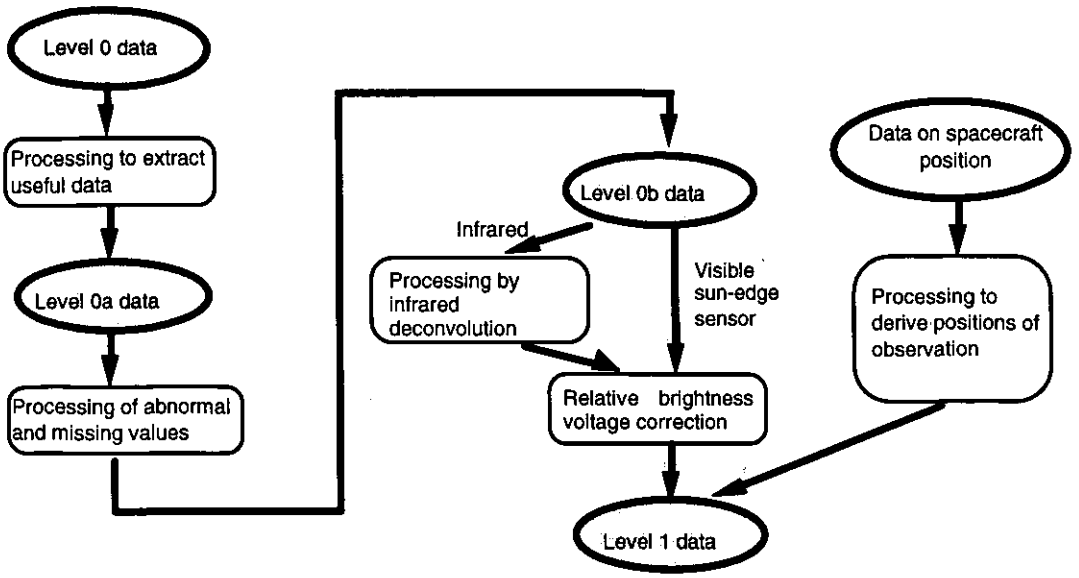


Fig. 2.3-2 Flow of level 0 to 1 processing

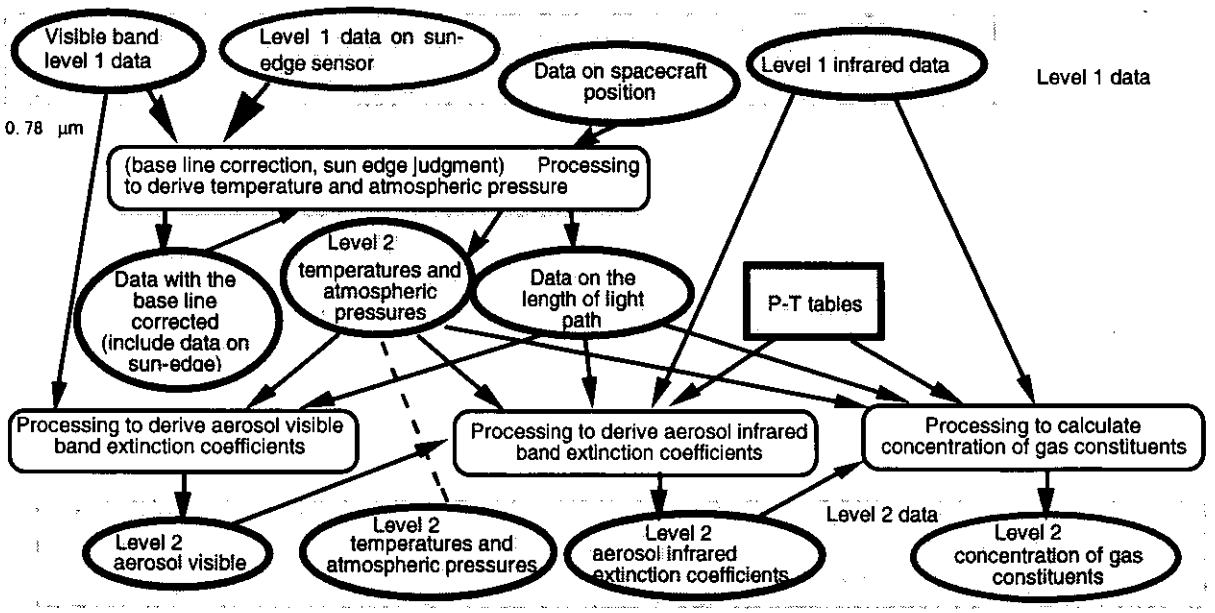


Fig. 2.3-3 Flow of level 1 to 2 processing

(1) Preliminary Processing

a. Calculation and Editing of P-T Tables

To compute cross-sectional values (absorption coefficients), many calculations are necessary, for example, retrieval of absorption shapes of a hundred and tens of thousands of absorption lines one by one and their addition must be made. In the routine processing, these are conducted at high speed by interpolation calculation using P-T tables computed in advance. These tables used for the interpolatory calculation are called P-T tables, as they are products of preliminary computations for acceptable atmospheric pressure (P) and temperature (T) (function of P and T).

b. Formulation and Editing of Various Tables

This processing produces and edits tables for the device function of respective elements of visible and infrared channels, for infrared band time series response functions, and for visible and infrared band solar illuminance.

c. Setting of Computation Conditions

This processing sets the conditional parameters for calculation, and allocates tables to establish the environment for distributed parallel processing.

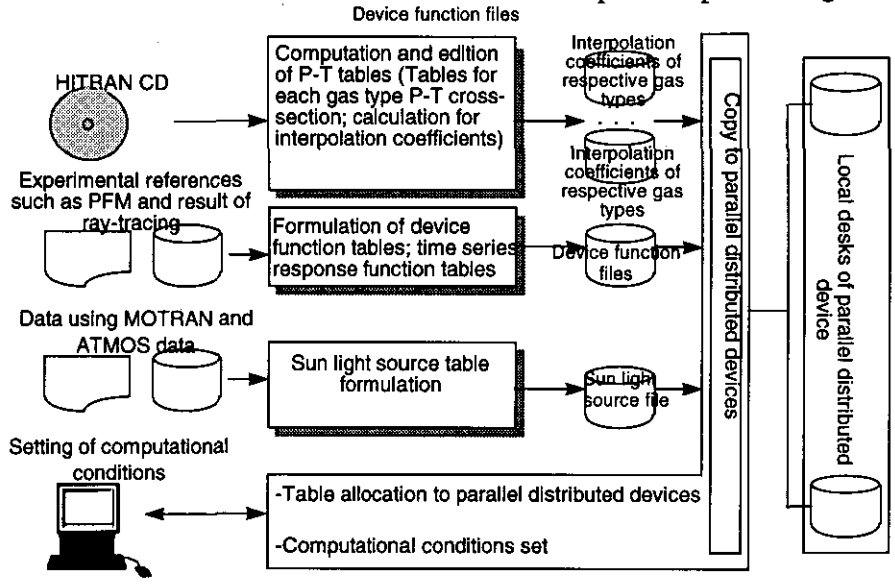


Fig. 2.3.-4 Overview of preliminary processing

(2) Level 0 to 1 Processing

This stage conducts calibration processing to ILAS level 0 data sent from the Earth Observation Center of NASDA, such as correction of abnormal and missing values, and drifts to produce level 1 data, which are the pseudo-data on the light transmitted through the atmosphere.

a. Processing to Extract Useful Data Parts

This processing produces level 0a data by extracting the data parts necessary for the subsequent processing. The extracted data parts are the following; the contents of the data is checked and the time of observation is computed at the same time.

- 0% signal section: Observed values necessary to estimate 0% values of the observed data and the drift line (Data on the light from dark space measured outside the atmospheric sphere and the data inside the ILAS casing)
- Atmospheric transmittance signal section: Values observed on the light transmitted through the atmosphere
- 100% signal section: The value observed at the time of direct observation of the sunlight source outside the atmosphere. This value is used to estimate the drift line for 100% values and to convert the observed values into (pseudo) transmittance.

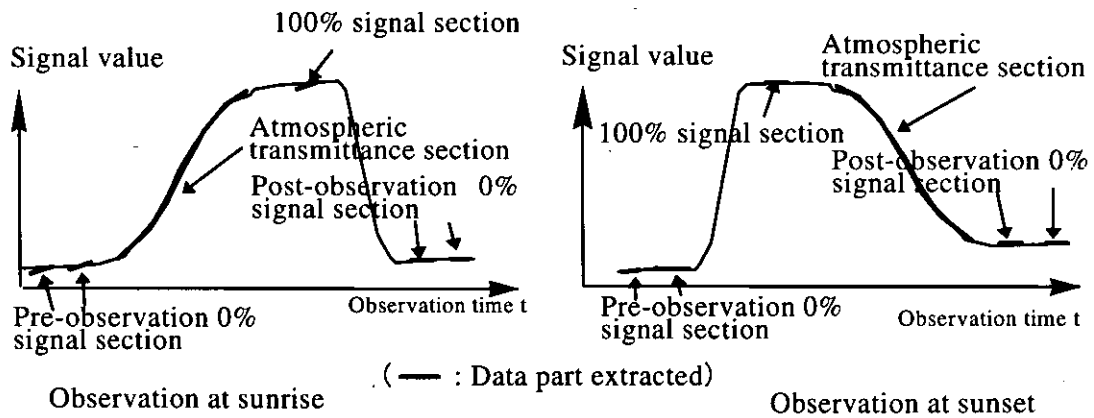


Fig. 2.3-5 Data Parts Extracted in the Processing to Extract Useful Data Parts

b. Processing of Abnormal and Missing Values

This processing produces level 0b data by judging abnormal and missing values, and assigning the respective element data the results of judgment in the form of a result flag. The data are restored within a set range by time serial interpolation.

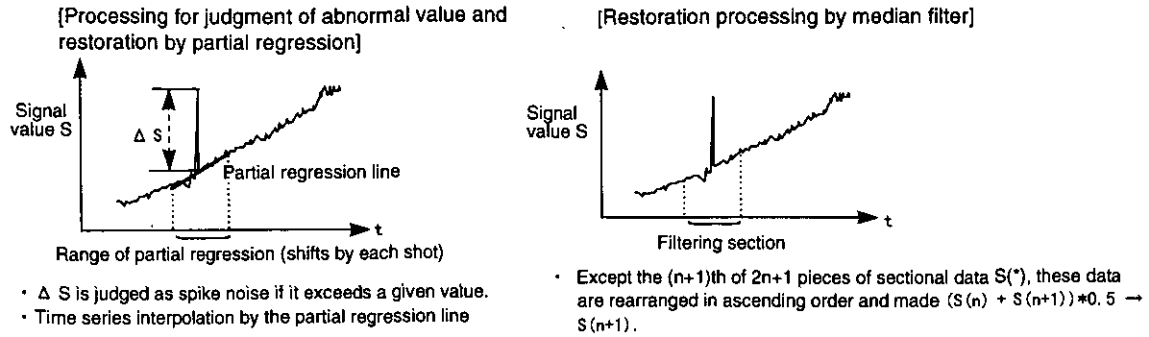


Fig. 2.3-6 Example of Abnormal Value Judgment and Restoration Processing in the Abnormal and Missing Values Processing

Table 2.3-3 Contents of Result Flags

Result flag (1byte[1]) bit position[2]	Meaning of bit	Content assigned
0th bit	Presence of parity error and fixed bit error	If a value has a parity error or does not agree with the given bit pattern, sets the bit to 1. If not, sets the bit to 0.
1st bit	Presence of error in checking with critical value	Critical value is the value beyond which no value is possible due to the constitution of the sensor. If a value exceed the limit, it sets the bit to 1. If not, sets the bit to 0.
2nd bit	Result of spike noise judgment	If a value is judged as spike noise by abnormal value judgment, it sets the bit to 1. If not, sets the bit to 0.
3rd bit	Result of missing value judgment	If a missing value is present, sets the bit to 1. If not, sets the bit to 0. The causes of missing value include errors with addressing of level 0 data memories, and TopSync. and EndSync. errors.
4th bit	Presence of restoration by interpolation or correction	If any restoration is carried out such as interpolation by the abnormal and missing values processing or abnormal value correction, sets the bit to 1, . If not, sets the bit to 0.
5th bit	Reserved	
7th bit	Reserved	
7th bit	Reserved	

Note 1: The result flag is allocated one byte for the data on each element of respective channels (visible band, infrared band, and sun-edge sensors).

Note 2: Regarding the bit positioning in one byte, bit position on the 2^0 digit is set in the 0th bit.

c. Infrared channel/band data deconvolution Processing

The data on the infrared channels with abnormal and missing values processed are deconvolution processed to remove time series integral effects of the sensor output signal caused by the lock-in amplifier in the ILAS sensor, and reproduce the instantaneous values.

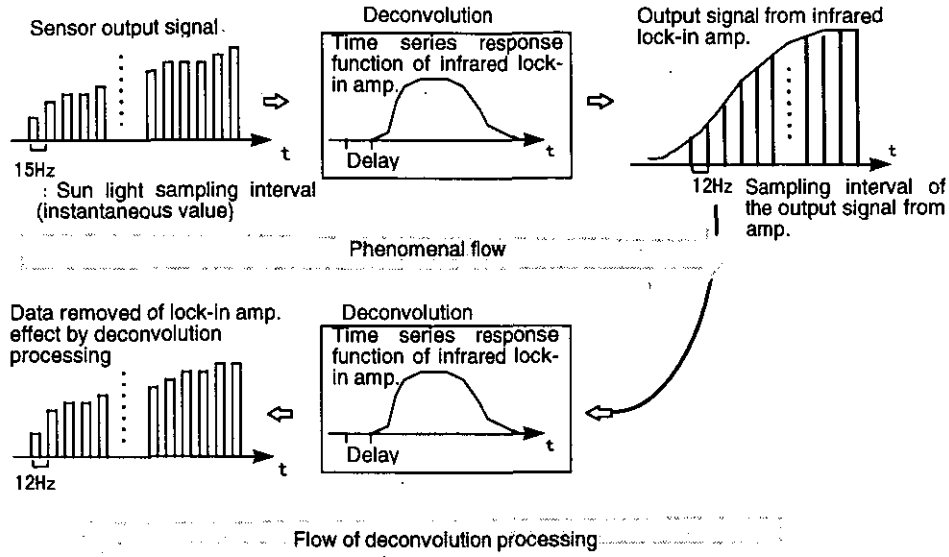
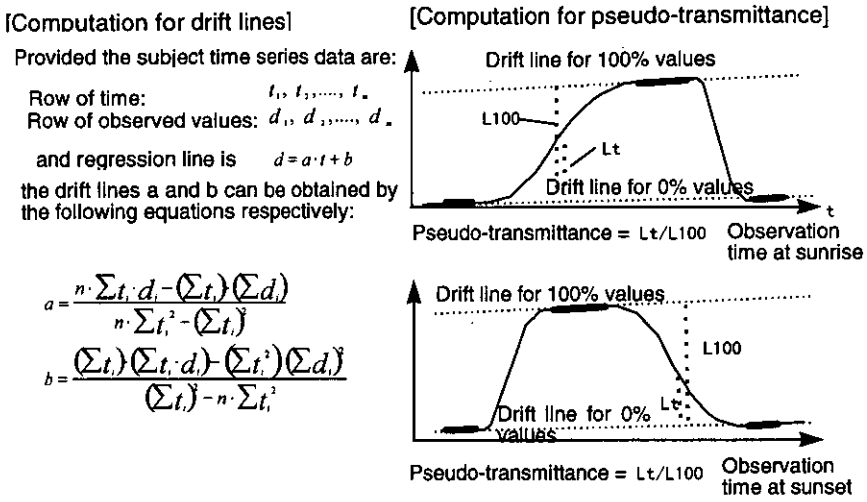


Fig. 2.3-7 Conceptual schematic illustration of infrared channel/band data deconvolution processing

d. Processing to Correct Relative Brightness Voltages

This processing corrects the drifts of 0% and 100% values of the observation data with abnormal and missing values processed (data processed by deconvolution for level 0b data and infrared channel). The correction method is as follows: first it derives the drift line of 0% values from the data of 0% values observed at two positions before and after sunlight observation, next, the drift line of 100% values by extrapolating it with the data of 100% values observed; and then produces level 1 data by computing the relative brightness voltage, i.e. pseudo transmittance, by normalizing the output values of the elements with the drift of 0% values corrected, and with the 100% values with the drift of 0% values corrected. Drift lines of 0% values and 100% values respectively used for the drift corrections are derived by computing the regression lines for each element in respective channels (visible, infrared, and sun-edge sensors) using time series observation data. The slope a and the intercept b of these regression lines are designated as "drift coefficients" and stored as a part of level 1 data.

Fig. 2.3-8 Overview of relative brightness voltage correction processing



e. Processing To Calculate the Positions for Observation

This processing computes the tangent heights of respective ILAS observations and the positions on the terrestrial surface, i.e., latitudes and longitudes. The tangent heights of respective observations, not obtainable at this stage because of the necessity of taking into account the refraction dependent on the temperatures and pressures of different atmospheric layers, are derived by computing the refraction with standard atmospheric models and data of climatic values. The definitive values are derived in computing temperatures and atmospheric pressures of the Level 1 to 2 Processing. The computations for the positions of observation are conducted as follows:

- Calculation for the spacecraft position: To derive the spacecraft position at the time of each observation from the data on the orbit.
- Calculation for the solar position: To derive the solar position at the time of each observation.
- Calculation for observation point: To obtain the observation point by taking into account atmospheric refraction of the light path due to respective positions of the spacecraft, the sun, and the earth.
- Calculation for eclipse: Calculate the possibility of eclipse from the positions of the spacecraft and the sun to check the subsequent influence.

(3) Level 1 to 2 Processing

This stage computes the altitude profiles of temperatures and atmospheric pressure and visible aerosol extinction coefficients using data on the visible channels from level 1 data produced by the level 0 to 1 processing, and then the altitude profiles of the concentration of infrared aerosol extinction coefficients using data on the infrared channel, and of the concentration of gas constituents such as ozone.

a. Processing to derive computing temperatures and atmospheric pressures

This processing computes the altitude profiles of atmospheric temperatures and pressures using level 1 data on the visible channel. The computation procedure is as follows (see Fig. 2.3-10):

・Establishment and correction of base line

This stage establishes the base line that shows the parts attributable to Rayleigh scattering and Mie scattering, and to the Wulfband of ozone, from the curve of spectral distribution on the element axis of level 1 data on the visible channel, and then corrects the level 1 data to have the base line be the 100% value of the transmittance. The corrected pseudo-transmittance data obtained here are compared for spectral fitting.

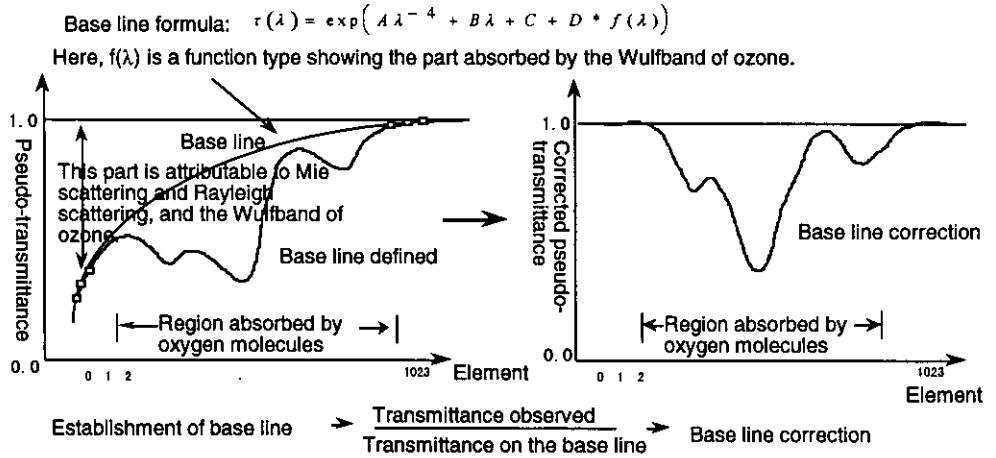


Fig. 2.3-9 Establishment of Base Line and Processing for Correction

・Computation for Atmospheric Temperatures and Pressures

The light absorptions by oxygen molecules are calculated line by line giving an optimal initial value for temperature and pressure of respective atmospheric layers, and then the transmittance by theoretical calculation taking into account the influences of the expanding field of view and the device function. The length of light path necessary for the calculation is derived from data on the spacecraft position and the position of IFOV (instantaneous field of view) derived from the data on the solar edge sensor taking into account atmospheric refraction of light.

The theoretical transmittance is spectro-fitted to the corrected pseudo-transmittance, and the fitting is iterated correcting the temperature and atmospheric pressure closer to the real values by the non-linear least squares method and recomputing the theoretical transmittance. This iteration for convergence is conducted

for each of the layers by the onion-peeling approach, establishing the values of temperature and atmospheric pressure one by one from the upper layer to the lower.

- Computation for Definitive Value of the Observation Position

This process computes the definitive value of the position at which observation was made by calculating the light path taking into account atmospheric refraction retrieved from the atmospheric temperatures and pressures obtained.

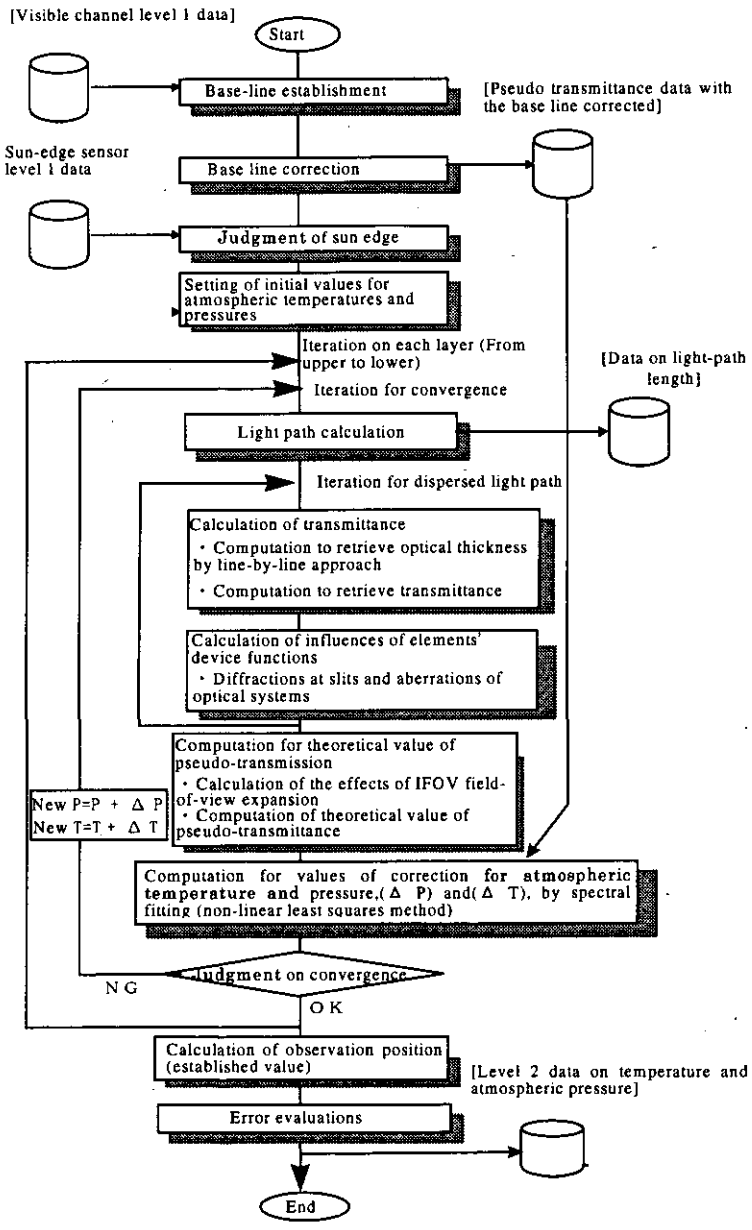


Fig. 2.3-10 Flow of Processing for Computing Temperatures and Atmospheric Pressures

b. Processing for Computing Visible Aerosol Extinction Coefficients

Of the visible channel level 1 data (observed transmittance), the visible aerosol extinction coefficient is computed using the value of the element having the wavelength of 0.78μm that is not affected by the absorption by a gas such as oxygen molecules. The part attributable to the Wulfband absorption of ozone obtained by the processing for base line establishment and correction in the Processing for Atmospheric Temperature and Pressure is removed prior to the computation.

This processing for computing aerosol extinction coefficients adopts the approach of dividing atmospheric layers into groups by the altitude and computing the extinction coefficients within the same group all together as a lump. The extinction coefficients of each layer in a group are derived by calculating the theoretical values taking into account the field-of-view expansion by assuming the extinction coefficients and iterating the convergence calculation to modify the extinction coefficients by the non-linear least squares method to have them fit the level 1 data. Of the extinction coefficients, the part attributable to the Rayleigh scattering by major atmospheric constituents is computed with model formulae from the values of temperatures and atmospheric pressures already obtained, and the remaining part is computed as attributable to aerosols (Mie scattering). These are treated as the visible aerosol extinction coefficients.

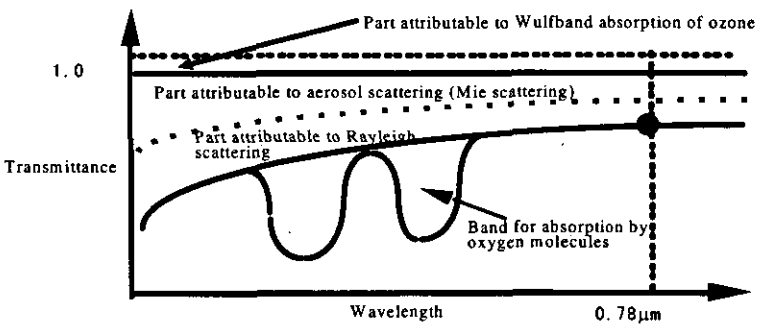


Fig. 2.3-11 Contribution of Aerosol Scattering to the Transmittance of Visible Channel

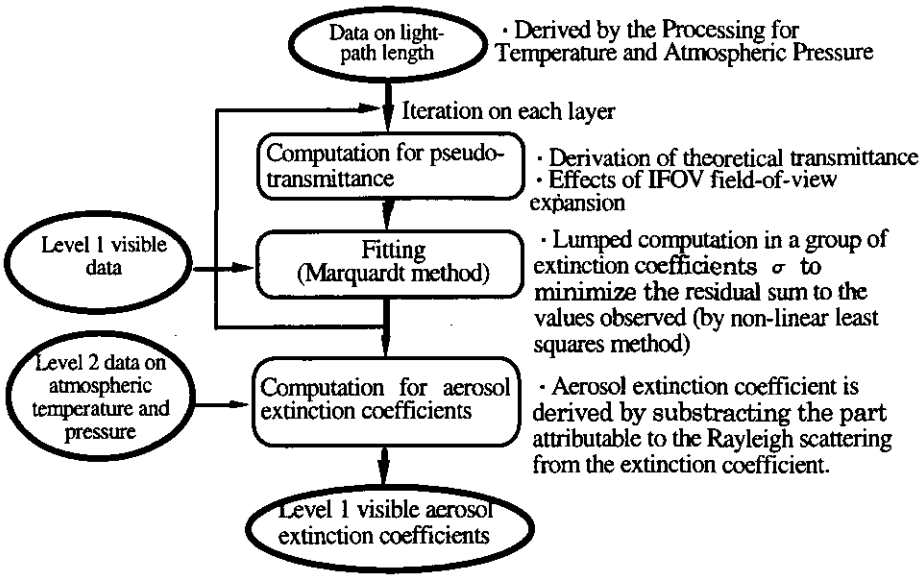


Fig. 2.3-12 Flow of Processing for Computing Visible Aerosol Extinction Coefficients

c. Processing for Computing Infrared Aerosol Extinction Coefficient

This process computes the altitude profiles of infrared aerosol extinction coefficients at 4 points in the band, i.e. 7.1 μm, 8.27 μm, 10.60 μm, and 11.76 μm, which are the window region of aerosol (the channel where absorptions by other gases or estimation error of absorption are small). The aerosol extinction coefficients over the whole range of the infrared channels are then estimated by extracting aerosol parameters (type of aerosol, number densities of particles, size distributions, and weight ratio of sulfuric acid) from the obtained extinction coefficients at the 4 wavenumber points and the visible aerosol extinction coefficients of the visible (0.78 μm) channel (b). These are used to remove the part attributable to aerosols in the Processing for Computing Concentration of Gas Constituents (d).

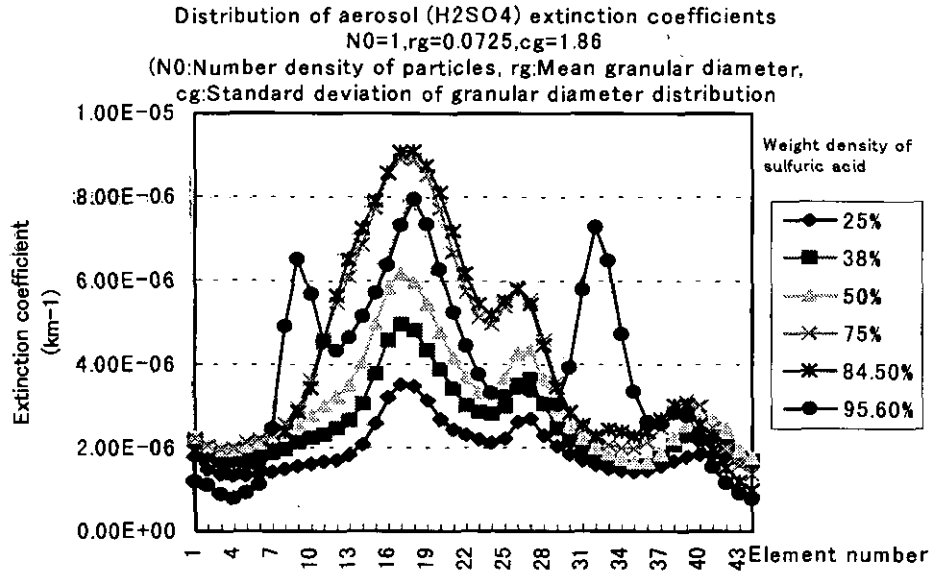


Fig. 2.3-13 Example of aerosol extinction coefficient estimations in infrared channels

d. Processing for Computing Concentration of Gas Constituents

The concentrations (volume mixing ratios) of respective gas constituents in atmospheric layers are determine by spectral fitting by the non-linear least squares method using the level 1 data on the infrared channel and the data on temperatures and atmospheric pressures obtained by the Processing for Computing Atmospheric Temperatures and Pressures (a). The fitting is conducted on the theoretical values, that are the pseudo-transmission derived by simulating the infrared level 1 data and the observed level 1 data. The procedure for the main processings is as follows. The processing flow is shown in Fig. 2.3-14.

- Calculation of Cross-sectional Value

  The cross-sectional area of absorption (cross-sectional value) is derived by computing the interpolation from P-T tables.

- Computation of the Light-path Length

  The data on the length of light-path obtained by the Processing for Computing Atmospheric Temperatures and Pressures (a) are used here.

- Theoretical Calculation of Pseudo-transmittance

  Based on assumed concentrations of respective gas constituents, the transmittance is computed, and then the theoretical values of the level 1 data on the infrared channels, that are pseudo-transmittance values, using cross-sectional values and taking into account the influences of the infrared aerosol extinction

coefficients (obtained in (c)), IFOV field-of-view expansion, device functions, and the cross-talk effects which are the interactions between elements, and so forth.

- Fitting

  Theoretical values of the pseudo-transmittance and the observed level 1 data on the infrared channels are spectro-fitted, and the concentration of each gas constituent is then modified using the non-linear least squares approach. The computation of theoretical values and fitting are further iterated using the modified values.

- Computation for the Concentration of Gas Constituent

  The concentrations of respective gas constituents in the atmospheric layer, subjected to computation, are derived by iterating the above computation and fitting until they meet the judgment criteria. This iteration for convergence is conducted for each atmospheric layer using the onion-peeling approach of defining the gas concentration one by one from the upper layer to the lower.

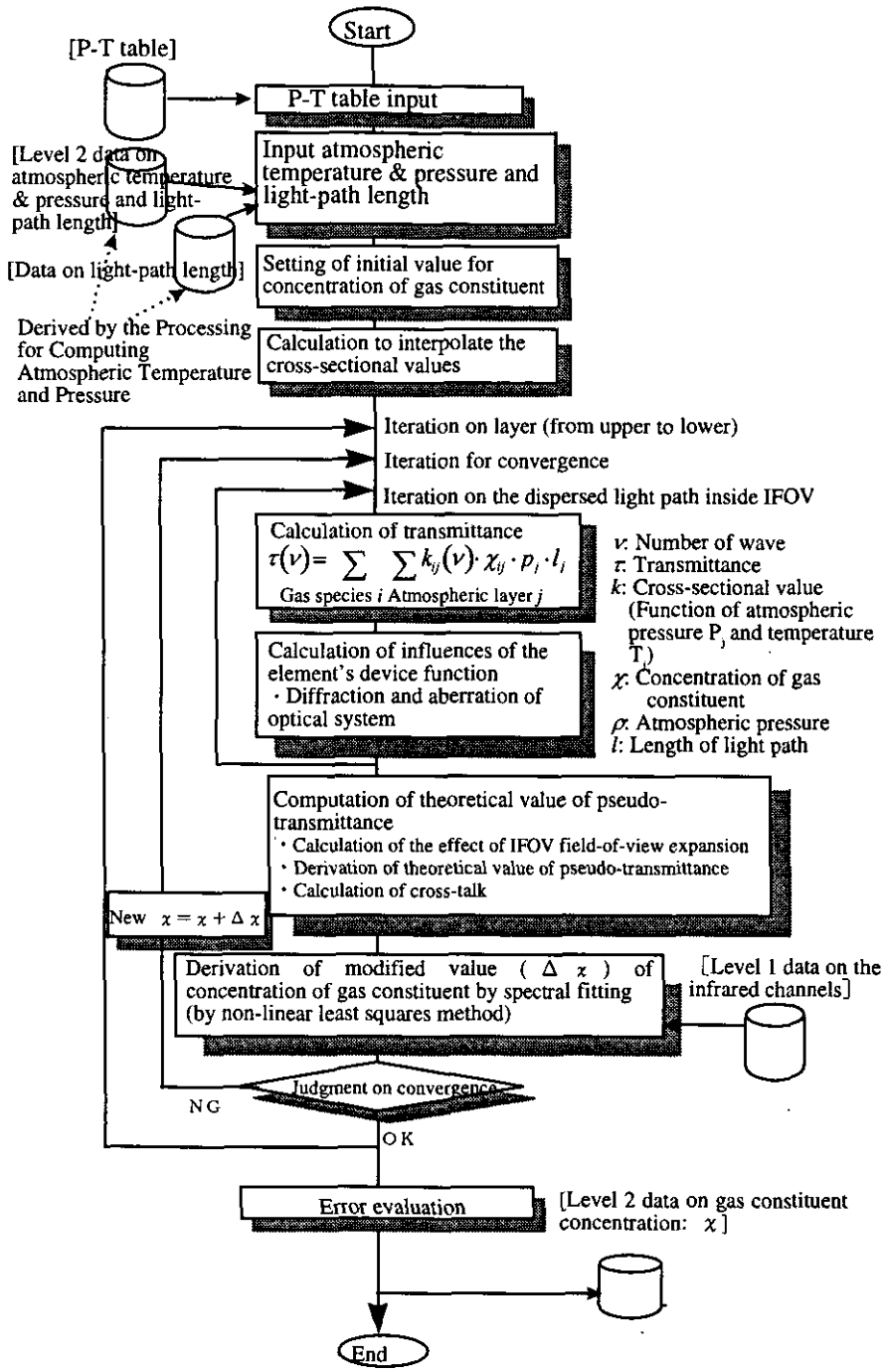


Fig. 2.3-14 Flow of Processing for Computing Concentration of Gas Constituent

2.3.3 Accuracy of Data

The estimated values of level 2 data produced by ILAS data processing are shown in Table 2.3-4. The figures in the table are values estimated by simulation.

Table 2.3-4 Accuracy of estimation with ILAS level 2 data

Parameter \ Altitude	10 km	20 km	30 km	40 km	50 km
O_3	±5%	±3%	±4%	±5%	±10%
HNO_3	±10%	±3%	±15%	N.D.	N.D.
NO_2	N.D.	±25%	±60%	N.D.	N.D.
N_2O	±2%	±4%	±40%	N.D.	N.D.
CH_4	±3%	±5%	±10%	±50%	±100%
H_2O	±2%	±3%	±5%	±10%	±50%
CFC-11	±5%	±20%	N.D.	N.D.	N.D.
CFC-12	(TBD)	(TBD)	(TBD)	(TBD)	(TBD)
N_2O_5	(TBD)	(TBD)	(TBD)	(TBD)	(TBD)
Aerosol extinction coefficient (Visible: 1 ch. Infrared: 4 ch.)	(TBD)	(TBD)	(TBD)	(TBD)	(TBD)
Temperature	±1 K	±1 K	±1 K	±1 K	±3 K
Atmospheric pressure	±0.5%	±0.5%	±0.5%	±0.5%	±2%

Note 1) Influences of aerosols in the infrared band are excluded.

Note 2) The values of temperature and atmospheric pressure are estimated from the accuracy of the devices, and not of the simulation.

Note 3) ND shows the error exceeding 100% or no possibility of obtaining an estimated value of convergence due to weak absorption signal of the atmospheric constituent or overlapping with signals of stronger absorption by other gases.

2.4 Evaluation and Analysis

2.4.1 Overview of Evaluation and Analysis

The evaluation and analysis of ILAS data consist of two parts, that which is done mechanically and automatically, and that done by specialists from the geophysical point of view. Even for the evaluation done mechanically and automatically, the criteria may vary as a result of further research and verification experiments.

The Evaluation and analysis consist of the following four steps:

Table 2.4-1 Outline of Evaluation and Analysis Steps

Evaluation step	Notes
STEP 1	<Mechanical and automatic evaluation of data quality> Automatic evaluation by software→Quality parameters ・Periodical reports from operators
STEP 2	<Trend evaluation of 0% and 100% values of level 1 data and noise evaluation > ・Periodical tasks of data analysis by operation SE
STEP 3	<Evaluation of level 2 convergence error> ・Automatic calculation of convergence error by software <Comparison between level 2 data and the atmospheric model for data quality evaluation> ・Automatic warning by software
STEP 4	<Studies of STEP 1 - 4> ・Project leader summons a meeting of project staffs upon necessity. ・Preparation of necessary correlation diagrams and time series variation diagrams by operation SE <Geophysical evaluation of level 2 data> ・Periodical reporting of the evaluation results on STEP 1-3 (From the project leader to the chief in charge of data quality evaluation) ・Preparation of necessary reference materials by operation SE (Execution of fixed form of works possible of automatic drawing, requested by the chief in charge of data quality evaluation) ・General evaluation of data quality by the chief in charge of data quality evaluation ・Final evaluation of data quality (the project leader)

Data quality is analyzed for evaluation by the following personnel in order of the steps.

Table 2.4-2 Evaluation and Analysis Procedure

	STEP 1	STEP 2	STEP 3	STEP 4	
				Studies on STEP 1-3 (meeting of project staffs)	Geophysical evaluation
Operator (OP)	○	Instruction	○	Preparation, Report	
Operation SE	Periodical reporting	○ ○		○ ○	
DHF operation controller	⊙	Periodical reporting	⊙		
DHF Manager	⊙		⊙ Periodical reporting (every day)	Suggestion	Periodical reporting, summon meeting
Project staffs		⊙ ⊙		⊙ ⊙ Summon meeting	
Project leader	⊙	⊙	⊙	⊙	○ ○
Chief of the group in charge of data quality evaluation					⊙ ○ Report

Although the data are derived from the same observation data, the results of the analysis for data quality evaluation are subject to alteration depending on the progress of subsequent research and results of later observation. The latest results of data quality evaluation are provided to users as level 1 or level 2 appendix information.

2.4.2 Information on Errors and Quality

There are various possible reasons for errors. Fig. 2.4.-1 shows the main factors for errors and the relationships. As it is virtually impossible to express information on errors for all those causes in error bars, they are expressed in error bars combining the convergence errors obtained by data processing and others evaluated by simulation. Further, the error and quality information may be updated at the request of the project leader, as extra factors are likely to be newly included due to progress of research and time series analyses of the results of observations. The factors causing error will be included in the comments when data are distributed.

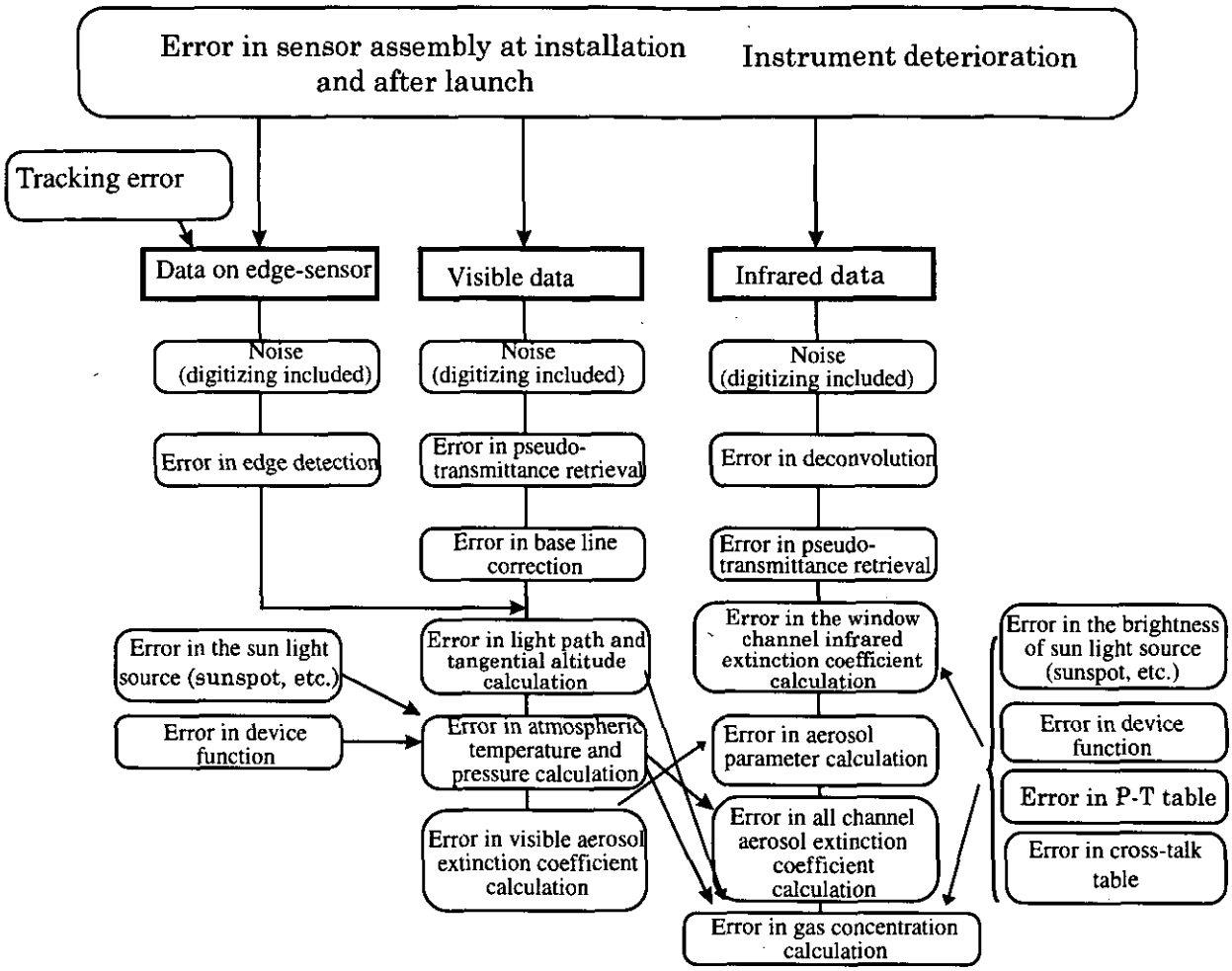


Fig. 2.4-1 Schematic Diagram of Relationship among Error Factors

Error and quality information are presented in the following scheme:

[Error information]

Information on errors is provided to users expressing the value of the standard deviation σ as an error bar separately for the (+) side and (-) side.

[Quality information]

Six comment ranks are set for quality : Good; Fair; Poor; Reject; Uncorrect ; No data

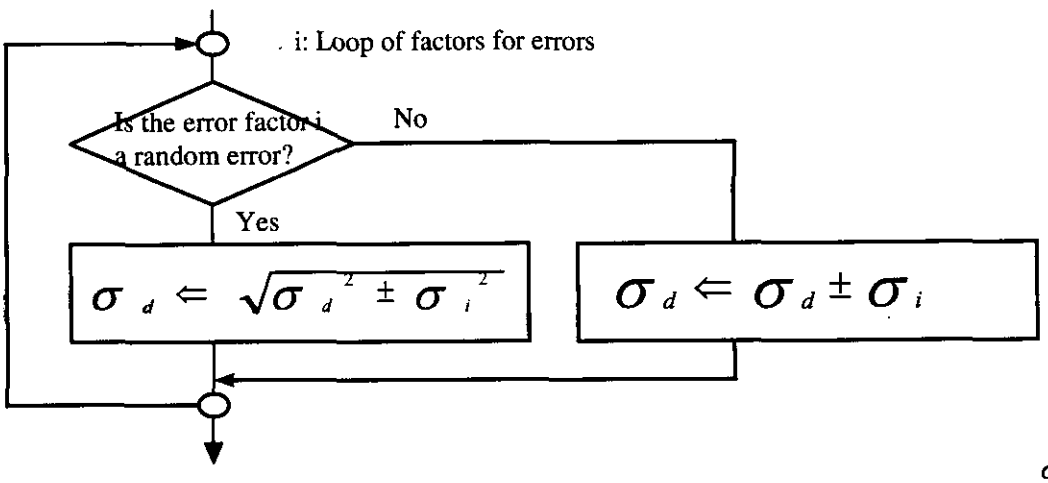
- The comment for level 1 and level 2 data is set from the rate of error occurrence such as missing values and abnormal values.

2.4.3 Method of error analysis

The following types of approach are possible for estimating the magnitude of error due to different error factors.

- Approach for errors which can be estimated mechanically and automatically from the results of experiments and numerical simulations.
- Approach for errors which are estimated by specialists such as project staffs but the estimation criteria can be set by numerical simulations.
- Approach for errors which require estimation by specialists such as the person in charge of data quality evaluation and project staffs.

For errors in the results of retrievals such as atmospheric temperature, atmospheric pressure, aerosol extinction coefficient, and gas concentration, error bars are computed based on the errors in their convergence by the least squares method. Errors include systematic errors and random errors depending on the cause. These are respectively reflected in the error bars by the following procedure:



σ_d: Estimated value of error bar, σ_i: Estimation error of the error factor i

Fig. 2.4-2 Flow of Error Bar Estimation

The error factors having error bars are likely to be renewed at the request of the project leader. Descriptions on error factors are given as comment data when the data are distributed.

2.4.4 Method of Quality Setting

Comments on each of the six ranks of quality (Good, Fair, Poor, Uncorrect, Reject, and No data) are chosen based on the setting method shown in Table 2.4-3. The constants a_{ij} and b_{ij} are the criteria for judging each quality comment. The judgments on respective data qualities are made by evaluating them with the conditions in the table in the order from Good to No data, and the quality that first meets one of the conditions is assigned to the data.

(1) Method of Setting the Quality of Level 1 Data

The quality comment on each level 1 data evaluates the data's validity ratio (ratio of valid data to total number of data) by referring to the values of criteria for judging quality (see Table 2.4-3). However, as to the drift coefficient, the quality comment is evaluated using both the validity ratio and the mean residual sums around the regression line for the drift. For the quality comment on the overall level 1 data set, the lowest quality among the quality comments on individual data is given.

(2) Method of Setting the Quality of Level 2 Data

The Quality comment on level 2 data is set to the same value as the quality comment on the overall level 1 data set (see Table 2.4-3(8)).

(3) Criteria for Judgment of Quality Comment

The criteria for judging the quality comment are decided by the project leader at the meeting of project staffs taking based the analyses of the results of processing and verification experiments.

Table 2.4-3 Method of Setting Quality Comment of Level 1 Data

Data type	Quality comment	Criteria for judging quality comment
(1) Visible channel data (visible pseudo-transmittance) (Evaluated from the top to down, and the quality comment of the part that first satisfies the condition is adopted.) Validity ratio: r_1 Value of criterion for judging validity ratio: r_1 : $a_{1,1} \geqq a_{1,2} \geqq a_{1,3} \geqq a_{1,4}$	Good	$1.0 \geqq r_1 \geqq a_{1,1}$
	Fair	$r_1 \geqq a_{1,2}$
	Poor	$r_1 \geqq a_{1,3}$
	Reject	$r_1 \geqq a_{1,4}$
	Uncorrect	$r_1 > 0$
	No data	$r_1 = 0$
(2) Infrared channel data (infrared pseudo-transmittance) (Evaluated from the top to down, and the quality comment of the part that first satisfies the condition is adopted.) Validity ratio: r, The value of criterion for judging validity ratio: r_2 : $a_{2,1} \geqq a_{2,2} \geqq a_{2,3} \geqq a_{2,4}$	Good	$1.0 \geqq r_2 \geqq a_{2,1}$
	Fair	$r_2 \geqq a_{2,2}$
	Poor	$r_2 \geqq a_{2,3}$
	Reject	$r_2 \geqq a_{2,4}$
	Uncorrect	$r_2 > 0$
	No data	$r_2 = 0$
(3) Sun-edge sensor data (Evaluated from the top to down and the quality comment of the part that first satisfies the condition is adopted.) Validity ratio: r3 The value of criterion for judging validity ratio: r_3 : $a_{3,1} \geqq a_{3,2} \geqq a_{3,3} \geqq a_{3,4}$	Good	$1.0 \geqq r_3 \geqq a_{3,1}$
	Fair	$r_3 \geqq a_{3,2}$
	Poor	$r_3 \geqq a_{3,3}$
	Reject	$r_3 \geqq a_{3,4}$
	Uncorrect	$r_3 > 0$
	No data	$r_3 = 0$

Table 2.4-3 Method of Setting Quality Comment of Level 1 Data (continued)

Data type	Quality comment	Criteria for judging quality comment
(4) Visible drift coefficient (Evaluated from the top to down and the quality comment of the part that first satisfies the condition is adopted.) r_4 : 100% value validity ratio r_5 : 0% value validity ratio z_4 : Mean residual sum with the 100% regression line z_5 : Mean residual sum with the 0% regression line Value of criterion for judging validity ratio : $r_4, r_5 : a_{1,3} \geqq a_{1,4}$ Value of criterion for judging mean residual sum : $z_4 : b_{4,1} \leqq b_{4,2} \leqq b_{4,3} \leqq b_{4,4}$ $z_5 : b_{5,1} \leqq b_{5,2} \leqq b_{5,3} \leqq b_{5,4}$	Good	$(1.0 \geqq r_4 \geqq a_{1,3}$ and $1.0 \geqq r_5 \geqq a_{1,3})$ and $(b_{4,1} > z_4$ and $b_{5,1} > z_5)$
	Fair	$(1.0 \geqq r_4 \geqq a_{1,3}$ and $1.0 \geqq r_5 \geqq a_{1,3})$ and $(b_{4,2} > z_4$ and $b_{5,2} > z_5)$
	Poor	$(1.0 \geqq r_4 \geqq a_{1,3}$ and $1.0 \geqq r_5 \geqq a_{1,3})$ and $(b_{4,3} > z_4$ and $b_{5,3} > z_5)$
	Reject	$(r_4 \geqq a_{1,4}$ and $r_5 \geqq a_{1,4})$ and $(b_{4,4} > z_4$ and $b_{5,4} > z_5)$
	Uncorrect	$(r_4 > 0$ and $r_5 > 0)$ and $(z_4 \geqq b_{4,4}$ or $z_5 \geqq b_{5,4})$
	No data	$r_4 = 0$ or $r_5 = 0$
(5) Infrared drift coefficient (Evaluated from the top to down and the quality comment of the part that first satisfies the condition is adopted.) r_6 : 100% value validity ratio r_7 : 0% value validity ratio z_6 : Mean residual sum with the 100% regression line z_7 : Mean residual sum with the 0% regression line Value of criterion for judging validity ratio : $r_6, r_7 : a_{3,3} \geqq a_{3,4}$ Value of criterion for judging mean residual sum : $z_6 : b_{6.1} \leqq b_{6.2} \leqq b_{6.3} \leqq b_{6.4}$ $z_7 : b_{7.1} \leqq b_{7.2} \leqq b_{7.3} \leqq b_{7.4}$	Good	$(1.0 \geqq r_6 \geqq a_{3,3}$ and $1.0 \geqq r_7 \geqq a_{3,3})$ and $(b_{6,1} > z_6$ and $b_{7,1} > z_7)$
	Fair	$(1.0 \geqq r_6 \geqq a_{3,3}$ and $1.0 \geqq r_7 \geqq a_{3,3})$ and $(b_{6,2} > z_6$ and $b_{7,2} > z_7)$
	Poor	$(1.0 \geqq r_6 \geqq a_{3,3}$ and $1.0 \geqq r_7 \geqq a_{3,3})$ and $(b_{6,3} > z_6$ and $b_{7,3} > z_7)$
	Reject	$(r_6 \geqq a_{3,4}$ and $r_7 \geqq a_{3,4})$ and $(b_{6,4} > z_6$ and $b_{7,4} > z_7)$
	Uncorrect	$(r_6 > 0$ and $r_7 > 0)$ and $(z_6 \geqq b_{6,4}$ or $z_7 \geqq b_{7,4})$
	No data	$r_6 = 0$ or $r_7 = 0$
(6) Sun-edge sensor drift coefficient (Evaluated from the top to down and the quality comment of the part that first satisfies the condition is adopted.) r_8 : 100% value validity ratio r_9 : 0% value validity ratio z_8 : Mean residual sum with the 100% regression line z_9 : 0Mean residual sum with the 0% regression line Value of criterion for judgment of validity ratio: : $r_8, r_9 : a_{3,3} \geqq a_{3,4}$ Value of criterion for judgment of mean residual sum : $z_8 : b_{8,1} \leqq b_{8,2} \leqq b_{8,3} \leqq b_{8,4}$ $z_9 : b_{9,1} \leqq b_{9,2} \leqq b_{9,3} \leqq b_{9,4}$	Good	$(1.0 \geqq r_8 \geqq a_{3,3}$ and $1.0 \geqq r_9 \geqq a_{3,3})$ and $(b_{8,1} > z_8$ and $b_{9,1} > z_9)$
	Fair	$(1.0 \geqq r_8 \geqq a_{3,3}$ and $1.0 \geqq r_9 \geqq a_{3,3})$ and $(b_{8,2} > z_8$ and $b_{9,2} > z_9)$
	Poor	$(1.0 \geqq r_8 \geqq a_{3,3}$ and $1.0 \geqq r_9 \geqq a_{3,3})$ and $(b_{8,3} > z_8$ and $b_{9,3} > z_9)$
	Reject	$(r_8 \geqq a_{3,4}$ and $r_9 \geqq a_{3,4})$ and $(b_{8,4} > z_8$ and $b_{9,4} > z_9)$
	Uncorrect	$(r_8 > 0$ and $r_9 > 0)$ and $(z_8 \geqq b_{8,4}$ or $z_9 \geqq b_{9,4})$
	No data	$r_8 = 0$ or $r_9 = 0$
(7) Overall level 1 data (8) level 2 data	Good Fair Poor Reject Uncorrect No data	Of the quality comments of respective level data 1 from (1) to (6), the lowest quality comment is treated as the quality comment of the overall level 1 data.

Note: Validity ratio = number of valid data / total number of data

Mean residual sum with regression line = square root of the average of total residual sum of squares

Chapter 3

Access to the ILAS Data of Standard Processing

3 Access to the ILAS Data of Standard Processing

ILAS & RIS DHF stores the respective Level 1 and Level 2 data processed from the data observed by ILAS (Level 0 data) in a medium appropriate to the data volume and frequency of utilization. The data are supplied to users after conversion into the requested medium.

3.1 Storage of ILAS data

The ILAS level 0 data received from the Earth Observation Center (EOC) of the National Space Development Agency of Japan (NASDA) are all stored on D-1 M cassettes. Of the ILAS level 1 data processed from the ILAS level 0 data, the data of the most recent three months period that are likely to be used most are stored on hard disk, and the previous are stored on D-1 M cassettes, as is the level 0 data. As for the level 2 data, which are the final products, the data of the entire period are stored on hard disk. Of the data stored and controlled at DHF, ILAS level 1 data and ILAS level 2 data are converted into the format and medium requested by users and supplied to them. The types of ILAS data stored at DHF are as shown in Table 3.1-1.

Table 3.1-1 Types of Stored Data

Types	Medium of storage	Storage period	Availability
ILAS level 0 data	D-1 M cassette	Entire period of ILAS mission One cassette contains the data for one month	No
ILAS level 1 data	Hard disk D-1 M cassette	Hard disks store the data of the last three months D-1 M cassettes store the data prior to the last three months	Yes
ILAS level 2 data	Hard disk	Storage of the data of the entire mission period	Yes

3.2 Guideline for data distribution

Before the data processed at DHF are provided to researchers, the quality of the data must be evaluated, validation analysis must be conducted, and trends of the instrument aboard the satellite evaluated. Therefore, the supply conditions such as the type and timing of data availability time vary depending on the purpose of data utilization and the category in which the researcher is registered.

Unverified Level 1 and Level 2 data are given to the members of the ILAS Science Team and the group of researchers invited by Joint Research Announcement (JRA-PIs) in charge of validation analysis and algorithm development without delay after the data acquisition and processing. At the same time, unverified Level 2 data and verified Level 2 data necessary for validation are given to the members of the Validation Experiment Team. The members of the ILAS Science Team and the JRA-PIs will then receive verified data after the validation process using the data of validation experiments. For general users, the data is made available as "Confirmed" data after evaluation of the stability of the quality and so forth. The confirmed data will be also given to all the above researchers.

Table 3.2-1 shows the categories of users by the Classification of Researcher Registration, Table 3.2-2 the product types for users in the respective categories, and Table 3.2-3 the data which is available depending on the purpose of use.

Table 3.2-1 Categories of users in accordance with the Classification of Researcher Registration

Category of user		Remarks
Specific users	ST (Science Team Member)	The members of the ILAS Science Team (Associated members included) and the members of the ILAS Project Advisory Committee
	PI (Principal Investigator)	JRA PIs (and their Co-Is)
	VT (Validation Experiment Team Member)	Members of the Validation Experiment Team (and their Co-Is)
General users	GR (General Researcher)	Other researchers

Table 3.2-2 Product types available for respective user categories and the timing of release

Product type	Data type	Validation stage	Definition (timing of release)
Product for specific users	Level 1 data: Pseudo transmittance data Level 2 data: Temperature; air pressure; aerosol extinction coefficient in the visible band (780 nm); mixing ratios of O_3, HNO_3, NO_2, N_2O, H_2O, CH_4, CFC-11, CFC-12, N_2O_5; aerosol extinction coefficient in infrared bands (7.12, 8.27, 10.6, 11.76 μm)	Unverified data (U)	Data not verified (After commencement of routine operation)
		Verified data (V)	All the data obtained by the ILAS instrument with the algorithms guaranteed by analyses with validation experiment data. (not later than May 1998)
		Confirmed data (C)	The data of which validity was confirmed after completion of the one year trend evaluation (not later than May 1998)
Product for the general users	Level 1 data: Pseudo-transmittance data Level 2 data: Temperature; air pressure; aerosol extinction coefficient in the visible band (780 nm); mixing ratios of O_3, HNO_3, NO_2, N_2O, H_2O, CH_4	Confirmed data (C)	The data of which validity was confirmed after completion of the one year trend evaluation (not later than May 1998)

Table 3.2-3 Available data in accordance with purpose of utilization

	Algorithm research	Validation analysis	Application research
Specific users			
ST	U, V, C	U, V, C	U, V, C
VT	N/A	U, V, C	N/A
PI	U, V, C	U, V, C	V, C
General users	C	C	C

3.3 Data search and ordering

(1) Products that can be searched and ordered

An OE (Occultation Event) observation is treated as the unit of one observation by ILAS, and the number of observations per day is approximately 14 OE's in both the northern and southern hemispheres respectively as the ADEOS satellite orbits the earth roughly 14 times (14+11/41) a day. ILAS level 1 data consists of one type of product per OE.

For ILAS level 2 data, a maximum 16 types of products are made with each OE for the specific users, and a maximum 9 types for general users. The contents of the products that can be searched and ordered are as follows :

1) Specific users

a) Validation stage possible to search and order

- Unverified data
- Verified data
- Confirmed data

b) Products possible to search and order

- ILAS level 1 products:
- ILAS level 2 products:

  Aerosol extinction coefficient in the visible band (780 nm);

  Mixing ratios of O_3, HNO_3, NO_2, N_2O, H_2O, CH_4, CFC-11, CFC-12, and N_2O_5;

  Aerosol extinction coefficients at infrared bands (7.12, 8.27, 10.6, 11.76 μm)

2) General users:

a) Validation stage possible to search and order:

- Confirmed data

b) Products possible to search and order

- ILAS level 1 products:

  Data of pseudo-transmittance

- ILAS level 2 products:

  Respective products of:

  Temperature and atmospheric pressure;

  Aerosol extinction coefficient at visible band (780 nm);

  Mixing ratios of O_3, HNO_3, NO_2, N_2O, H_2O, CH_4

The procedures for data searching and ordering for general users will be decided later.

3.3.1 Data searching and ordering services provided by DHF for specific users

As ways for users to search and order data, DHF offers search and order services by means of a search system, E-mail, letter and facsimile.

The available products will be revised from time to time during the mission period so that users can search up-to-date data by themselves according to their own purpose of utilization.

The followings are the search and order services for the specific users.

(1) Search and order by data distribution system

Users make their search by themselves using up-to-date information by Internet access to the data distribution system installed on a barrier segment at the National Institution for Environmental Studies. After completion of the search, the user proceeds to order the data using the data distribution system. Access is made by telnet to distdhf.nies.go.jp. The specific users log-in with the login ID and the password given beforehand. If the log-in is approved, a log-in message appears on the monitor followed by User Information display. Searching and ordering then become possible. Please see the attached Appendix B, "Data Distribution System Utilization Manual" for details on the searching and ordering procedures by the Data Distribution System.

(2) Search and order by WWW

Users make their search by themselves using up-to-date information by Internet access to the ILAS's WWW (http://www-ilas.nies.go.jp/) installed on a barrier segment at the National Institution for Environmental Studies and by the services for specific users implemented on the ILAS WWW server. After completion of the search, the user proceeds to order the data through the WWW. The ID for user identification is common to the data distribution system.

(3) Search and order by CEOS-IDN

CEOS-IDN is a system that provides (directory) information on data in the field of earth sciences as well as on the world's earth observation satellites, such as locations, contact addressees and how to acquire the data. The system is operated at three organizations; NASA, ESA and NASDA. ILAS & RIS DHF is participating in CEOS-IDN as a data center linked to the NASDA node. Through this CEOS-IDN, the same service as the (1) Search by data distribution system is available. Detailed information about CEOS-IDN is available from the Planning Section of the Earth Observation Center, National Space Development Agency of Japan (Phone: +81-492-96-1611).

(4) Search and order by E-mail, letter or fax.

Fill in the proper order form with the name of user, place of delivery, desired storage medium and items to be searched, and send it either by E-mail, letter, or by FAX, DHF

will then return the results of their search either by E-mail, letter, or fax. The data stored in the requested medium are then sent to the user if such data exist and are available.

If ftp data receipt is requested, the object data are produced in the directory used by the specific user. The order form is available either from the WWW home page of ILAS or by entering "Request order form" in the "Subject" column of E-mail and sending it to admdhf@ilasris.nies.go.jp.

The following items must be filled in by users in order to use these searching and ordering services provided by DHF:

1) Name of spacecraft: Compulsory
   Only "ADEOS" presently.
2) Name of sensor: Compulsory
3) Product level: Compulsory
   ILAS "Level 1" or ILAS "level 2"
4) Validation stage: Can be left blank
   Either "Unverified" or "Verified" or "Confirmed." If not entered, "Confirmed" is searched.
   If "Unverified" is selected, all stages including "Unverified" and "Confirmed" are searched. For "Unverified" "Verified" and "Confirmed" are searched.
5) Quality: Compulsory
   If "Poor" is selected, all qualities including "Fair" and "Good" are searched. For "Fair" "Fair" and "Good" are searched.
6) Data parameters: Compulsory
   Parameters are selectable only when the product level is ILAS level 2.
   For specific users ;
   Temperature and atmospheric pressure:
   Aerosol extinction coefficient in the visible band (780 nm);
   Mixing ratios of O_3, HNO_3, NO_2, N_2O, H_2O, CH_4, CFC-11, CFC-12, and N_2O_5; and one or more of the aerosol coefficients in the visible bands (7.12, 8.27, 10.6, 11.76μm)
7) Date of observation to commence the search: Can be left blank
   The first day of the observation period to be searched.
   If not entered, the first day of the available observation period is assigned.
8) Date of observation to finish the search: Can be left blank
   The date the search is terminated.

If not entered, the last day of the available observation period is assigned.

9) Target latitude range and longitude range for the search: Can be left blank

Possible to specify the latitude range and the longitude range of the place of observation for the search.

If the latitudes are not entered, all latitudes are searched.

If the longitudes are not entered, all longitudes are searched.

10) Purpose of the utilization: **Compulsory**

Enter "Algorithm research", "Validation analysis" or "Application"

3.4 Data distribution

DHF converts the ordered data into various types of media as requested and delivers them to individual users. For the specific users registered beforehand, direct on-line distribution by WWW or ftp is offered for level 2 products.

(1) Form of distribution

There are two forms of product distribution: distribution in the form of medium and on-line distribution. The specific users can use both medium and on-line distribution. Table 3.4-1 shows the form of distribution depending on the product levels.

Table 3.4-1 Form of distribution by product levels

Users' category	Product level	Delivery form
Specific users	Level 1 product	Medium
	Level 2 product	Medium, On-line

(2) Media for distribution

Table 3.4-2 shows the media available for product distribution.

Table 3.4-2 The media available for product distribution

Medium	Storage capacity	Format etc.
3.5 inch floppy disk	2HD: 1.44 MB, (1.2 MB) 2DD: 720 KB, (640 KB)	PC-DOS (PC-98 format optional), Macintosh format
1/4 inch magnetic tape	QIC-150: 150 MB approx.	tar, dd command
8 mm magnetic tape	5 GB approx.	tar, dd command Conformity to ISO; Corresponds to 5 GB, 2 GB
4 mm DAT	2 GB approx.	tar, dd command ANSI DDS format
3.5 inch Magneto optical disk (Under consideration)	128 MB approx. 230 MB approx.	Conformity to ISO
CD-ROM (Under consideration)	650 MB approx.	ISO, HPF, Hybrid

(3) Product format

The product format for distribution can be specified as either HDF (Hierarchical Data Format) or Text Format. However, Text format is only for the level 2 data due to the limited data capacity. HDF is a data format developed by NCSA (National Center for Supercomputing Application) of the University of Illinois, USA, to facilitate the handling of data by users in various computer environments. The ILAS products of the HDF format distributed in DHF conform to the NASA EOSDIS V0 Data Product Implementation Guidelines. The AMES format is employed for the Text format, which allow the data to be used without needing special tools. For details, please see "Product Format Manual" in Appendix 1.

(4) The volume of the data in respective products

The volume of the data in the level 1 and level 2 products and the recommended storage media are shown in Table 3.4-3.

Table 3.4-3 Data capacity and recommended storage media

Product level	Volume in one product	Volume in products per day	Volume in products per month	Volume in products per year
Level 1	Volume: 9.8 MB Recommended media: CMT, 8 mm, DAT, (MO)	Volume: 274.4 MB Recommended media: 8 mm, DAT	Volume: 8.3 GB Recommended media: 8 mm (plural windings)	Volume: 99.6 GB Recommended media: 8 mm (plural windings)
Level 2	Volume: 5.2 KB Recommended media: Floppy disk	Volume: 145.6 KB Recommended media: Floppy disk	Volume: 4.4 MB Recommended media: CMT, 8 mm, DAT, (MO)	Volume: 52.8 MB Recommended media: CMT, 8 mm, DAT, (MO)

Note: Level 1 product: One occultation event produces one product.
Level 2 product: One parameter produces one product.
Parameter: Maximum 16 parameters per occultation event.
(MO is under consideration.)

The form for searching and ordering by fax is shown on the following page.

ILAS DATA SEARCH/ORDER (1/2)

ILAS-9607-A

Addressee:
ILAS Data Manager
ILAS & RIS DHF,
Main Research building III,
National Institute for Environmental Studies,

16-2 Onogawa, Tsukuba,
Ibaraki 305, Japan

Phone: +81-298-50-2568
Fax: +81-298-56-6995

Date: . .
I request for:
☐Data search only
☐Data search/order

Orderer: If you have a user's ID, please write it in the space below.

User's class: ☐specific user
User ID:

Title
Name
Department
Name of Organization (company)
Address (incl. Postal code)

Phone: Fax:
E-mail address:
Signature
Date

(1) Required data

Name of spacecraft ☐ ADEOS
Name of sensor ☐ ILAS
Product:
☐ Level 1 data
☐ Level 2 data:
(Common to specific users and general users):
☐Atmospheric pressure ☐Temperature ☐Aerosol extinction coefficient (Visible band: 780 nm)
☐ O_3 ☐ HNO_3 ☐ NO_2 ☐ N_2O ☐H_2O ☐CH_4
(Specific user only):
☐CFC-11 ☐CFC-12 ☐ N_2O_5
☐ Aerosol extinction coefficient (Infrared: 7.12 μm) ☐ Aerosol extinction coefficient (Infrared: 8.27 μm)
☐ Aerosol extinction coefficient (Infrared: 10.6 μm) ☐ Aerosol extinction coefficient (Infrared: 11.76 μm)
Valiation stage (Specific user only):
☐ Unverified ☐ Verified ☐ Confirmed
Quality:
☐ Good ☐ Fair ☐ Poor

(2) Date of observation and target area to be searched (If not entered, the entire observation period and area are searched)

Date of observation to be searched: day /month /year ~ day /month /year
Area to be specified:
☐Rectangular area
Latitude ☐N, ☐S __° __' ~ ☐N, ☐S __° __'
Longitude ☐E, ☐W __° __' ~ ☐E, ☐W __° __'
☐ Center and radius to be specified of circular area:
Latitude and longitude of the center area
Latitude ☐N, ☐S __° __'
Longitude ☐E, ☐W __° __'
Radius _____km

ILAS DATA SEARCH/ORDER (2/2)

ILAS-9607-B

(3) Purpose of use

Purpose of use of the data:
☐ Algorithm research ☐ Validation analysis ☐ Application research

(4) Data format and receiving method (Orderer only)

Level 2 data format (only HDF for Level 1 data)
☐ HDF ☐ Text

Receiving method
☐ Medium:
☐ 3.5 inch floppy disk :
☐ DOS Format {☐ 2HD (1.44MB) ☐ 2HD (1.2MB) ☐ 2DD (720KB) ☐ 2DD (640KB)}
☐ Macintosh format {☐ 2HD (1.44MB) ☐ 2DD (720KB)}
☐ 1/4 inch magnetic tape (CMT):
☐ tar format ☐ dd format
☐ 8 mm magnetic tape:
☐ tar format ☐ dd format
☐ 4 mm magnetic tape (DAT) :
☐ tar format ☐ dd format
☐ 3.5 inch magneto optical disk (MO) : (Under consideration)
☐ 128MB format ☐ 230MB format
☐ On-line (Specific user and Level 2 data only)

If you have any requests about delivery or administrative procedures, please write them below.

Comment		
Use of DHF only	SV	
	OP	
	Handling	
	Delivery	
	Number	

Chapter 4

Contact Points

4. Contact Points

Information about the ILAS project

Yasuhiro Sasano
ILAS Project Leader
Global Environmental Division
National Institute for Environmental Studies

16-2 Onogawa, Tsukuba, Ibaraki 305, Japan
Phone: +81-298-50-2444
Fax: +81-298-50-2569
E-mail: sasano@nies.go.jp

Information about the available ILAS data

DHF data Manager
ILAS & RIS DHF
National Institute for Environmental Studies

16-2 Onogawa, Tsukuba, Ibaraki 305, Japan
Phone: +81-298-50-2568
Fax: +81-298-56-6995
E-mail: admdhf@ilasris.nies.go.jp

Chapter 5

Reference Materials

5. Reference Materials

5.1 Reference

- Kanzawa, H., Y. Kondo, C. Camy-Peyret, Y. Sasano: Balloon campaigns at Kiruna-Esrange planned in ILAS Correlative Measurements Program. Proc. 12th ESA Symp. European Rocket and Balloon Programmes and Related Research (Lillehammer, 29 May - 1 June 1995), (1995)

- Sasano, Y., M. Suzuki, T. Yokota, H. Kanzawa: Improved limb atmospheric spectrometer (ILAS) project: ILAS instrument, performance and validation plan, SPIE Vol. 2583, 193-204, (1995)

- Suzuki, M., A. Matsuzaki, T. Ishigaki, N. Kimura, N. Araki, T. Yokota, Y. Sasano: ILAS, the Improved Limb Atmospheric Spectrometer, on the Advanced Earth Observing Satellite, IEICE TRANS. Commun., E78-B, 12, 1560-1570, (1995)

- Yokota, T.: ILAS: Monitoring of high-latitude ozone layer: Part 2 Data Retrieval Algorithm, Ozone Layer Observation by Satellite Sensors (Proc. of Int. Workshop Global Environ. Earth Obs. Satellite Sensors, Tokyo, 8-9 December 1993), edited by Y. Sasano and T. Yokota, 52-53, (1994)

  [Available from National Institute for Environmental Studies]

5.2 List of acronym

A

ADEOS	Advanced Earth Observing Satellite
AOCS	Attitude and Orbit Control System
AVNIR	Advanced Visible and Near Infrared Radiometer

B

BBM	Bread Board Model

C

C&DH	Communication & Data Handling
CEOS	Committee on Earth Observation Satellites
CEOS-IDN	CEOS-International Directory Network
CRL	Communications Research Laboratory

D

DAT	Digital Audio Tape
DHF	ILAS & RIS DHF
DIR-1000 (D1)	Digital Instrumentation Recorder - 1000 series
DT	Direct Transmission
DTL	Direct Transmission for Local Users

E

EM	Engineering Model
EOC	Earth Observation Center
EPS	Electrical Power Subsystem
ESA	European Space Agency

F

FM	Flight Model
FTP	File Transfer Protocol

H

HALOE	Halogen Occultation Experiment
HKDT	House Keeping Data

I

IFOV	Instantaneous Field Of View
ILAS	Improved Limb Atmospheric Spectrometer
ILAS & RIS DHF	ILAS & RIS Data Handling Facility
IMG	Interferometric Monitor For Greenhouses Gases
IOCS	Inter Orbit Communication Subsystem
IR	infrared

M

MDP	Mission Data Processor
MO	*Magneto-Optical disk*

N

NASA	National Aeronautics and Space Administration
NASDA	National Space Development Agency of japan
NASDA/EOC	NASDA/Earth Observation Center
NIES	National Institute for Environmental Studies
NOAA	National Oceanic and Atmospheric Administration
NSCAT	NASA Scatterometer

O

OBC	On Board Computer
OCTS	Ocean Color and Temperature Scanner

P

PCD	Payload Correction Data
PDL	Paddle
PFM	Proto Flight Model
POLDER	Polarization and Directionality of the Earth's Reflectance's
PSC	Polar stratospheric cloud

Q

QQC	Quality, Quantity and Continuity

R

RIS	Retroreflector In Space

S

SAGE	Stratospheric Aerosol and Gas Experiment

T

TBD	To Be Determined
TOMS	Total Ozone Mapping Spectrometer

U

UARS	Upper Atmosphere Research Satellite
UKMO	UK Met Office

APPENDIX A

ADEOS/ILAS

PRODUCT FORMAT MANUAL

Version 1.0

Contents

1 overview

This manual describes the products for ILAS users. The products are produced in the following two types of format for users:

- HDF (Hierarchical Data Format)
- Text format (AMES format: level 2 data only)

The HDF product format employs HDF V 3.3 complying with the EOSDIS Version 0 Data Product Implementation Guideline. (For HDF, see The HDF Information server, http://hdf. ncsa.uiuc.edu)

The text format employs the AMES format proposed by the NASA Ames Research Center. Products in the AMES format consist of ASCII letters and are available only for level 2 data.

2 Outline of the data

2.1 Definition of data level

ILAS measurement data are processed for level 0 editing at NASA/EOC, and produced as ILAS level 0 data twice a week. ILAS & RIS DHF (ILAS & RIS Data Handling Facility) obtains these ILAS level 0 data through a 512-kbps high-speed digital channel and process them further. ILAS & RIS DHF gives higher-order processing to the ILAS level 0 data obtained at NASA/EOC after checking the format, and derives level 1, level 2 and level 3 (TBD) data. The levels of data processing for the products to be offered are level 1 and level 2. The near real-time data (level 0' data) edited immediately after the direct reception at NASA/EOC are processed to higher order and derived as level 1', level 2' and level 3' (TBD) data, as is the level 2 data. These data are reserved for flash reports and not offered as products because the data on the satellite orbit are forecasted values. The following table shows the definition of the respective data levels to be distributed as products:

Levels of data products

Processing level	Contents	Remarks
Level 1	Data of respective channels (Visible band spectrometer, Infrared spectrometer and Sun edge sensor) with abnormal/ missing data processing and relative intensity collection; data on the satellite's orbiting track.	Level 1 products of one kind for one occultation event (OE) is available [The size of one file: approximately 9.8 MB]
Level 2	Geophysical parameters are expressed as altitude distributions	One file contains one parameter. Up to 16 types of level 2 products are derived from one OE. [Size of one file: approximately 5.2 KB] < Target parameters > Temperature, Pressure, Aerosol extinction coefficient (780 nm), Mixing ratios of O3, Mixing ratios of HNO3, Mixing ratios of NO2, Mixing ratios of N2O, Mixing ratios of H2O, Mixing ratios of CH4, Mixing ratios of CFC-11, Mixing ratios of CFC-12, Mixing ratios of N2O5, Aerosol extinction coefficient (7.12μm), Aerosol extinction coefficient (8.27μm), Aerosol extinction coefficient (10.6μm), Aerosol extinction coefficient (11.76μm)

2.2 Product types

There are two types of product; one is for specific users, and the other for general users. (For the definitions of the user classification, please see Section 2.5.3 of the Handbook.)

The data to be distributed are validated to guarantee the quality and the reliability. They are classified into three categories according to the respective validation stages, i.e., unverified data, verified data, and confirmed data (see Table 2-2 for the definition of the respective validation stages). The products for specific users are distributed from the validation stage of unverified data or verified data. The products for general users are from the validation stage of confirmed data, the validity and the stability of which are confirmed prior to distribution, by evaluating them for one year after the data validation by validation experiment observations.

Further, the type of available parameters of level 2 data are different between the products for specific users and those for general users. While nine types of parameters are available for the products for general users, 16 types are available for specific users.

Categories of products

Category	Validation stage	Definition of validation stage (the time scheduled for distribution)	Remarks
Products for specific users	Unverified Data	Data not validated yet (after commencement of the routine operation)	1 type of level 1 products and 16 types of level 2 products are available with 1 occultation event (OE). <Parameters for level 2 products> Temperature, Pressure, Aerosol extinction coefficient (780 nm), O3, HNO3, NO2, N2O, H2O, CH4, CFC-11,CFC-12, N2O5, Aerosol extinction coefficient (7.12μm), Aerosol extinction coefficient (8.27μm), Aerosol extinction coefficient (10.6μm), Aerosol extinction coefficient (11.76μm)
	Verified Data	All the data obtained with the observation instruments and processed with processing algorithms, the validities of which have been verified by validation analyses using data for validation. (21 months after the launch of ADEOS)	
Products for general users	Confirmed Data	Data with confirmed validity after completion of the trend evaluation for one year on the verified data (21 months after the launch of ADEOS)	1 type of level 1 products and 9 types of level 2 products are available with 1 occultation event (OE) <Parameters for level2 products> Temperature, Pressure, Aerosol extinction coefficient (780 nm), O3, HNO3, NO2, N2O, H2O, CH4

2.3 Structure of HDF products

There are two types of HDF product including a guide file and an HDF file consisting of level 1 data or level 2 data. The following shows the structure in which data are stored on each proposed medium.

- Guide File (Readme)
- HDF File (Level 1 data or level 2 data)

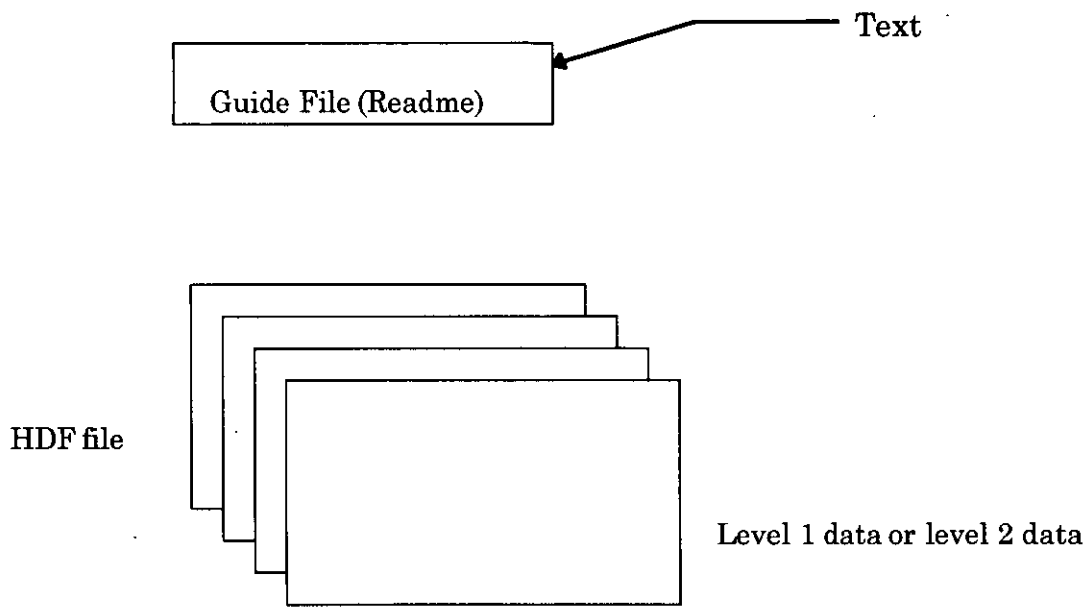


Fig. 2-1 Structure of HDF products

2.3.1 Guide File (Readme)

The guide file is an ASCII text file containing a list of file names for all the level 1 or level 2 data requested by a user. This file contains:

1) Header information
2) Archive contents

Header information

Header information includes descriptions of the date and the name of organization the medium was produced, the medium number (when provided on a medium), and the notes. It is a character string beginning with "#" as the first byte .

Archive contents

This contains the number of files and the names.
The file naming method is as follows:

YYmmmNNN.{R|S}{1|2} [type of observation] : File name

YY	: the year of observation (the second two digits of the Christian calendar year)
mmm	: Annual total days of observation (the total days summing up from January 1 of the year: 001-365, or 366 UT)
NNN	: Observation Path number (001～585)
{R | S}	: Observation mode (either R: Sun Rise or S: Sun Set)
{1 | 2}	: Data Level (either 1: Level 1 or 2: Level 2)

[Types of observation] : The types of parameters that should be added to level 2 only (1,2,~ A,B,··)

1: Temperature profile
2: Pressure profile
3: Aerosol extinction coefficient (780 nm)
4: O3 profile
5: HNO3 profile
6: NO2 profile
7: N2O profile
8: H2O profile
9: CH4 profile
A: CFC-11 profile
B: CFC-12 profile
C: N2O5 profile
D: Aerosol extinction coefficient (7.12μm)
E: Aerosol extinction coefficient (8.27μm)
F: Aerosol extinction coefficient (10.6μm)
G: Aerosol extinction coefficient (11.76μm)

2.4 Structure of text format products

A text form product consists of a guide file and level 2 data. The data are available in the structure shown below:

■Level 2 data (AMES format)

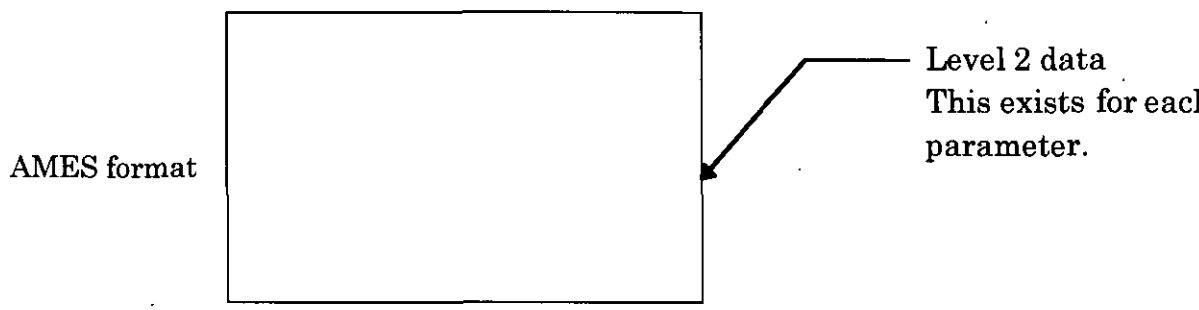


Fig. 2-2 Structure of text format products

3. Level 1 data

3.1 Introduction

ILAS level 0 data, produced at NASDA/EOC by adding a few necessary data such as ADEOS satellite orbit determinant values to the data obtained by ILAS, are transmitted through the exclusive channels to ILAS & RIS DHF.

ILAS & RIS DHF extracts effective measurement data from the level 0 data, and calculates data of the measured intensity calibrated with the signal values of 0% and 100% after processing abnormal and missing values. The calculated data are the level 1 data. Level 1 products are those that include information on the satellite position added to the level 1 data and are stored as HDF files.

3.2 Structure of level 1 data (HDF)

The structure of the HDF file of level 1 data is as follows:

- L1 Data Attribute
- V group

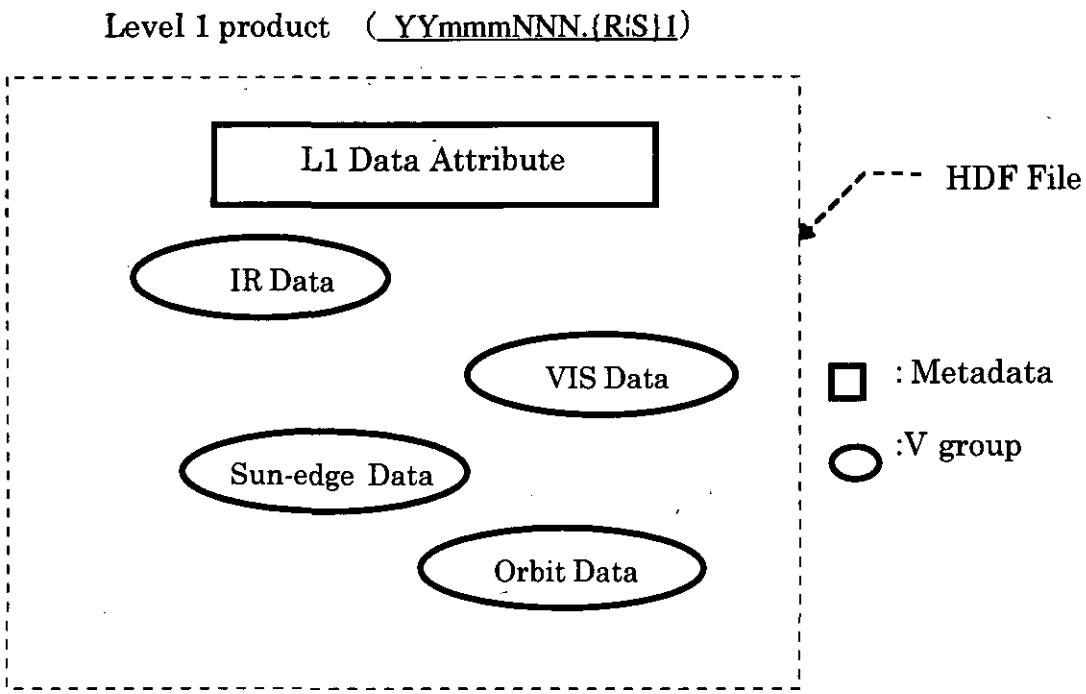


Fig. 3-1 Structure of level 1 product

3.2.1 Level 1 Data Attributes

L1 Data Attributes store information on the attributes of product descriptions. This data is in the V data format, and is described in the form of Label value.

■ Information on L1 data products

This defines the product label such as the organization that produced the level 1 data and the name of the data set.

The contents of the information in the L1 data product are as follows:

L1 Data Product Table

Data name	Data type	Size (Byte)	Number of data	Contents of description
Data center	Cha	12	1	Facility that produced the product: "ILAS&RIS DHF"
Data product name	Cha	10	1	File name (See Section 2.3.1 for file name.)
Spacecraft name	Cha	5	1	Name of spacecraft used: "ADEOS"
Sensor name	Cha	4	1	Name of the sensor used: "ILAS"
Investigator	Cha	15	1	Name of researcher: "Yasuhiro Sasano"
Processing level	Cha	7	1	Processing level: "Level 1"
Processing time	Cha	21	1	Time of level 1 processing (UTC) "YYYYMMDD hh:mm:ss.ttt"
Data verification level	Cha	1	1	Validation level (Note 1) "U": unverified data "V": verified data "C": confirmed data

Cha: Character string
Short: 2 byte integer
Real: 4 byte real number
Double: 8 byte real number

Note 1: See Section 2.2 "Product types" for details.

■ Information on the time of L1 observation and position of the spacecraft.

Information is stored on the time and position of the observation data of which is stored.

The contents are as follows.

Information on L1 observation time and spacecraft position

Data name	Data type	Size (Byte)	Number of data	Contents of description
Observation start date/time	Cha	21	1	Time of commencing observation (UTC) "YYYYMMDD hh:mm:ss.ttt"
Observation end date/time	Cha	21	1	Time of completing observation (UTC) "YYYYMMDD hh:mm:ss.ttt"
Path number	Short	2	1	RSP path number for commencing observation ("1" ~ "585")
Orbit number	Short	2	1	Orbit number for commencing observation ("1" ~ "585")
Occultation Event number	Cha	10	1	ILAS OE number A unique number used in the software at ILAS & RIS DHF
Latitude of a tangent point	Real	4	1	The latitude of the typical position for observation at a typical altitude of 20 km (deg)
Longitude of a tangent point	Real	4	1	The longitude of the typical position for observation at a typical altitude of 20 km (deg)
Sunrise/sunset flag	Cha	3	1	"SRE": Observation at sunrise "SSE": Observation at sunset

Cha: Character string
Short: 2 byte integer
Real: 4 byte real number
Double: 8 byte real number

■ **Information on the quality of Level 1 product**

This defines the information on the processing of product qualities. The contents are as follows:

Information on the quality of Level 1 product

Data name	Data type	Size (Byte)	Number of data	Contents of description
Quality of Level 1 Data	Cha	9	1	Comprehensive quality of the Level 1 data (Note 2) "GOOD " "FAIR " "POOR " "REJECT " "UNCORRECT" "NO DATA "
Quality of IR Data	Cha	9	1	Comprehensive quality of the Infrared band spectrum data (Note 2) "GOOD " "FAIR " "POOR " "REJECT " "UNCORRECT" "NO DATA "
Quality of VIS Data	Cha	9	1	Comprehensive quality of the visible band spectrum data (Note 2) "GOOD " "FAIR " "POOR " "REJECT " "UNCORRECT" "NO DATA "
Quality of sun-edge Data	Cha	9	1	Comprehensive quality of the data on the sun-edge sensor (Note 2) "GOOD " "FAIR " "POOR " "REJECT " "UNCORRECT" "NO DATA "
Processing version	Cha	6	1	Processing version (Vxx.xx)

■ Note 2: As to the criteria for judging qualities, please see "ILAS User's Handbook; 2.4.4 Method for Quality regulation"

■ IR data attribute

Structural Metadata of Infrared band spectrum data are defined.

The contents are shown below:

Data name	Data type	Size (Byte)	Number of data	Contents of description
Number of extracted effective IR data	Short	2	1	The number of effective data extracted from the infrared band spectra: n
Start time of IR data	Double	8	1	The time of observation commencement (second) The time elapsed from the beginning of the day of observation (UTC) for respective OEs (Note 3)
End time of IR data	Double	8	1	The time of completing observation (second) The time elapsed from the beginning of the day of observation (UTC) for respective OEs (Note 3)

■ VIS data attribute

Structural Metadata of visible band spectrum data are defined.

The contents are as below:

Data name	Data type	Size (Byte)	Number of data	Contents of description
Number of extracted effective VIS data	Short	2	1	The number of effective data extracted from the visible band spectra: n
Start time of VIS data	Double	8	1	The time of observation commencement (second) The time elapsed from the beginning of the day of observation (UTC) for respective OEs (Note 3)
End time of VIS data	Double	8	1	The time of completing observation (second) The time elapsed from the beginning of the day of observation (UTC) for respective OEs (Note 3)

Cha: Character string

Short: 2 byte integer

Real: 4 byte real number

Double 8 byte real number

Note 3: If the commencement time of data observation is 1.000 second past ten o'clock and 10 minute on December 1st 1996, the elapsed time from the 0 hour 0 minuets 0 second on December 1st 1996 totals 36601.000 (sec).

■ Sun-edge data attribute

The structural metadata of the Sun-edge sensor data are defined.
The contents are shown below:

Data name	Data type	Size (Byte)	Number of data	Contents of description
Number of extracted effective Sun-edge data	Short	2	1	The number of effective data extracted from the Sun-edge sensor data: n
Start time of Sun-edge data	Double	8	1	The time of observation commencement (second) The time elapsed from the beginning of the day of observation (UTC) for respective OE's (Note 3)
End time of Sun-edge data	Double	8	1	The time of completing observation (second) The time elapsed from the beginning of the day of observation (UTC) for respective OEs (Note 3)
IFOV angle unit	Cha	6	1	The unit of IFOV angle: "radian"

■ Orbit data attribute

The structural metadata of the Orbit data are defined. The contents are shown below:

Data name	Data type	Size (Byte)	Number of data	Contents of description
Number of Orbit data	Short	2	1	The number of orbit data: n (Equivalent to the number n of extracted effective data)
Start time of Orbit data	Double	8	1	The time of observation commencement (second) The time elapsed from the beginning of the day of observation (UTC) for respective OE's (Note 3)
End time of Orbit data	Double	8	1	The time of completing observation (second) The time elapsed from the beginning of the day of observation (UTC) for respective OE's (Note 3)
Observation time unit	Cha	6	1	The unit of the time of the orbit data: "second"
Spacecraft position unit	Cha	2	1	The unit of satellite position: "km"
Spacecraft velocity unit	Cha	9	1	The unit of satellite velocity: "km/second"

3.2.2 V group

Level 1 data include the following four types of V groups. The data of this group correspond to the real data. The respective object data are of multidimensional array in the form of SDS (Scientific Data Set).

1) IR Data : Infrared band spectrum data
2) VIS Data : visible band spectrum data
3) Sun-edge Data : sun-edge sensor data
4) Orbit data : spacecraft orbit data

■ **Infrared band spectrum data** **V group title : IR_Data**

Name of data	Data type	Number of data (Dimension)	Size (Byte)	Contents
Observation data of IR	Real	44*n (2 dimension)	4*44*n	Level 1 observation data derived from the ILAS infrared band channels. (Infrared band channels : 44)
Drift correction coefficient of IR	Real	44*2 (2 dimension)	4*44*2	Coefficients to remove influence from 100 % drift: the values of regression correction coefficients a_{100} and b_{100} at the respective sampling points which correspond to the 44 channels. (Note 4)
Zero-drift correction coefficient of IR	Real	44*2 (2 dimension)	4*44*2	Coefficients to remove influence from 0 % drift: the values of regression correction coefficients a_0 and b_0 at the respective sampling points which correspond to the 44 channels. (Note 4)
Processing result flag of IR	Cha	44*n (2 dimension)	44*n	Flags of the results of the level 0 - 1 processing of the respective channels. (Note 5)

n : Number of extracted effective data
Cha: Character string
Short: 2 byte integer
Real: 4 byte real number
Double: 8 byte real number

Note 4: As to the drift correction coefficients, please see "ILAS User's Handbook; 2.3.2 The outline of data processing, (2) Level 0-1 processing"

Note 5: As to the contents of the results flag, please see "ILAS User's Handbook; 2.3.2 The outline of data processing, (2) Level 0-1 processing"

■ **Visible bands spectrum data** **V group title: VIS_Data**

Name of data	Data type	Number of data (Dimension)	Size (Byte)	Contents
Observation data of VIS	Real	1024*n (2 dimension)	4*1024*n	Level 1 observation data derived from the ILAS visible band channels. (Visible band channels: 1024)
Drift correction coefficient of VIS	Real	1024*2 (2 dimension)	4*1024*2	Coefficients to remove influence from 100 % drift: the values of regression correction coefficients a_{100} and b_{100} at the respective sampling points which correspond to the 1024 channels. (Note 4)
Zero-drift correction coefficient of VIS	Real	1024*2 (2 dimension)	4*1024*2	Coefficients to remove influence from 0 % drift: the values of regression correction coefficients a_0 and b_0 at the respective sampling points which correspond to the 1024 channels. (Note 4)
Processing result flag of VIS	Cha	1024*n (2 dimension)	1024*n	Flags of the results of the level 0 - 1 processing of the respective channels. (Note 5)

n: Number of extracted effective data
Cha: Character string
Short: 2 byte integer
Real: 4 byte real number
Double 8 byte real number

■ **Sun edge sensor data** **V group title:Sun-edge_Data**

Name of data	Data type	Number of data (Dimension)	Size (Byte)	Contents
Observation data of sun-edge	short	1024*n (2 dimension)	4*1024*n	Level 1 observation data obtained from the edge-sensor (Visible band channels: 1024)
Upper sun-edge of IFOV position	Real	n (1 dimension)	4*n	Sun upper-edge position The relative position of the solar disk's upper edge derived from the calculation based on the real circle solar size having the center as 0, the upper edge as +100 and the lower edge as -100.
Bottom sun-edge of IFOV position	Real	n (1 dimension)	4*n	Sun lower-edge position The relative position of the solar disc's lower edge derived from the calculation based on the real circle solar size having the center as 0, the upper edge as +100 and the lower edge as -100.
IFOV angle	Real	n (1 dimension)	4*n	IFOV angle (radian)
Drift correction coefficient of sun-edge	Real	1024*2 (2 dimension)	4*1024*2	Coefficients to remove influence from 100 % drift: the values of regression correction coefficients a_{100} and b_{100} at the respective sampling points which correspond to the 1024 channels. (Note 4)
Zero-drift correction coefficient of sun-edge	Real	1024*2 (2 dimension)	4*1024*2	Coefficients to remove influence from 0 % drift: the values of regression correction coefficients a_0 and b_0 at the respective sampling points which correspond to the 1024 channels. (Note 4)
Processing result flag of sun-edge	Cha	1024*n (2 dimension)	1024*n	Flags of the results of the level 0 to 1 processing of the respective channels. (Note 5)

n: Number of extracted effective data

Cha: Character string

Short: 2 byte integer

Real: 4 byte real number

Double: 8 byte real number

■ **Orbit data** **V group title: Orbit_Data**

Name of data	Data type	Number of data (Dimension)	Size (Byte)	Contents
Observation time	Double	n (1 dimension)	8*n	The time of the orbit data (second): The time elapsed from the beginning of observation day of each OE (Note 3)
Spacecraft position	Double	3*n (2 dimension)	8*3*n	x,y,z components of the spacecraft position (km)
Spacecraft velocity	Double	3*n (2 dimension)	8*3*n	x,y,z components of the satellite velocity (km/second)

n: Number of extracted effective data
Cha: Character string
Short: 2 byte integer
Real: 4 byte real number
Double: 8 byte real number

4 Level 2 data

4.1 Introduction

Level 2 data include the data of temperature and atmospheric pressure, aerosol extinction coefficients of different altitudes computed from the data of visible band spectra, and the data of atmospheric trace constituents and aerosol extinction coefficients computed from the data of infrared band spectra with ILAS level 1 data as the inputs.

Level 2 products are HDF files and text files containing data of the vertical distributions of temperatures, atmospheric pressures, aerosol extinction coefficients, atmospheric trace constituents and their observation errors of respective OEs.

Level 2 data product is produced for each observed parameters. For example, if 16 types of data such as atmospheric pressure, temperature, aerosol extinction coefficients (780nm), O3, HNO3, NO2, N2O, H2O, CH4, CFC-11, CFC -12, N2O5 and aerosol extinction coefficients (infrared 4ch) are derived from one observation, the level 2 data are produced in 16 products.

4.2 Structure of level 2 data (HDF)

The structure of the HDF file of level 2 data is as follows.

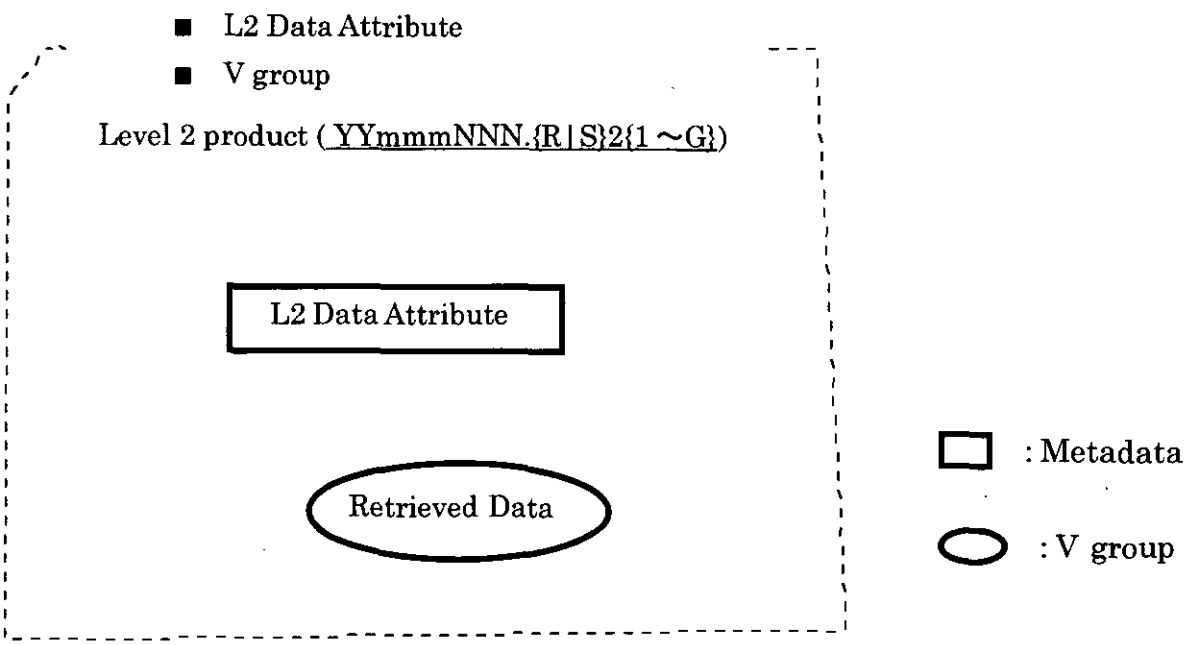


Fig. 4-1 Structure of level 2 standard product file

4.2.1 Level 2 data attributes

L2 Data attributes are metadata that contain attribute information such as explanations on a level 2 data product and in the V data format, which is the same as the level 1 standard product.

■ Information on L2 Data Product

This defines the product label such as the name of the organization that produced the level 2 data product, and the name of the data set.

The contents of the information in the L2 Data Product are as follows.

L2 Data Product Table

Data name	Data type	Size (Byte)	Number of data	Contents
Data center	Cha	12	1	Facility that produced the product: "ILAS/RIS DHF"
Data product name	Cha	10	1	File name (see Section 2.3.1 for file name)
Spacecraft name	Cha	5	1	Name of spacecraft "ADEOS"
Sensor name	Cha	4	1	Name of sensor "ILAS"
Investigator	Cha	15	1	Name of researcher "Yasuhiro Sasano"
Processing level	Cha	7	1	Processing level "Level 2"
Processing Time	Cha	21	1	Time of level 2 processing (UTC) "YYYYMMDD hh:mm:ss.ttt"
Data verification level	Cha	1	1	Validation level "U": unverified data "V": verified data "C": confirmed data

Cha: Character string
Short: 2 byte integer
Real: 4 byte real number
Double: 8 byte real number

■ Information on the time of L2 observation and position of the spacecraft

Information is stored on the time and the point of the observation.
The contents are as follows.

Information on L2 observation time and spacecraft position

Data name	Data type	Data size (Byte)	Number of data	Contents
Observation start date/time	Cha	21	1	Time of commencing observation (UTC) "YYYYMMDD hh:mm:ss.ttt"
Observation end date/time	Cha	21	1	Time of completing observation (UTC) "YYYYMMDD hh:mm:ss.ttt"
Path number	Short	2	1	RSP path number for commencing observation ("1"-"585")
Orbit number	Short	2	1	Orbit number for commencing observation ("1"-"585")
OE number	Cha	10	1	ILAS OE number A unique number used in the software at ILAS & RIS DHF
Latitude of a tangent point	Real	4	1	Latitude of typical observation point (deg)
Longitude of a tangent point	Real	4	1	Longitude of typical observation point (deg)
Lowest tangent height of observation	Real	4	1	Lowest tangent height of observation (km)
Highest tangent height of observation	Real	4	1	Highest tangent height of observation (km)
Sunrise/sunset flag	Cha	3	1	"SRE": Observation at sunrise "SSE": Observation at sunset

Cha: Character string
Short: 2 byte integer
Real: 4 byte real number
Double: 8 byte real number

■ Information on L2 product quality

This information defines the quality of product processing. The contents are as follows.

L2 Product Quality Information

Data name	Data type	Data size (Byte)	Number of data	Contents
Quality of Level 2 Data	Cha	9	1	Overall quality of level 2 data "GOOD " "FAIR " "POOR " "REJECT " "UNCORRECT" "NO DATA "
Data parameter	Cha	12	1	"Temperature ": Temperature "Pressure ": Atmospheric pressure "VIS Aerosol ": Aerosol extinction coefficient (780nm) "O3 ": O3 "HNO3 ": HNO3 "NO2 ": NO2 "N2O ": N2O "H2O ": H2O "CH4 ": CH4 "CFC-11 ": CFC-11 "CFC-12 ": CFC-12 "N2O5 ": N2O5 "IR Aerosol-1": Aerosol extinction coefficient (7.12μm) "IR Aerosol-2": Aerosol extinction coefficient (8.27μm) "IR Aerosol-3": Aerosol extinction coefficient (10.6μm) "IR Aerosol-4": Aerosol extinction coefficient (11.76μm)
Number of division in the vertical direction	Short	2	1	Number of altitude divisions in the vertical direction: m
Processing version	Cha	6	1	Processing version (Vxx.xx)

■ Retrieval data attributes

This defines the structural metadata of retrieval data.
The contents are as follows.

Data name	Data type	Data size (Byte)	Number of data	Contents
Number of division in the vertical direction	Short	2	1	Number of altitude divisions in the vertical direction: m
Observation time unit	Cha	6	1	Unit of observation time "second"
Tangent height unit	Cha	2	1	Unit of tangent height "km"
Observation parameter unit	Cha	4	1	Temperature "K " Atmospheric pressure "hPa " Aerosol extinction coefficient "km-1" Densities of other parameters (Volume mixture ratio) "ppmv"

Cha: Character string
Short: 2 byte integer
Real: 4 byte real number
Double: 8 byte real number

4.2.2 V group

Level 2 data include only one type of V group. The data of the V group correspond to the real data. The respective object data are in a multi-dimensional array in the form of a scientific data set (SDS).

■ Retrieval data Name of V group: Retrieval Data

Data name	Data type	Data size (Dimension)	Number of data (Byte)	Contents
Observation time	Double	m (1 dimension)	8*m	Time of observation that corresponds to the tangent height (Number of height divisions (second)) The time elapsed from the beginning of the observation day of each OE (UTC)
Tangent height	Real	m (1 dimension)	4*m	The tangent height for the data corresponding to the observation time. (km)
Observation values	Real	m (1 dimension)	4*m	The values resulting from retrieval computations
Estimation error	Real	2*m (2 dimension)	4*2*m	(-) error and (+) error of the retrieved values

m: Number of division in the vertical direction
Cha: Character string
Short: 2 byte integer
Real: 4 byte real number
Double: 8 byte real number

4.3 Structure of level 2 data (Text Format)

Just like HDF format, level 2 data of text format have one file for each observation parameter.

The following shows the text format of level 2 data. The format complies with the AMES format proposed by NASA. The format definition marked with * are those which were uniquely defined to meet the requirements of ILAS level 2 data.

■ Data Format (Level 2 data only)

Record Number	Format Definition	Contents
1	NLHEAD	Number of Header Record "24"
2	ONAME	Project leader "Sasano Yasuhiro"
3	ORG	Name of the organization that produced the product "NIES/ILAS & RIS DHF"
4	SNAME	Target of observation (parameter) / Method of observation "Temperature" "Pressure" "Aerosol extinction coefficient (780 nm)" "Volume Mixing Ratio of O3" "Volume Mixing Ratio of HNO3" "Volume Mixing Ratio of NO2" "Volume Mixing Ratio of N2O" "Volume Mixing Ratio of H2O" "Volume Mixing Ratio of CH4" "Volume Mixing Ratio of CFC-11" "Volume Mixing Ratio of CFC-12" "Volume Mixing Ratio of N2O5" "Aerosol extinction coefficient (7.12 micro-meter)" "Aerosol extinction coefficient (8.27 micro-meter)" "Aerosol extinction coefficient (10.6 micro-meter)" "Aerosol extinction coefficient (11.76 micro-meter)"
5	MNAME	Name of spacecraft / Name of sensor "ADEOS/ILAS project"
6	DATE RDATE	DATE : The date of commencing observation "YYYYMMDD"

		RDATE : Date of level 2 data processing "YYYYMMDD"
7	PLEVEL* VLEVEL*	PLEVEL : Processing level "Level 2" VLEVEL : Validation level "Unverified Data" "Verified Data" "Confirmed Data"
8	LATP* LOTP*	LATP : Latitude of typical observation point at TH = 20 km point (deg) "xxx.xx" LOTP : Longitude of typical observation point at TH = 20 km point (deg) "xxxx.xx"
9	PATH* MODE*	PATH : RSP path number for commencing observation "xxx" MODE : Observation mode "Sunrise" : Observation at sunrise "Sunset" : Observation at sunset
10	QDATA* PVER*	QDATA : Overall quality of the data "GOOD" "FAIR" "POOR" "REJECT" "UNCORRECT" "NO DATA" PVER : Processing version "Vxx.xx"
11	DX(1)	Interval value of the axial variable ( ): The number of the axial variable; 1 Level 2 product stores the tangent height as an axial variable at the interval given below: "1" : 1 km interval "0" : variable
12	XNAME(1)	Explanation of the axial variable (1) ( ): The number of the axial variable; 1 "Tangent height (km)" : The tangent height for retrieval
13	NV	Number of variables other than the axial variable: n "4" Stored in the section for the real data from "24 RECORD" in order

		from the left: Axial variable (1), variable (1), variable (2), variable(3), variable (4) n=1 (first variable) : Time of observation (second) n=2 (second variable): Result of retrieval computation n=3 (third variable) : (-) error of the result of retrieval computation n=4 (fourth variable): (+) error of the result of retrieval computation
14	VSCAL(n) n=1,4	Scale factor of the variable (n)=1, 4 Real value (scale factor) = Variable (n) x VSCAL(n) Different depending on the object parameter of observation "1 0.001 0.001 0.001" : Temperature "1 0.001 0.001 0.001" : Pressure "1 0.0000001 0.0000001 0.0000001" : Aerosol extinction coefficient (720nm) "1 0.00001 0.00001 0.00001" : O3 "1 0.000001 0.000001 0.000001" : HNO3 "1 0.0000001 0.0000001 0.0000001" : NO2 "1 0.000001 0.000001 0.000001" : N2O "1 0.00001 0.00001 0.00001" : H2O "1 0.00001 0.00001 0.00001" : CH4 "1 0.0000001 0.0000001 0.0000001" : CFC-11 "1 0.0000001 0.0000001 0.0000001" : CFC-12 "1 0.0000001 0.0000001 0.0000001" : N2O5 "1 0.0000001 0.0000001 0.0000001" : Aerosol extinction coefficient (7.12μm) "1 0.0000001 0.0000001 0.0000001" : Aerosol extinction coefficient (8.27μm) "1 0.0000001 0.0000001 0.0000001" : Aerosol extinction coefficient (10.6μm) "1 0.0000001 0.0000001 0.0000001" : Aerosol extinction coefficient (11.76μm)
15	VMISS(n) n=1,4	Number of digits for {Variable(n) n=1,4} "99999.999 999999 999999 999999"
16	VNAME(n) n=1	Description of variable (1) "Observation time (second)" : Time of observation that corresponds to tangent height. Indicates the time elapsed from the beginning of the observation day (UTC).
17	VNAME(n) n=2	Description of variable (2)

		"Temperature (K)" : Result of retrieval computation "Pressure (hPa)" : Result of retrieval computation "Aerosol(7.12 micro-meter) extinction coefficient (km-1)" "Aerosol(8.27 micro-meter) extinction coefficient (km-1)" "Aerosol(10.6 micro-meter) extinction coefficient (km-1)" "Aerosol(11.76 micro-meter) extinction coefficient (km-1)" : Result of retrieval computation Aerosol (4 types) "Volume Mixing Ratio of O3 (ppmv)" "Volume Mixing Ratio of HNO3 (ppmv)" "Volume Mixing Ratio of NO2 (ppmv)" "Volume Mixing Ratio of N2O (ppmv)" "Volume Mixing Ratio of H2O (ppmv)" "Volume Mixing Ratio of CH4 (ppmv)" "Volume Mixing Ratio of CFC-11 (ppmv)" "Volume Mixing Ratio of CFC-12 (ppmv)" "Volume Mixing Ratio of N2O5 (ppmv)" : Result of retrieval computation Other Parameters
18	VNAME(n) n=3	Description of variable (3) "Estimation minus error (K)" : Result of retrieval computation The (-) error of temperature "Estimation minus error (hPa)" : Result of retrieval computation The (-) error of pressure "Estimation minus error (km-1)": Result of retrieval computation The (-) error of aerosol "Estimation minus error (ppmv)" : Result of retrieval computation The (-) error of other parameters
19	VNAME(n) n=4	Description of variable (4) "Estimation plus error (K)" : Result of retrieval computation The (+) error of temperature

		"Estimation plus error (hPa)" : Result of retrieval computation The (+) error of pressure "Estimation plus error (km-1)": Result of retrieval computation The (+) error of aerosol "Estimation plus error (ppmv)" : Result of retrieval computation The (+) error of other parameters
20	NSCOML	The number of Comment 1 records "2"
21	SCOM(1)	Comment 1 (1) "Number of division in the vertical direction : m" The number of records m of variables is stored.
22	SCOM(2)	Comment 1 (2) " " Blank (reserved)
23	NNCOML	The number of Comment 2 records
24	NCOM(1)	Comment 2 (1) "#TH(km) time(s) values -error +error ###"
25	X(1,1) (V(1,n),n=1,4)	Axial variable (1), variable (1), variable (2), variable (3), variable (4) (The first record of the real data section)
26	X(2,1) (V(2,n),n=1,4)	Axial variable (1), variable (1), variable (2), variable (3), variable (4) (The second record of the real data section)
⋮	⋮	⋮
24+m	X(m,1) (V(m,n),n=1,4)	Axial variable (1), variable (1), variable (2), variable (3), variable (4) (The m-th record of the real data section)

● Sample of AMES format No. 1

(Target parameters for Level 2 data observation: Temperature)

```
24
Sasano Yasuhiro
NIES/ILAS & RIS DHF
Temperature
ADEOS/ILAS project
19961231 19970107
Level 2 Unverified Data
 65.78   23.45
120 Sunrise
GOOD  V01.00
1
Tangent height (km)
4
1 0.001 0.001 0.001
99999.999 999999 999999 999999
Observation time (second)
Temperature (K)
Estimation minus error (K)
Estimation plus error (K)
2
Number of division in the vertical direction : 111

1
#TH(km)   time(s)   values -error   +error ###
  10.00 10000.000 225100    1000    1000
  11.00 10004.500 226300    1000    1000
    :       :       :         :       :
  40.00 10234.500 262300    1000    1000
    :       :       :         :       :
  80.00 10409.200 200000    3000    3000
    :       :       :         :       :
 120.00 10743.700 200000    5000    5000
```

● Sample of AMES format No. 2

(Target parameters for level 2 data observation: Volume mixing ratio of O3)

```
24
Sasano Yasuhiro
NIES/ILAS & RIS DHF
Volume Mixing Ratio of O3
ADEOS/ILAS project
19961231 19970107
Level 2 Unverified Data
 65.78   23.45
120 Sunrise
FAIR V01.00
1
Tangent height (km)
4
1 0.00001 0.00001 0.00001
99999.999 999999 999999 999999
Observation time (second)
Volume Mixing Ratio of O3 (ppmv)
Estimation minus error (ppmv)
Estimation plus error (ppmv)
2
Number of division in the vertical direction :111

1
#TH(km)   time(s)   values -error   +error ###
  10.00 10000.000   18900     900     900
  11.00 10004.500   28300    1400    1400
    :       :         :       :       :
  40.00 10234.500  723000   35000   35000
    :       :         :       :       :
  80.00 10409.200   14100    1400    1400
    :       :         :       :       :
 120.00 10743.700      51      20      20
```

5 Procedure for reading out data

The procedure for reading out data varies depending on the distribution format (HDF or Text format). The following explains how to read out each format.

5.1 HDF

ILAS & RIS DHF provides users with access routines necessary for using ILAS products (in HDF). Among them are exclusive routines for ILAS products other than the function and utilities which are standard routines provided by NCSA. Users can acquire the necessary information and data by using these exclusive routines and HDF standard libraries.

● **HDF libraries directory structure**

HDF/ -------- There are three subdirectories in this directory:

man/ ----- man page(s) for HDF.

hdf/ ----- contains the source code for the HDF 'base library', HDF utilities, ILAS standard product utilities and several MAKE files.

mfhdf/ ----- contains the netCDF/HDF part of HDF.

5.1.1 Exclusive command utilities

ILAS & RIS DHF provides users with the following exclusive command utilities in order to use ILAS products (in HDF). The respective utilities are C-language sources that will run on various UNIX computer platforms (Sun AIX). Users can make different routines and commands by using the HDF standard libraries.

Usage	Name of utility	Contents
Basic access utility	vgshow	Displays the inner structure of HDF file
	metashow	Displays V data
	sdsattr	SDS attribute output
	hdftotxt	HDF file text output (only for the Level 2 data)
	sdstobin	SDS binary output

5.1.2 Utility references

The command utility references for the above are shown below. Other than these command utilities, NCSA standard utilities and libraries are provided at the same time. For the details on the HDF libraries, see the Reference Manual (available from NCSA ftp server: ftp.ncsa.uiuc.edu, as of July 1996).

◆ vgshow

○ Implementation format

vgshow *Name of HDF file*

○ Function

Display of HDF file structure (constituents of V data and V group)

○ Practical example

% vgshow 95072188.D1 > text.file

< Example of text file contents >

```
FILE: 96366160.S1

vg:0 <1965/2> (L1_Data_Product {Meta}) has 8 entries:
  mt:0 <1962/3> nv=12 vsize=1 (Data center {})
  mt:1 <1962/4> nv=11 vsize=1 (Data product name {})
  mt:2 <1962/5> nv=5 vsize=1 (Spacecraft name {})
  mt:3 <1962/6> nv=4 vsize=1 (Sensor name {})
  mt:4 <1962/7> nv=15 vsize=1 (Investigator {})
  mt:5 <1962/8> nv=7 vsize=1 (Processing level {})
  mt:6 <1962/9> nv=21 vsize=1 (Processing time {})
  mt:7 <1962/10> nv=1 vsize=1 (Data verification level {})

vg:1 <1965/11> (L1_Observation_Info {Meta}) has 8 entries:
  mt:0 <1962/12> nv=21 vsize=1 (Observation start date/time {})
  mt:1 <1962/13> nv=21 vsize=1 (Observation end date/time {})
  mt:2 <1962/14> nv=1 vsize=2 (Path number {})
  mt:3 <1962/15> nv=1 vsize=2 (Orbit number {})
  mt:4 <1962/16> nv=10 vsize=1 (Occultaion Event number {})
  mt:5 <1962/17> nv=1 vsize=4 (Latitude of a tangent point {})
  mt:6 <1962/18> nv=1 vsize=4 (Longitude of a tangent point {})
  mt:7 <1962/19> nv=3 v size=1 (Sunrise/sunset flag {})

vg:2 <1965/20> (L1_Product_Quality {Meta}) has 5 entries:
  mt:0 <1962/21> nv=9 vsize=1 (Quality of Level1 Data {})
```

V group number

mt: Meta number

Name of V group

Name of V group

mt:1 <1962/22> nv=9 vsize=1 (Quality of IR Data {})
mt:2 <1962/23> nv=9 vsize=1 (Quality of VIS Data {})
mt:3 <1962/24> nv=9 vsize=1 (Quality of sun-edge Data {})
mt:4 <1962/25> nv=6 vsize=1 (Pocessing version {})

vg:3 <1965/26> (IR_Data_Attributes {Meta}) has 4 entries:
mt:0 <1962/27> nv=1 vsize=2 (Number of extracted effective IR data {})
mt:1 <1962/28> nv=1 vsize=8 (Start time of IR data {})
mt:2 <1962/29> nv=1 vsize=8 (End time of IR data {})

vg:4 <1965/31> (VIS_Data_Attributes {Meta}) has 4 entries:
mt:0 <1962/32> nv=1 vsize=2 (Number of extracted effective VIS data {})
mt:1 <1962/33> nv=1 vsize=8 (Start time of VIS data {})
mt:2 <1962/34> nv=1 vsize=8 (End time of VIS data {})

vg:5 <1965/36> (Sun-edge_Data_Attributes {Meta}) has 5 entries:
mt:0 <1962/37> nv=1 vsize=2 (Number of extracted effective Sun-edge data {})
mt:1 <1962/38> nv=1 vsize=8 (Start time of Sun-edge data {})
mt:2 <1962/39> nv=1 vsize=8 (End time of Sun-edge data {})
mt:3 <1962/40> nv=6 vsize=1 (IFOV angle unit {})

vg:6 <1965/42> (Orbit_Data_Attributes {Meta}) has 6 entries:
mt:0 <1962/43> nv=1 vsize=2 (Number of Orbit data {})
mt:1 <1962/44> nv=1 vsize=8 (Start time of Orbit data {})
mt:2 <1962/45> nv=1 vsize=8 (End time of Orbit data {})
mt:3 <1962/46> nv=6 vsize=1 (Observation time unit {})
mt:4 <1962/47> nv=2 vsize=1 (Spacecraft position unit {})
mt:5 <1962/48> nv=9 vsize=1 (Spacecraft velocity unit {})

sd: SDS number

vg:7 <1965/49> (IR_Data {SDS}) has 4 entries:
sd:0 <700/50> (Observation data of IR)
sd:1 <700/52> (Drift correction coefficient of IR)
sd:2 <700/54> (Zero-drift correction coefficient of IR)
sd:3 <700/56> (Processing result flag of IR)

vg:8 <1965/83> (VIS_Data {SDS}) has 4 entries:
sd:0 <700/84> (Observation data of VIS)

sd:1 <700/86> (Drift correction coefficient of VIS)
sd:2 <700/88> (Zero-drift correction coefficient of VIS)

sd:3 <700/90> (Processing result flag of VIS)

vg:9 <1965/141> (Sun-edge_Data {SDS}) has 7 entries:
sd:0 <700/142> (Observation data of Sun-edge)
sd:1 <700/144> (Upper sun-edge of IFOV position)
sd:2 <700/145> (Bottom sun-edge of IFOV position)
sd:3 <700/146> (IFOV angle)
sd:4 <700/147> (Drift correction coefficient of sun-edge)
sd:5 <700/149> (Zero-drift correction coefficient of sun-edge)
sd:6 <700/151> (Processing result flag of sun-edge)

Name of SDS data

vg:10 <1965/244> (Orbit_Data {SDS}) has 3 entries:
sd:0 <700/245> (Observation time)
sd:1 <700/247> (Spacecraft position)
sd:2 <700/249> (Spacecraft velocity)

sd: SDS number

◆ metashow

○ Implementation format

metashow *Name of HDF file* *[Vgroup number]*

○ Function

Enters the V group number displayed by vgshow and delivers a standard output of the contents in the form: Name of V data = Value.

[ ] can be left blank. In this case, all the V data are displayed.

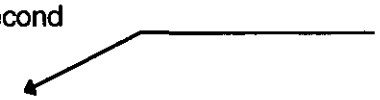
○ Practical example

% metashow 95072188.D1 1 > outfile

<Example of outfile contents with [ ] not entered>

```
HDF file:96366160.S1

----- vg no:0  Vgroup name:L1_Data_Product (8 entries) -----
Data center=ILAS&RIS DHF
Data product name=96366160.S1
Spacecraft name=ADEOS
Sensor name=ILAS
Investigator=Yasuhiro Sasano
Processing level=Level 1
Processing time=19960906 00:00:00.000
Data verification level= U

----- vg no:1  Vgroup name:L1_Observation_Info (8 entries) -----
Observation start date/time=19961231 06:39:13.000
Observation end date/time=19961231 06:45:13.000
Path number=160
Orbit number=115
Occultaion Event number=961231160S
Latitude of a tangent point=0.000000
Longitude of a tangent point=0.000000
Sunrise/sunset flag=SSE

----- vg no:2  Vgroup name:L1_Product_Quality (5 entries) -----
```

```
Quality of Level1 Data=GOOD
Quality of IR Data=GOOD
Quality of VIS Data=GOOD
Quality of sun-edge Data=GOOD
Pocessing version=V01.00

----- vg no:3  Vgroup name:IR_Data_Attributes (4 entries) -----
Number of extracted effective IR data=744
Start time of IR data=23953.000000
End time of IR data=24313.000000

----- vg no:4  Vgroup name:VIS_Data_Attributes (4 entries) -----
Number of extracted effective VIS data=744
Start time of VIS data=23953.000000
End time of VIS data=24313.000000

----- vg no:5  Vgroup name:Sun-edge_Data_Attributes (5 entries) -----
Number of extracted effective Sun-edge data=2040
Start time of Sun-edge data=23953.000000
End time of Sun-edge data=24313.000000
IFOV angle unit=radian

----- vg no:6  Vgroup name:Orbit_Data_Attributes (6 entries) -----
Number of Orbit data=744
Start time of Orbit data=23953.000000
End time of Orbit data=24313.000000
Observation time unit=second
Spacecraft position unit=km
Spacecraft velocity unit=km/second

----- vg no:7  Vgroup name:IR_Data (4 entries) -----

----- vg no:8  Vgroup name:VIS_Data (4 entries) -----

----- vg no:9  Vgroup name:Sun-edge_Data (7 entries) -----

----- vg no:10  Vgroup name:Orbit_Data (3 entries) -----
```



◆ sdsattr

○ Implementation format

sdsattr *Name of HDF file [V group number] [SDS num ber]*

○ Function

Enters the V group number (n of vg:n)and SDS number (m of vg:m), and feed back the SDS information to the standard output.

Displaycontents (contents of Metadata)

[ ] can be left blank. In this case, all the SDS data information is displayed.

vg	:	V group number
sd	:	SDS number
rank	:	Number of dimensions
dim0	:	Number of first dimensional data
dim1	:	Number of second dimensional data
dim2	:	Number of third dimensional data
ntype	:	Data type
name	:	Name of SDS data

○ Practicalexample

```
% sdsattr 95072188.D1 1 1 > text.file
```

< Example of text file with [ ] not entered>

```
FILE: 96366160.S1
 vg sd rank dim0 dim1 dim2 ntype     name
-------------------------------------------------------------------
  7  0    2   744   44    REAL      Observation data of IR
  7  1    2   2     44    REAL      Drift correction coefficient of IR
  7  2    2   2     44    REAL      Zero-drift correction coefficient of IR
  7  3    2   744   44    CHAR      Processing result flag of IR
  8  0    2   744   1024  REAL      Observation data of VIS
  8  1    2   2     1024  REAL      Drift correction coefficient of VIS
  8  2    2   2     1024  REAL      Zero-drift correction coefficient of VIS
```

8	3	2	744 1024	CHAR	Processing result flag of VIS
9	0	2	2040 1024	SHORT	Observation data of Sun-edge
9	1	2	74 1024	REAL	Upper sun-edge of IFOV position
9	2	2	74 1024	REAL	Bottom sun-edge of IFOV position
9	3	2	74 1024	REAL	IFOV angle
9	4	2	2 1024	REAL	Drift correction coefficient of sun-edge
9	5	2	2 1024	REAL	Zero-drift correction coefficient of sun-edge
9	6	2	2040 1024	CHAR	Processing result flag of sun-edge
10	0	1	744	DOUBLE	Observation time
10	1	2	744 3	DOUBLE	Spacecraft position
10	2	2	744 3	DOUBLE	Spacecraft velocity

◆ sdstobin

○ Implementation format

sdstobin *Name of HDF file Name of output file V group number SDS number*

○ Function

Enters V group number (n of the vg:n) and outputs SDS (multi-dimensional array data) as binary data.

The binary data are stored in the sequence produced by the SDS as a combination of the number of dimensions in the SDS information output by "sdsattr". Array elements dim0, dim1, dim2, and so forth are in the order of:

[0][0]
[0][1]
:
[0][dim1]
[1][0]
[1][1]
:
[dim0][dim1-1]
[dim0][dim1] (two dimensional array)

○ Practical example

% sdstobin 95072188.D1 outfile.bin 1 1

◆hdftotxt

○ Implementation format

hdftotxt *Name of text file* *Name of output file*

○ Function

Delivers a HDF file of Level 2 Data in the text format (AMES format).

○ Practical example

% hdftotxt 95072188.D1 amesfile

(Please see AMES Format Sample for the output file: A-29 and A-30)

5.2 Text format (AMES Format)

The following command is provided for reading out text data. This command is a C language source that will run on various UNIX computer platforms (Sun, AIX).

◆ amestxt

○ Implementation format

amestxt *Name of text file* *Name of output file*

○ Function

Extracts the data section from the AMES format text file (the part other than the header records) and feeds it back to the standard output.

○ Practical example

% amestxt amesfile > outfile.

(Please see AMES Format Sample for the output file: A-29 and A-30)

APPENDIX B

ILAS DATA DISTRIBUTION SYSTEM USER'S GUIDE

Version 1.0

Data delivery subsystem

1. Operational Procedures

(1.1) How to get started

1) Log-in to ILAS & RIS DHF

(Domain: distdhf. nies.go.jp)

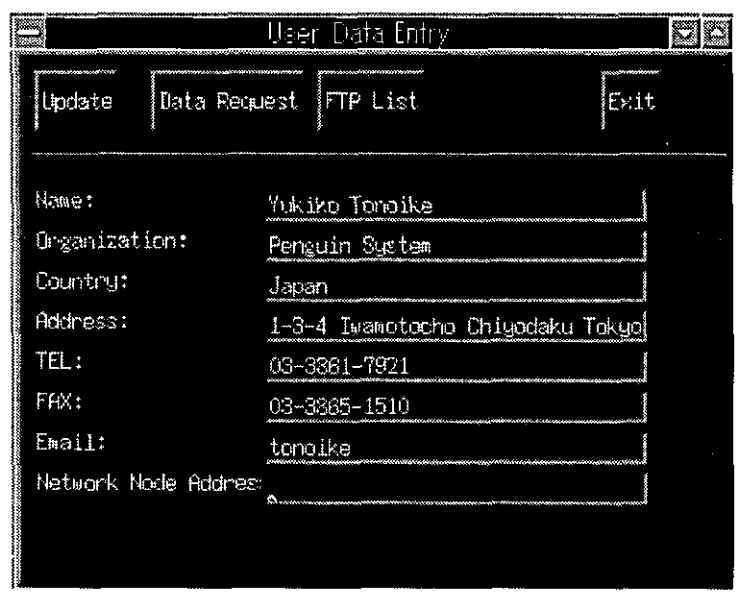
```
> telnet distdhf.nies.go.jp
> login: ********
> password : : ********
```

*Your log-in ID and password should be those which have already been assigned to you.

2) After logging-in, the system prompts you to select a GUI or TTY to be displayed. Enter the number.

```
##  ------------------------------------------  ##
##          Welcome to ILAS & RIS DHF           ##
##  ------------------------------------------  ##
##  Data shown below is available.
##  Confirmed     : 1996/10/011 - 1996/10/05
##  Verified      : 1996/10/01  - 1996/10/07
##  Unverified    : 1996/10/01  - 1996/10/10
##  ------------------------------------------  ##
   Select following type
   1. GUI  2. TTY  3. EXIT
   -> 1
```

3) If GUI is selected, the User Data Entry screen (Fig. 1.1) is displayed.



(Fig. 1.1)

- Update – User data are revised after a changing a value in the entry column.
- Data Request – A screen for entering the level, etc. is displayed.
- FTP List – A list of the data requested by FTP is displayed.
- Exit – Exit the data distribution subsystem.

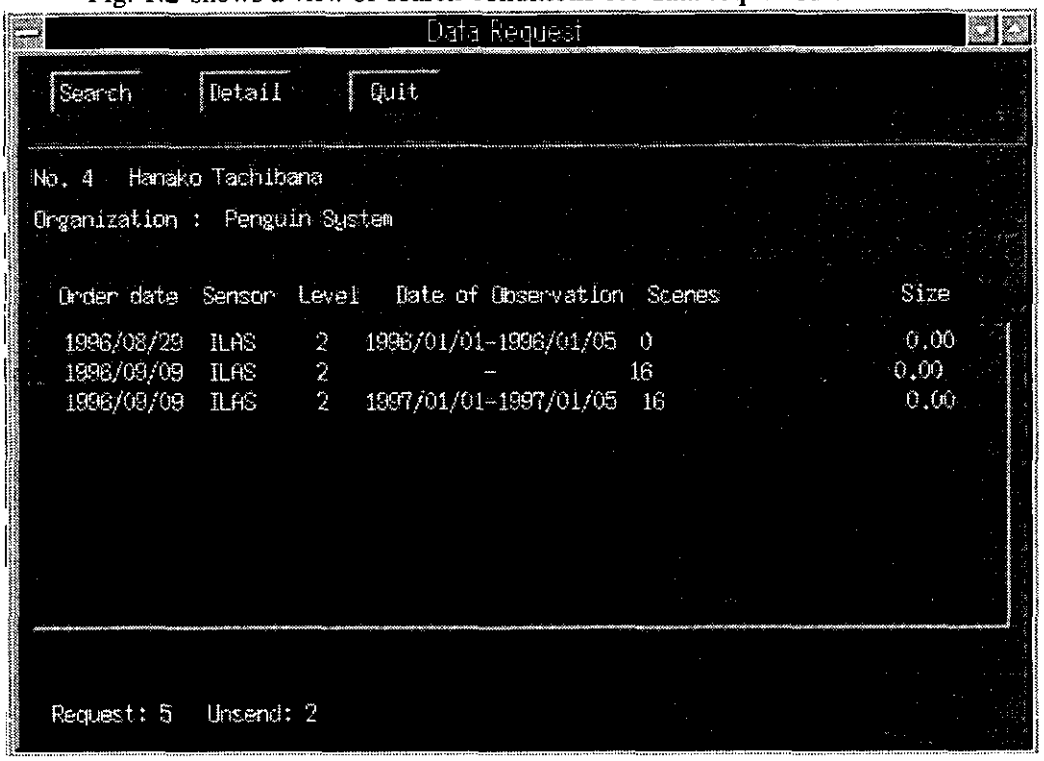
(1.2) The data in each column change if there is a change in the registered data.

1)Name - Name of user
2)Organization -Name of organization of user
3)Country - Country
4)Address - Address
5)TEL - Telephone number
6)FAX - Facsimile number
7)Email - Email address
8)Network Node Address - Networknode address

(1.3) Select the " Update" button after making any changes.

(1.4) Select the " Data Request" button . The data request screen (Figure 1.2) will appear.

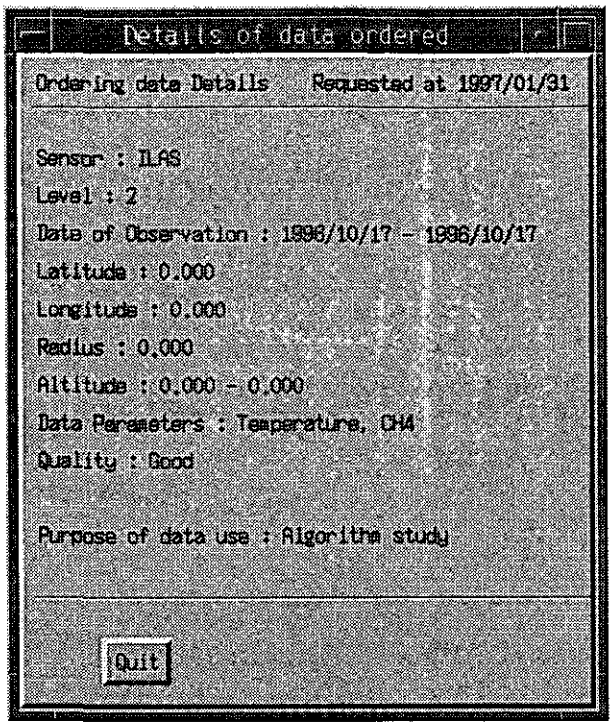
Fig. 1.2 shows a view of search conditions for data requested thus far.



(Fig. 1.2)

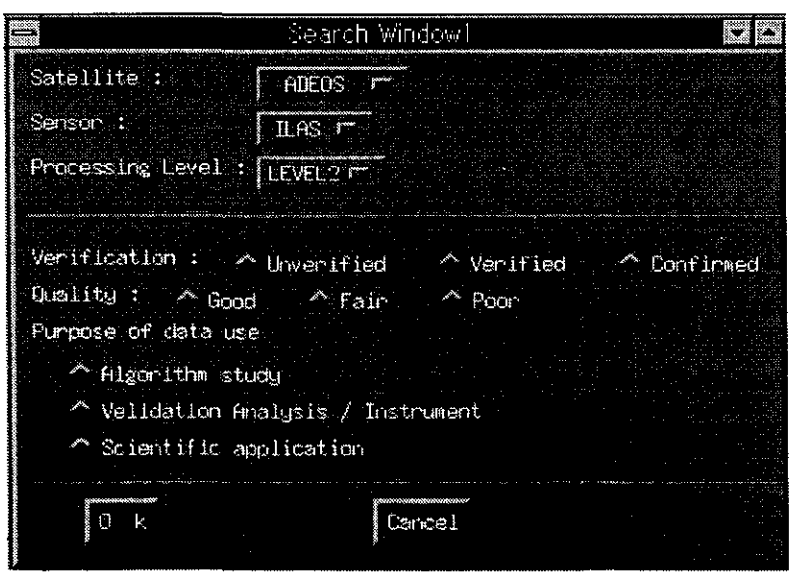
- Order - Number of data items ordered thus far
- Unsent - Number of data items which have not yet been sent

1) Search ----Fields for entering search conditions are displayed.
2) Detail ----The contents of the data previously requested are displayed.
Press the " Detail" button to check the contents.
The requested contents are displayed.(Fig. 1.3)



(Fig. 1.3)

2) Select the " Search" button to search the data.
Fields for entering the level, etc. are displayed. (Fig. 1.4)



(Fig. 1.4)

(6) Select the items:

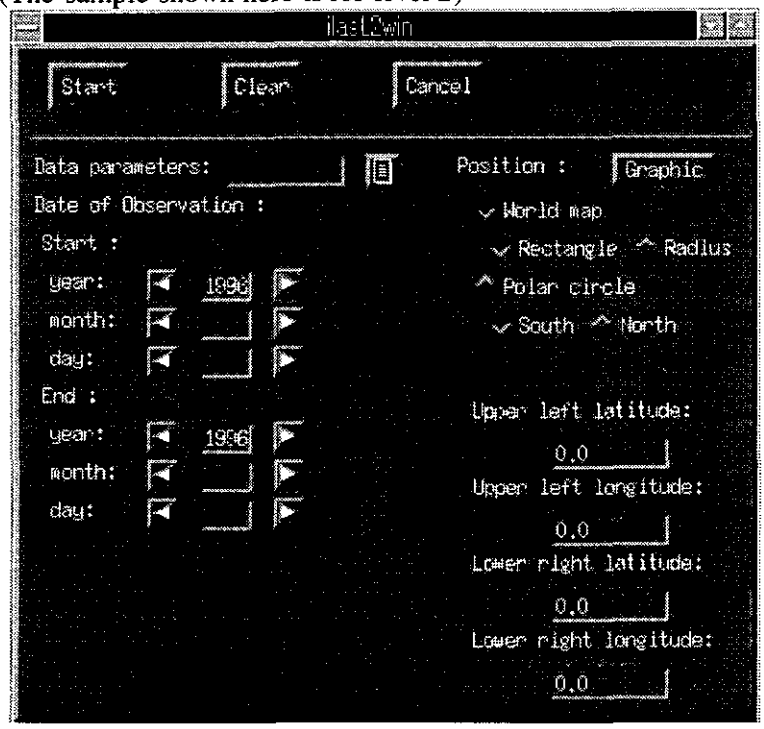
1) Satellite -- Name of sensor (ADEOS only)
2) Sensor -- Name of spacecraft (ILAS only)
3) Processing Level -- Level (1 or 2)
4) Verification -- Verification stage (select one of those listed)
5) Quality -- Quality of data (multiple values can be selected)
If only one is selected, the following search conditions apply:

a. Good only-- Only data of high quality are searched
b. Poor only-- Both good and poor data are searched
c. Fair only-- Good, poor, and fair data are all searched

6) Purpose of data use (Please select one of the choices)

(7) Select the " OK" button when selection is finished.

(8) A screen (Fig. 1.5) for entering the search conditions in detail is then displayed.
(The sample shown here is for level 2)



(Fig. 1.5)

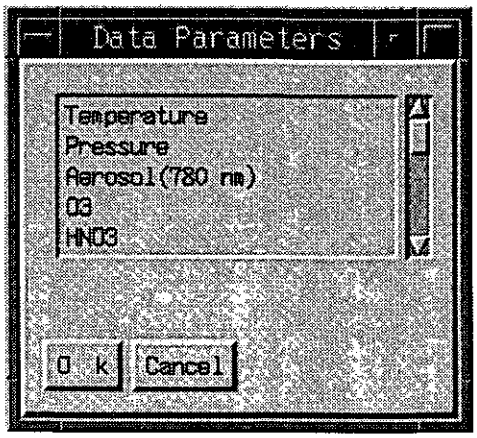
* On the Level 1 search screen, only the Data parameter input column is missing; everything else is the same.

(9) Enter the search conditions in the respective entry columns.

1)Data Parameters -Data type

Click the mark on the right side of the blank column.

The list (Fig. 1.6) will appear. Select the required types from the list (multiple values can be selected) and press the " OK" button. The selected types are then displayed. (Direct entry is not possible here.)



(Fig. 1.6)

2) Date of Observation - Observation period

Either enter the observation period in the input column or place the numbers on display by clicking the arrows on the right and left sides.

3) Position - Latitude and longitude

Either enter the latitude and longitude in the entry column or from the map displayed by selecting the " Graphic" button. It is possible to select the usual world map or the polar circle for entering from the map.

- World map - Usual (Fig. 1.7)

  Rectangular designation or center-and-radius designation can be selected:

  Rectangle.. -Rectangular designation

  Circle.. -Center-and-radius designation

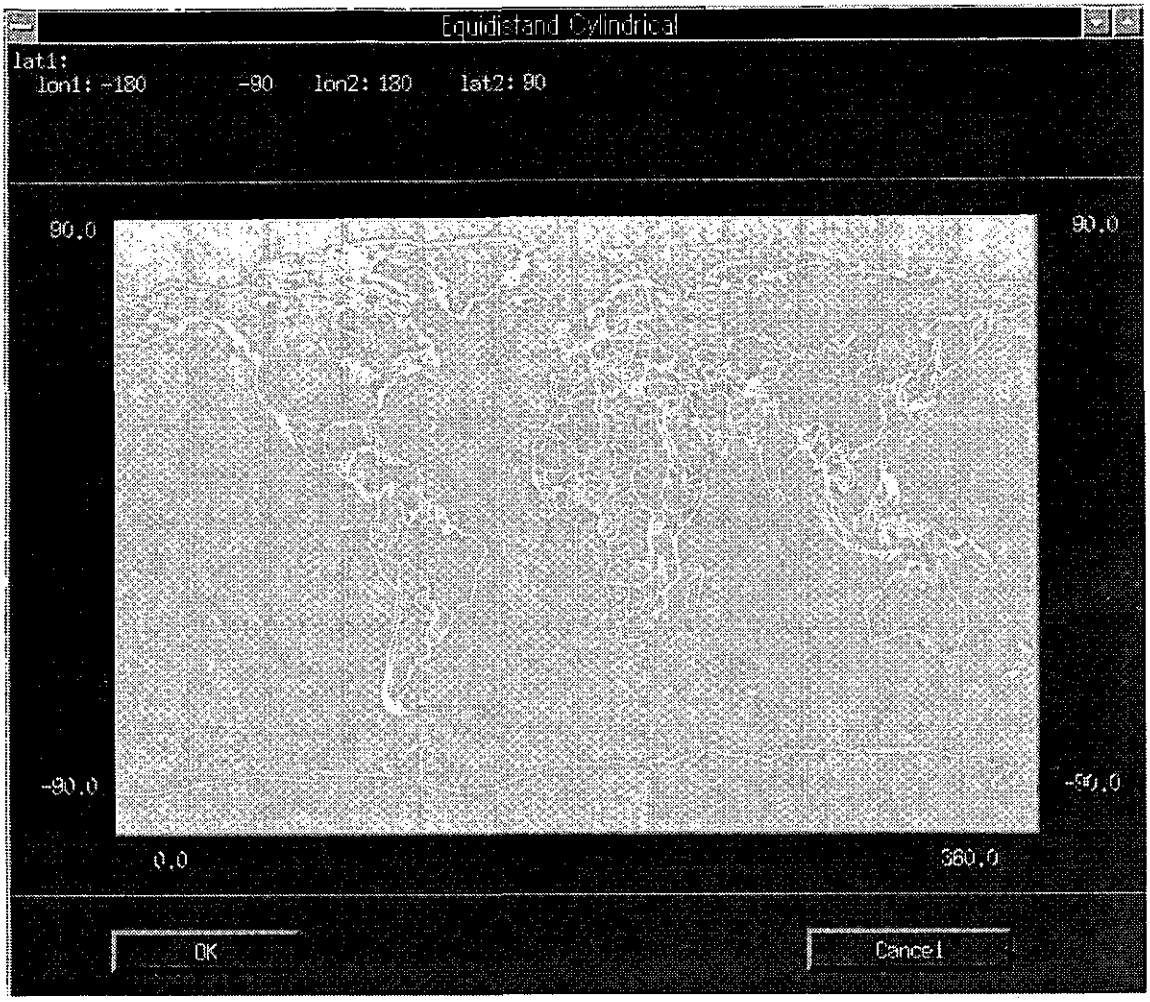
- Polar circle -Polar circle (Figure 1.8)

  The South Pole or the North Pole can be selected:

  South -South Pole

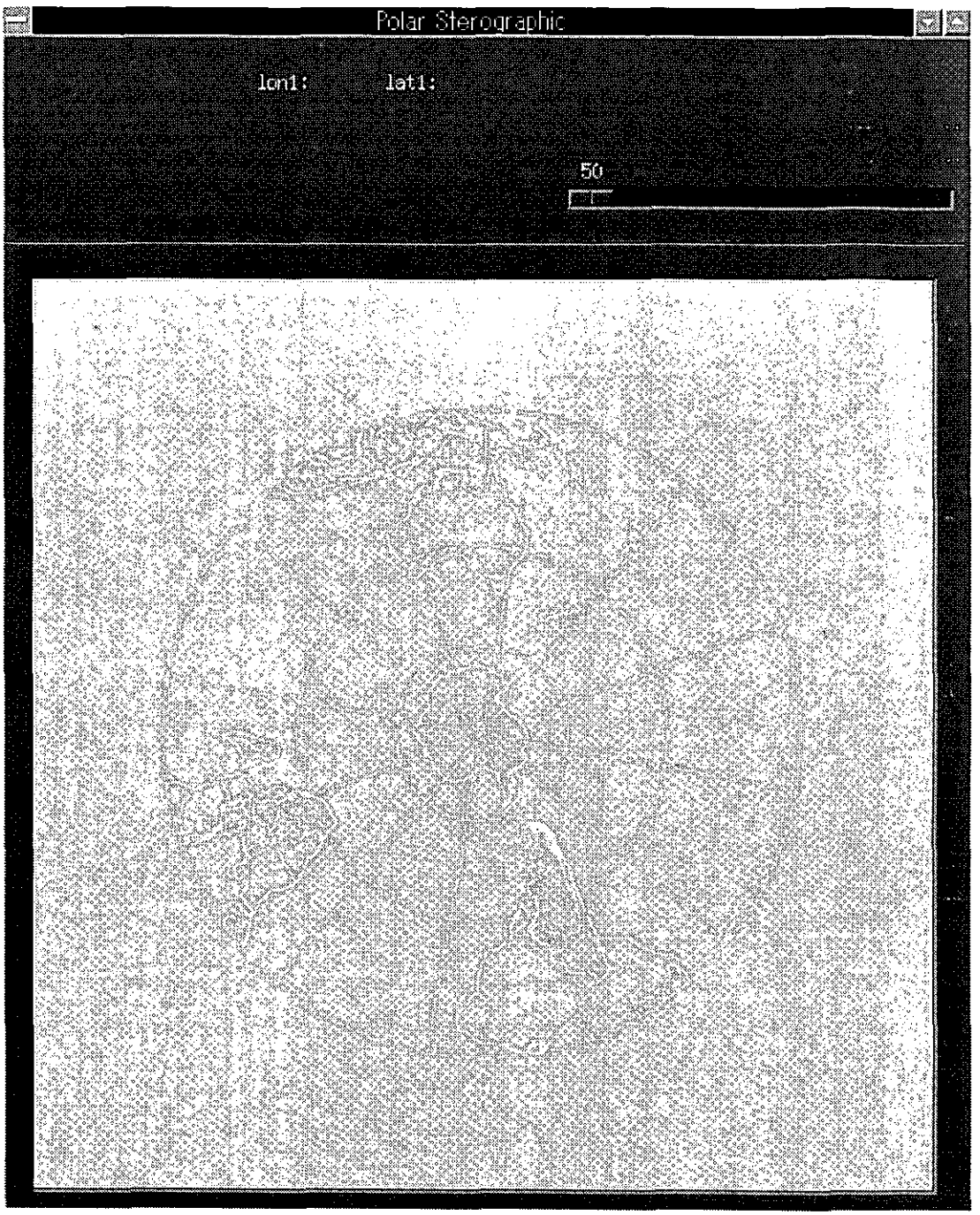
  North -North Pole

World map (usual)



(Fig. 1.7)

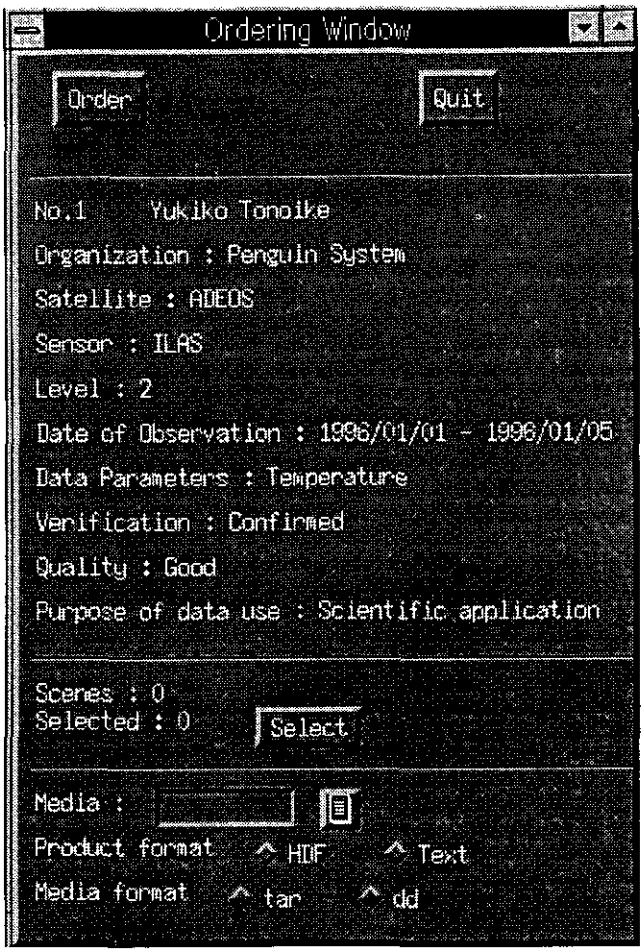
- Rectangular entry: Press the left mouse button at the starting point.
  The rectangle enlarges as the mouse is moved with the button kept pressed. Release the button at the finishing point.
  If the finishing point is to the left of the starting point, the rectangle extends over both ends.
  The latitudes and longitudes of the designated rectangle are displayed on the map. Check them and press the " OK" button.
- Center-and-radius designation: Press the left mouse button at the center.
  Then set the radius by moving the slider in the upper right of the picture. (The sample image does not show the slider as it is for rectangular entry.)



(Fig. 1.8)

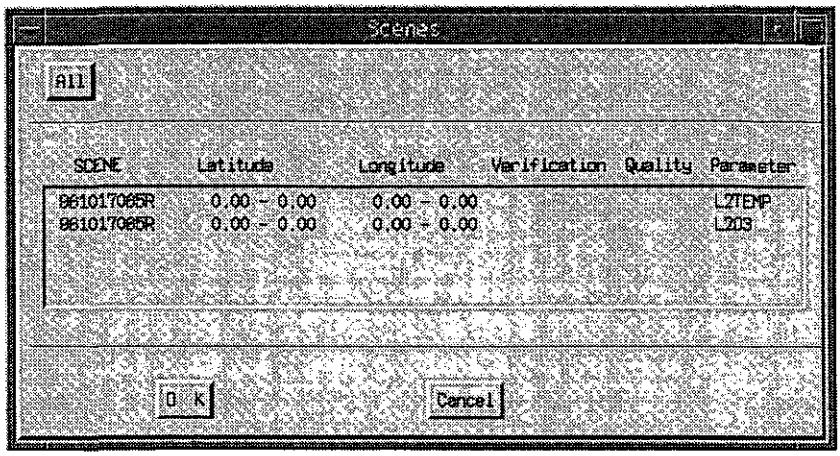
Both rectangular and circular input can be used.
The entry method is the same as that for Figure 1.7.

(10) Select the " Start" button after entering the search conditions.
The search is carried out under the conditions entered.
(11)A n image for ordering will appear after the search is completed. (Fig. 1.9)



(Fig. 1.9)

* This picture shows the search conditions entered up to " Scenes" The entries necessary for ordering are " Media" and those below. Press the " Select" button on the right side of " Scenes" for the list of scenes retrieved by the search. The list (Figure 1.9.1) will appear on the display.

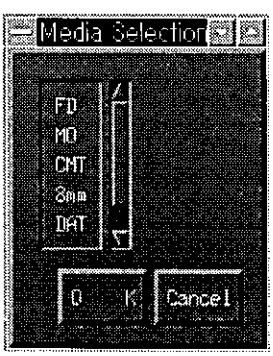


(Fig. 1.9.1)

Select the necessary scenes from the list. (Multiple values can be selected)
Select " All" if all scenes are needed.
Press " Quit" after completing the selections.

(12) S elect the information required for ordering the data.

1) Media -- Select the medium to be requested.
Click the mark on the side of the entry column. A list of Media names will appear on the display. (For data acquisition by FTP, select " FTP" .)



(Fig. 1.10)

Select a medium and press the " OK" button.
(MO and CD can not be selected at present.)

2) Product format --.Select either " HDF" or " Text" format only for level 2.

3) Media format -- Select the format for downloading on the medium requested.
(not necessary for FTP)

(13) Press the " Order" button after completing the selections. The data will be ordered.
The following screen is displayed when the ordering is completed.

(Fig. 1.11)

(14) Press the " OK" button. (Returns to the Request Screen)

1) The product will be sent to the user as soon as the operators finish the compiling. We will also send mail to the user informing the number of scenes, the data size, and a reference number for inquiries

2) For products by FTP, we will compile the data, and send mail to the user after completion. The user then performs the FTP procedure by using the name of directory containing the data that was informed by the mail. (These data can be also viewed by choosing the FTP List button from the User Data Input Screen when logging in.)

(2) How to Use the TTY Screen

*1) Underlined sections indicate user input

2) Commands on any screen may be entered in either capital or minuscule letters.

(2.1) How to Get Started

Please select 2.TTY from the screen which first appears after start-up. (For information on screens, please refer to the instructions for using the GUI screen). The User Update screen will appear after start-up (Fig. 2.1).

```
                User Data Update

  1. Name         : Taro Tanaka
  2. Organization: Penguin System
  3. Country      : Japan
  4. Address      : 1-3-4 Iwamotocho Chiyodaku Tokyo
  5. TEL          : 03-3861-7921
  6. FAX          : 03-3865-1510
  7. Email        : taro@nies.go.jp
  8. Network Node Address    :

 If you need to change these data, input number.
   Valid Command <Update, Next, Exit>


 ENTER COMMAND  >
```

(Fig. 2.1)

<Commands>

Update- -Data are updated.

Next --The next (requested) screen is displayed.

Exit --Terminates the data supply system

(2.2) Please enter the number(s) of the item(s) you wish to update.

Example: Telephone number (underlined sections are the entered values)

ENTER COMMAND # NUMBER > 5

TEL : 03-3861-7922

When the updating (revision) is completed, please enter UPDATE on the COMMAND line. This will update the listings in the database.

ENTER COMMAND # NUMBER > update

(2.3) Then, please enter NEXT. The Request Screen will then appear (see Fig. 2.2).

ENTER COMMAND # NUMBER > next

(2.4) Request Screen

```
                Data Request

                Ordering Data List

 No.  Order Date  Sensor  Level  Date of Observation  Scenes  Size
 1    96/10/01    ILAS    2      960917 - 960920      27      100
 1    96/10/01    ILAS    2      960917 - 960920      27      100
 1    96/10/01    ILAS    2      960917 - 960920      27      100

      Valid Command <Next, Cancel, Exit>

      ENTER NUMBER # COMMAND >
```

(Fig.2.3)

This screen displays all the data which have been requested thus far.

<Commands>

Next-- Displays the next screen (showing level, quality, etc.)

Cancel --- Displays the preceding (i.e., data update) screen.

1) Please enter NEXT. This will display screens showing level, data quality, etc. (see Fig. 2.4).

ENTER COMMAND > next

(2.5) Inventory Search Screen 1

```
          Inventory  Search  Screen 1

 Give the following information.

   1. Satellite          :  ADEOS
   2. Sensor             :  ILAS
   3. Level              :  2
   4. Verification       :  Confirmed
   5. Quality            :  Good
   6. Purpose of data use  :  Algorithm studies

  Valid Command <Next, Cancel, Exit>

   ENTER  NUMBER # COMMAND >
```

(Fig. 2.4)

<Commands>

Next --- Screen inputs detailed search conditions

Cancel --- Displays previous screen

1) When the following items are displayed on the screen, default values are already set, so there is no need to enter if no updating is required. (Default values are shown on the right side).

- Satellite --- ADEOS
- Verification --- Confirmed
- Quality --- Good

* Item #1 (Satellite) cannot be set to anything except ADEOS, so even if a number is entered, an input screen will not be displayed.

2) Entering the number of an item for which a value is entered will display input screens for each item. (See 2.9 for explanations of these input screens).

```
ENTER NUMBER # COMMAND > 2
```

3) When the settings have been completed, please enter NEXT. A detailed inventory search screen will then appear (see Fig. 2.5).

(2.6) Inventory Search Screen for Level 2 (Example: ILAS Level 2 data)

```
                ILAS Level2Screen

    Sensor          : ILAS
    Level           :  2
    Verification    : Confirmed
    Quality         : Good
    Purpose         : Algorithm studies

  Please set the searching conditions below.

     1. Date of Observation  :  1996/10/01 — 1996/10/05
     2. Position  :latitude  : **.** -  **.**
                  longitude  : **.** -  **.**
     3. Data Parameters      : Temparature, H20

  Valid Command <SearcH, Cancel, Exit>

  ENTER NUMBER # COMMAND >
```

(Fig. 2.5)

<Commands>>

Search — Begins search

Cancel — Returns to the previous screen (level input screen, etc.)

1) The number of the item for which you wish to enter a value should be entered on the COMMAND line.

ENTER NUMBER # COMMAND > 1

Since the input screen is displayed for this item, please make your entry. (Input screens are explained in 2.9).

ENTER NUMBER # COMMAND > 1

2) When you have finished your inputting, please enter SEARCH.

After the data search has been completed, the results of this search will be displayed (see Fig. 2.6).

(2.7) Screen display of search results

```
                Searching Result

Satellite :ADEPS
Sensor    : ILAS
Level     : 2

Date of Observation  : 1996/10/01 - 1996/10/05
Position : latitude  : **.** - **.**
       longitude     : **.** - **.**
Parameters           : Temperature, H2O
----------------------Result ----------------------
 Number of scenes     : 56

    Good        :  3
    Fair        :  38
    Poor        :  15

 Valid Command <Order, Cancel, Exit>

ENTER COMMAND >
```

(Fig. 2.6)

<Commands>

Order --- Displays the Ordering Screen

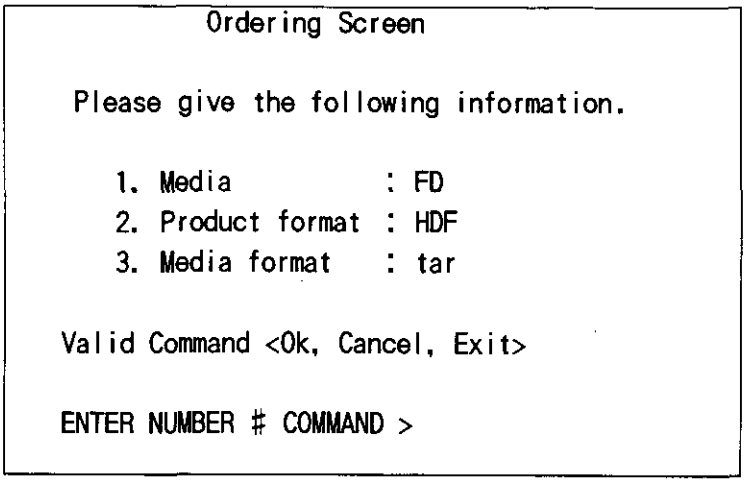
Cancel --- Returns to the Request Screen

(This cancels the search conditions which had previously been inputted)

1) To confirm the search results, please enter ORDER on the COMMAND line. This will display the Data Ordering screen (see Fig. 2.7).

ENTER COMMAND > Order

(2.8) Ordering Screen



(Fig. 2.7)

<Commands>
OK — Orders data
Cancel — Returns to the Request Screen

1) Items are set (You can set up to 3).
Enter on the COMMAND line the number(s) of the item(s) you wish to set.
The following is an explanation of input methods and input screens for each item.

<Media>

(1) ENTER NUMBER # COMMAND > 1

(2) The Media Selection Screen will be displayed (see Fig. 2.7.1).

```
            Media Selection
        1. FD (UNIX)
        2. FD (DOS)
        3. FD (Macintosh)
        4. MO
        5. CMT
        6. 8mm
        7. DAT
        8. FTP

        Valid Command <Cancel>

    ENTER NUMBER # COMMAND >
```

(Fig. 2.7.1)

1) Please enter the number of the medium.

ENTER NUMBER # COMMAND > 1

Entering the number and pushing the Return key will return to the previous screen.

2) If no entry is made, entering Cancel will return to the previous screen.

<Product format >

(1) ENTER NUMBER # COMMAND > 2

(2) The Product Format screen will be displayed (see Fig. 2.7.2).

```
        Product Format
    1. HDF
    2. TEXT

    Valid Command <Cancel>

    ENTER NUMBER # COMMAND >
```

(Fig. 2.7.2)

1) Please enter the number

ENTER NUMBER # COMMAND > 1

Entering the number and pushing theReturn key will return to the previous screen.

2) If no entry is made, entering Cancel will return to the previous screen.

<Media Format>

(1) ENTER NUMBER # COMMAND > 3

(2) The Media Format screen will be displayed.

```
            Media Format
        1. tar
        2. dd

        Valid Command <Cancel>

        ENTER NUMBER # COMMAND >
```

(Fig. 2.7.3)

1) Please enter the number

ENTER NUMBER # COMMAND > 1

Entering the number and pushing the Return key will return to the previous screen.

2) If no entry is made, entering Cancel will return to the previous screen.

2) When all items have been set, please enter OK.

This orders the data.

ENTER NUMBER # COMMAND > OK

3) When the data ordering has been completed, the following message will be displayed.

Do you want to order another data ? (y/n) —>

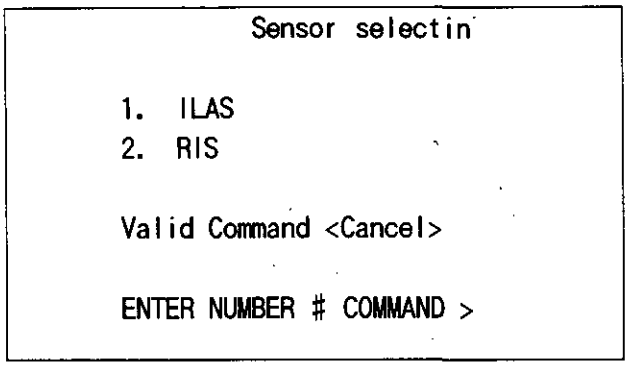
(1) If you wish to continue ordering data under different conditions, please enter y and press the Return key. This will return you to the Request Screen.

(2) If you have completed your data ordering, please enter n and press the Return key. This will terminate the data supply system.

4) The data will be compiled by an operator and sent later. At that time, the user will be sent mail confirming the number of scenes, the data size, and the order number. Please note that users seeking to acquire data by FTP will be notified of the directory name by E-mail as soon as the data are ready. Therefore, users should themselves run FTP within the designated (1 week) time limit.

(2.9) Explanation of Search Conditions Input Screen

1) Sensor Selection Screen



1) Please enter the number of the sensor you wish to set.

ENTER NUMBER # COMMAND > 1

Entering this number will return you to the previous screen.

2) If you do not set any sensors, please enter CANCEL.

This will return you to the previous screen. Previously set values will not be affected.

2) Processing Level Selection Screen

```
Processing Level

1. Level 1
2. Level 2

Valid Command <Cancel>

ENTER NUMBER 3 COMMAND >
```

* Input method is the same as for the Sensor Name Selection Screen

3) Verification Stage Selection Screen

```
Verification

1. Unverified
2. Verified
3. Confirmed

Valid Command <Cancel>

ENTER NUMBER # COMMAND >
```

* Input method is the same as for the Sensor Name Selection Screen

4) Data Quality Selection Screen

```
Quality

1. Good
2. Fair
3. Poor

Valid Command <Cancel>

ENTER NUMBER # COMMAND >
```

* Input method is the same as for the Sensor Name Selection Screen

5) Purpose of Use Selection Screen

```
Quality

1. Algorithm Studies
2. Validation analysis /
   Instrument Characterization
3. Scientific Application

Valid Command <Cancel>

ENTER NUMBER # COMMAND >
```

* Input method is the same as for the Sensor Name Selection Screen

6) Observation Date Input Screen

```
        Date of Observation

    1.  Start   : 19961001
    2.  End     : 19961005

    Valid Command <Ok, Cancel>

    ENTER NUMBER # COMMAND >
```

(1) When this screen is displayed, first enter the start date after Start : Entering the start date and pressing the Return key will take you to the End line, on which you should enter the end date and press the Return key

(2) Even if you have finished entering the dates, you can still input dates by entering the number at the following prompt:

ENTER NUMBER # COMMAND > 1

To re-input the start date, enter 1; to re-input the end date, enter 2.

(3) If you set the inputted date(s) as a search condition, please enter OK. If you wish to cancel what you have inputted, please enter CANCEL. This will return you to the previous screen.

7) Position Input Screen

First, a screen will appear which offers the selection of either a rectangle or a circle.

```
Position

1. Rectangle
2. Circle

Valid Command <Cancel>

ENTER NUMBER # COMMAND >
```

Please enter the number.

This will cause the Position Input Screen to appear.

<Rectangle>

```
Longitude and Latitude

1. Upper left longitude   :
2. Upper right latitude   :
3. Lower left longitude   :
4. Lower right longitude  :

Valid Command <Ok, Cancel>

ENTER NUMBER # COMMAND >
```

(1) As with the Observation Date Input Screen, entries will be made in order from top to bottom; the method for updating inputted data is also the same.

(2) If you set inputted values as a search condition, please enter OK. If you wish to cancel what you have inputted, please enter CANCEL.

<Circle>

```
        Longitude and Latitude

    1.  latitude   :
    2.  longitude  :
    3.  radius     :

     Valid Command <Ok, Cancel>

    ENTER NUMBER # COMMAND >
```

* Inputting is done the same way as with Rectangle.

8) Data Parameter Input Screen

```
                Data Parameters

        1.    Temperature
        2.    Pressure
        3.    Aerosol (780 nm)
        4.    03
        5.    HN03
        6.    N02
        7.    N20
        8.    H20
        9.    CH4
        10.   CFC11
        11.   CFC12
        12.   N205
        13.   AEROSOL  (7.12 μm)
        14.   AEROSOL  (8.27 μm)
        15.   AEROSOL  (10.6 μm)
        16.   AEROSOL  (11.76 μm)

        Valid Command <Ok, Cancel>

        ENTER NUMBERS # COMMAND >
```

(1) Enter the data parameter(s). (Multiple entries possible)

ENTER NUMBERS # COMMAND > 1,2,3

When multiple selections are made, please type a' before the first number and a' after the final number.

(2) If you set inputted data parameters as a search condition, please enter OK. If you wish to cancel what you have inputted, please enter CANCEL.

In either case, you will then return to the previous screen.