1. *Development of the providing and management system for the evaluated-information on the satellite-data characteristics*

Hirohito Kojima[1], Shigeyuki Obayashi[2] and Akihiro Furuta[3]

Abstract: Due to the advancement and diversification of the earth-observation satellite, this paper points out the necessities of providing and managing the Evaluated Information (termed EI) on the characteristics of the satellite data newly observed. As occasion demands from the end-users, those evaluated-information are continuously produced according to the following points of view: 1) pre-image processing, 2) image analysis, and 3) post-image processing. Furthermore, we have been tackled to construct the Internet based-supporting system for providing the EI, and to investigate the practical use of those through the network. The structures of the data sets on the EI are divided into two sites as the "Web site" and the "Data Base (DB) site", respectively. A huge amount of information resource in the Web site is managed by the "DSMS (Data Set Management Systems)". Without being disturbed in the management for the data sets, the users can only attend to retrieve the stored data sets through environment. Based on the unitary management of the data sets according to the kinds of satellites, the improvement of the work efficiency as well as the continuity in collecting, storing and managing the data sets on the EI could be achieved. Such a systematized approach might be essential to promote the future progressive satellite data.

Key Words: *evaluation of image characteristics, satellite remote sensing data, Data Set Management*

1. Introduction

Nowadays, satellite remote sensing data with ground resolution as fine as several meters is made available, and methods of earth observation are reaching a turning point. Though spatial resolution and spectral resolution of those data become higher, it is pointed out that conventional concept of image processing and analysis, method can not be used as they are thereby posing a problem. Clarification of "Utilities and Limitations" of the next generation high-resolution satellite remote sensing data, as well as exploration of possible fields of application now become an urgent and indispensable issue.

When looking back on results of image characteristics evaluation for the satellite remote sensing data made till today, it is noticed that majority of evaluations was to merely verify whether the design specification of the satellite remote sensing sensor and system correction accuracy were met or not. However, for those who utilize the data, image quality (i.e., noise, cloud, shade information, etc.) after system correction and accuracy of ground surface recognition by the image are more important. Further, when basic image processing or analysis method is applied, (Evaluation information for data utilization) such as how much processing accuracy is improved compared with conventional data obtained from the satellite is required. If evaluated information on the image characteristics derived satellite remote sensing data together with next generation high-resolution satellite remote sensing data, the issue will become vital for effective utilization of the satellite remote sensing data.

Based on the above backgrounds, this study is directed for investigation how should the satellite remote sensing data image characteristics be evaluated from user standpoints. At the same time, RIC (The providing and management system for the evaluated-information on the satellite Remote sensing Image Characteristics) has been developed. With this system, characteristics evaluation information is controlled by kind of satellite-unit in unified manner, and everyone can easily access to any of those information through Internet environments.

2. Significance of this study

2.1 Necessity of providing the evaluated information of satellite data characteristics

Many peoples concerned have an interest in the approach to share various earth observational information including satellite remote sensing data via Internet. Various systems are already made public under which everyone on the earth can refer to the metadata (hereafter referred to as the "data-set specification") under network environment. System of this sort is advantageous in that location of the data and results of processing can be referred to in the form of browse image. However, if the user attempts to process or analyze the satellite

1) Member of JSCE, Dr. Eng., Associate Professor, Department of Civil Engineering, Tokyo University of Science (TUS)
(2641 Yamazaki, Noda-City, Chiba 278-8510, JAPAN Tel : +81-4-7124-1501, E-mail:kojima_h@rs.noda.tus.ac.jp)
2) Member of JSCE, Dr. Eng., President of Land Information Technology Laboratory (LITERA) Co., Ltd.
3) Member of JSCE, M. Eng., Researcher, Land Information Technology Laboratory (LITERA) Co., Ltd.

remote sensing data actually, they may notice that fundamental information such as how to obtain the data or characteristics of the data are insufficient.

When the user wants to know which satellite remote sensing data should be used to meet with their purpose or data characteristics, even experts who have been utilizing the satellite remote sensing data by application field might have experienced a burden in referring to more than two documents related to remote sensing or literary documents.

Under today's circumstances where next generation satellite observation project is being planned and kinds of satellite remote sensing data are diversified, well maintained system designed for Internet environments to which everyone can refer may contribute to development by researches in many field, as well as utilization and promulgation of the satellite remote sensing data by general public.

2.2 Meaning of current research and development

(1) Position of this system (RIC)

Speaking of satellite remote sensing data characteristics evaluation information, various items are cited. In order to clarify position of the information to be handled and the system (RIC) developed by this study, related parties are largely divided into "Satellite remote sensing sensor development side" and "Satellite remote sensing data utilization side" as shown in **Fig. 1**. Then life cycle in data observation and utilization required in each stage are put in order.

At satellite remote sensing sensor development side, reports are available in which sensor design specifications and initial verification information are summarized. Access to this information is possible only through limited research institutes while in many cases, general public is unable to do so. Thus, collection of information and accumulation of information with continual manner are difficult. Therefore, information occurring at satellite remote sensing sensor development side is not included in this research and development. As shown in **Fig. 1**, however, RIC is of course designed to be expanded information presentation system to accumulate this information. (cf.**4.2 (1)**)

At satellite remote sensing data utilization side, it is possible to divide information into those "Used at data retrieval and purchasing" and those "Used at data utilization". In the former case, information relating to image quality such as noise, cloud amount, shadow, etc. are necessary. In the latter case, information required in the processes of various image processing and analysis including thematic map, pre-processing and post-processing become necessary. This information is primarily dealt with in this research and development.

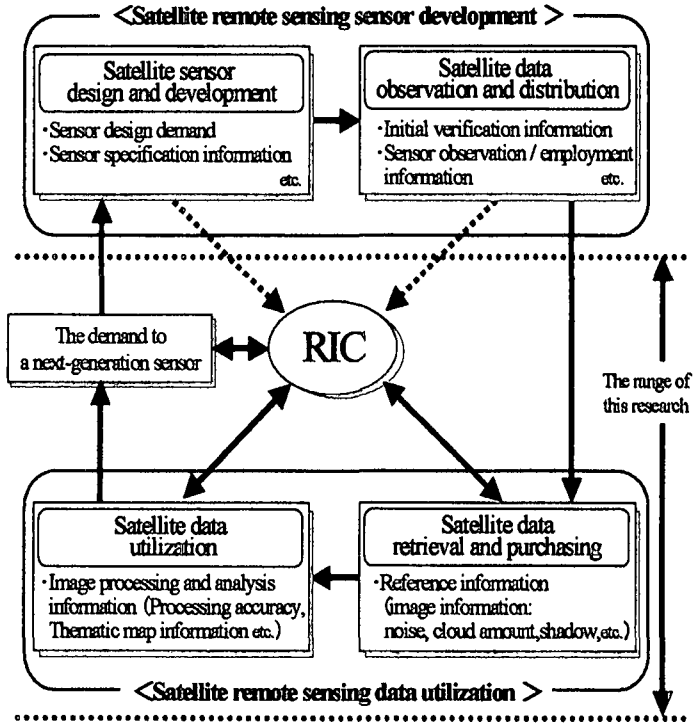

Fig. 1 Life cycle on data observation/utilization and Position of this system (RIC)

(2) Investigation of data set structure

In this study, in handling evaluated-information on the satellite remote sensing data characteristics, information are divided into three categories of [1] Characteristics evaluation information, [2] Relevant information, and [3] Common information. (cf.**4.1 (4)**) Information are classified and sorted out according to this information division to be used for designing data set structure.

Much time and work are used in the stage of setting of information divisions and assignment of information items belonging to them (cf. **Table 2**). According to the information division set by current study, cumbersome job of information classification and sorting can be done effectively. At the same time, burden borne by system management is greatly reduced.

(3) Management of information by the kind of satellite remote sensing data

In order to maintain diversified relevant information from both quality and volume viewpoints, as well as characteristics evaluation information of the satellite remote sensing data handled in this study, following three requirements should be met:

- Requisite 1: Simplicity of sorting and accumulation of information
- Requisite 2: Continuity of system operation
- Requisite 3: Expandability of system

If any problem arises in data set maintenance after development of the system is completed, it is attributable to

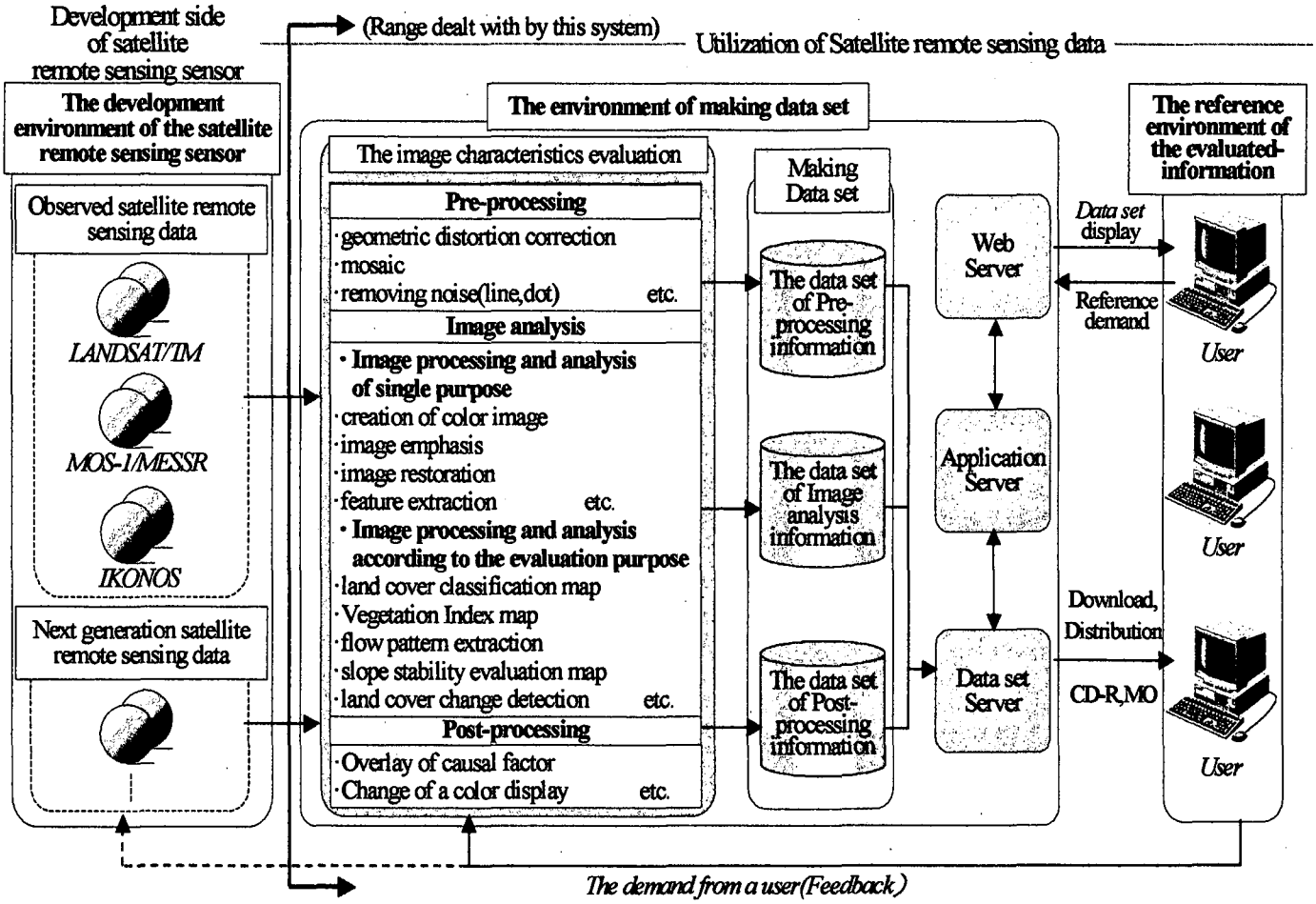

Fig. 2 Operational environment of the developed system (RIC) in this study

that these requisites are not satisfied. This is frequently caused by that the developer pays much attention to element technology itself composing of the system in question.

To resolve this problem, in this study, characteristics evaluation items are sorted out and information divisions are set to allow centralized management of information relating to characteristics information by "kind of satellite remote sensing data" to attain efficient information sorting work. Further more, considerations are given so that data set can be accumulated easily according to sorting division of the information every time characteristics evaluation information is generated.

The satellite remote sensing data improve their value as the "earth observing information" while being accumulated in the past, at present and in the future. As shown in **Fig. 1**, by clarifying correspondence between data observation and utilization stage, and the information to be handled by the system, priority order of design and development can be set finally and at the same time, efficient lifecycle involving development and application of the system can be realized. The contents of this can give new suggestions for design and development of various image database systems aiming at image understanding and evaluation support, as well as satellite remote sensing data.

As mentioned above, in addition to that end user layer can share the characteristics evaluation information of the satellite remote sensing data under Internet environments, one of distinctive features of this research and development is that DSMS (Data Set Management System) is constructed by which these information can be controlled continuously by kind of satellite remote sensing data.

3. Designing of whole system

3.1 Definition of system requirements

Requirements of the information presentation system (RIC) developed by this study are summarized into following three items:

- Image characteristics evaluation is carried out, and information divisions that allow efficient classification and sorting of the various information relating to results of this evaluation are set.

Table 1 Items of the image characteristics evaluation

	Evaluation item on the image characteristics
Pre-processing	◦ Removing noise(line,dot) ◦ Mosaic of the images ◦ Geometric distortion correction ◦ Calculation between images ◦ Editing processing ◦ Change of a slice ◦ Masking ◦ Removal and correction of a shadow Etc.
Image analysis	**<Image processing and analysis of single purpose>** 1.Creation of color image 2.Exact geometric distortion correction 3.Emphasizing image ◦ Concentration conversion of the whole image ◦ Luminance correction ◦ Binarization ◦ Edge emphasis/Enhancement (Lapracean) ◦ Smoothing 4.Image restoration ◦ MTF correction ◦ Gauss-Seidel method 5.Extraction of the features ◦ Calculation between images ◦ Single/multiple regression analysis ◦ Principal component analysis ◦ Edge detection ◦ Texture analysis 6.Filtering ◦ Mean value filter ◦ Median filter ◦ Differential filter 7.Fusion use with DTM ◦ Principal component analysis **<Image processing and analysis according to the valuation purpose>** 1.Land cover classification Land cover classification map ◦ Supervised maximum likelihood classifier ◦ Cluster analysis 2.Vegetation Vegetation map Vegetation Index image Vegetation changes image 3.Water area Flow pattern figure Wave direction figure Abstracting water brink line Water quality distribution map 4.Relation of city region Form extraction of a structure Extraction of traffic high density Shadow map 5.Relation of land use capability classification map Land use capability classification map Land use conception figure Mutual regulation map 6.Relation of slope stability evaluation Slope stability evaluation map 7.Land cover change detection Dissimilarity image Etc.
Post-processing	◦ Creation of the unification image of a slice ◦ Overlay of a topographical map ◦ Overlay of causal factor ◦ Image masking ◦ Creation of introductory notes ◦ Compression and defrosting of a image ◦ A setup of a scale and a direction Etc.

- Based on these information divisions, data set structure is designed in such that all information are controlled in the form of centralized management by kind of satellite remote sensing data, and DSMS is constructed for effective management of the data set.
- As shown in **Fig. 1**, information presentation system is established to cope with every stage of the life cycle of observation and utilization of the satellite remote sensing data.

3.2 System operating environment

Operating environment of this system is consisted of "Characteristics evaluation information reference environment" and "Data set making environment" for satellite remote sensing data user and "Satellite remote sensing sensor development environment" for satellite remote sensing sensor developer as shown in **Fig. 2.**

Table 3 Attributes for data set (1) Characteristics evaluation information reference environment

Under Internet environments, users refer to and utilize the data set via data set specification under this environment. As for data set making environment, it is possible to propose new characteristics evaluation items and to ask evaluation of the

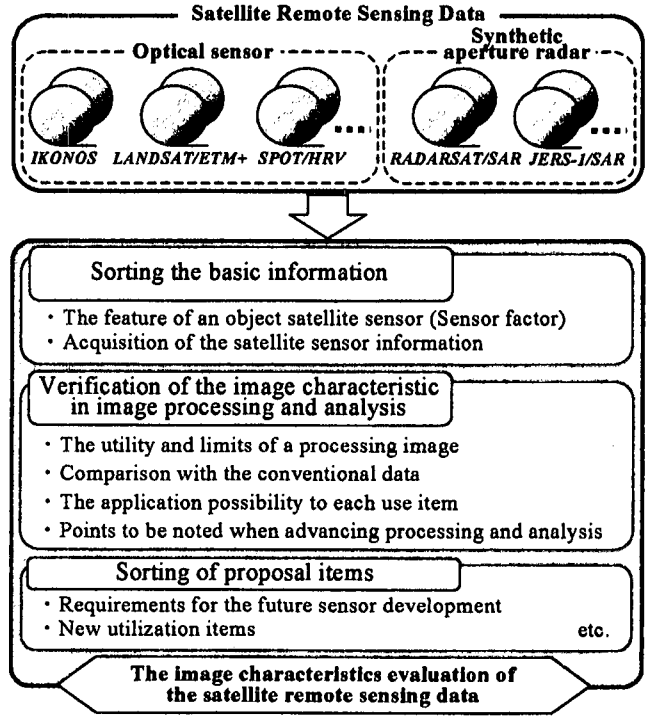

Fig. 3 Evaluation and sorting of the information in image characteristics evaluation

Table 2 Classification of the image characteristics evaluation items

	Characteristics evaluated information	The relevant information		The common information	
		Image information	Numerical value and text information	Image information	Numerical value and text information
Pre-processing	The evaluated-information table on the image characteristics (According to evaluation item) [Items mentioned] 1.Name of evaluation items 2.Name of processing methods 3.Specification of evaluation data ・The name of sensor ・The ground resolution ・Observation date ・Image size 4.Evaluation image 5.Introductory notes 6.Note *Characteristic evaluation information carries out unitary management according to evaluation item in the evaluated-information table on the image characteristics	・Results of characteristics evaluation(Image analysis) ・Results of characteristics evaluation(Post-processing) ・Results of characteristics evaluation of different-species satellite remote sensing data ・Topical map creation middle image ...etc	・The image-processing method explanation ・Related reference ・The various amounts of statistics ・Report ・(Processing source program) ...etc	・Topographical map ・Catalog of satellite remote sensing data ・Digital terrain model ・Single band satellite remote sensing image ・Color composition image ・Aerial photograph ・National land survey information ・Local photograph ...etc	・Specification of satellite remote sensing sensor ・Link information ・Observing area ・Related organization ・Related reference ・Report ...etc
Image analysis		・Results of characteristics evaluation(Pre-processing) ・Results of characteristics evaluation(Post-processing) ・Results of characteristics evaluation of different-species satellite remote sensing data ・Topical map creation middle image ・Training data ...etc	・The image-processing method explanation ・Related reference ・The various amounts of statistics ・Report ・(Processing source program) ...etc		
Post-processing		・Results of characteristics evaluation(Pre-processing) ・Results of characteristics evaluation(Image analysis) ・Results of characteristics evaluation of different-species satellite remote sensing data ・Topical map creation middle image ...etc	・The image-processing method explanation ・Related reference ・The various amounts of statistics ・Report ・(Processing source program) ..etc		

satellite remote sensing data not uploaded.

(2) Data set making environment

Image characteristics evaluation is carried out for the satellite remote sensing data in each evaluation item. Besides, under this environment, for the sake of sharing of evaluation results between users, evaluation information are converted to data set according to the information division and uploaded to the WEB server.

(3) Satellite remote sensing sensor development environment

Under this environment, initial verification evaluation is carried out for newly observed satellite remote sensing data. Verification information, satellite remote sensing data observation information and operational information are also controlled. The Institutions who act as the contact point of distribution of satellite remote sensing data are included in this category. It is possible to access various relevant information from this system through linkage.

3.3 Evaluation of satellite image characteristics

Image characteristics evaluation in this study is defined to be evaluation and sorting of the information for the purchasable satellite remote sensing data as shown in **Fig. 3**.

(1) Sorting of basic information relating to satellite remote sensing data

Basic information such as spatial resolution and observation waveband of the satellite remote sensing sensor concerned for the satellite remote sensing data, and coverage map are sorted out. The contact address of distribution of ach data and method of data purchasing are also summarized.

(2) Verification of image characteristics

Various image processing and analysis method are applied to the satellite remote sensing data of interest, and legible information are taken from the processed image, and utility and limits are evaluated based on statistics value. The problems arising at processing and analysis and countermeasures to be taken are summarized as points to be noted. Results of those image characteristics evaluations are summarized in characteristics evaluation table. (cf. **4.1 (2)**.)

(3) Sorting of proposal items

The application fields and new utilization items, and requirements from user side for future sensor development are sorted. After evaluated information are sorted by kind of satellite remote sensing data, characteristics of the data necessary for processing and analysis can be known immediately and differences with other satellite remote sensing data are easily identified. Reference to or comparison between examples of research and development related to these evaluation information and results of initial verification of the satellite remote sensing sensor is possible.

Table 3 Attributes for data set

1.Dataset name (satellite remote sensing sensor name/evaluation items) 2.Processing items 3.Dataset evaluation items 4.The evaluated-information (file name/the area for evaluation/ observation day/creation day) 5.The relevant information (file name/preservation form/ resources management place/up date) 6.The common information (file name/preservation form/ resources management place/up date) 7.The contact about data set

4. Detailed system design

4.1 Investigation of the characteristic evaluation items and information division

(1) Setting of characteristic evaluation items tributes for data set

As shown in **Table 1**, the characteristic evaluation items are divided into pre-processing, image analysis and post-processing according to ordinary processing procedures. There are many evaluation items in "image analysis" which are further classified into two categories of "image processing and analysis by single purpose" and "image processing and analysis by evaluation purposes".

By dividing evaluation items into three categories and by setting evaluation items, presentation of information valuable to the particular end-user suited for their purpose becomes possible. With this system, considerations are given in such that flow diagram relating to processing and analysis of various images and application examples can be referred to via these results of evaluation. This may become valuable support information for engineers at image processing and analysis who are familiar with handling of satellite remote sensing data.

(2) Proposal of characteristics evaluation table

Items to be stated in the evaluation table are shown in the characteristics evaluation information column in **Table 2**. Processing image and analysis image are arranged at the center of the evaluation table so that image quality of the data and results of image processing and analysis may be read easily. It is further designed that statistical indicator for evaluation of processing accuracy, various findings, and relevant information can be accessed via linkage from the evaluation table. (cf. **5.2 (3)**.)

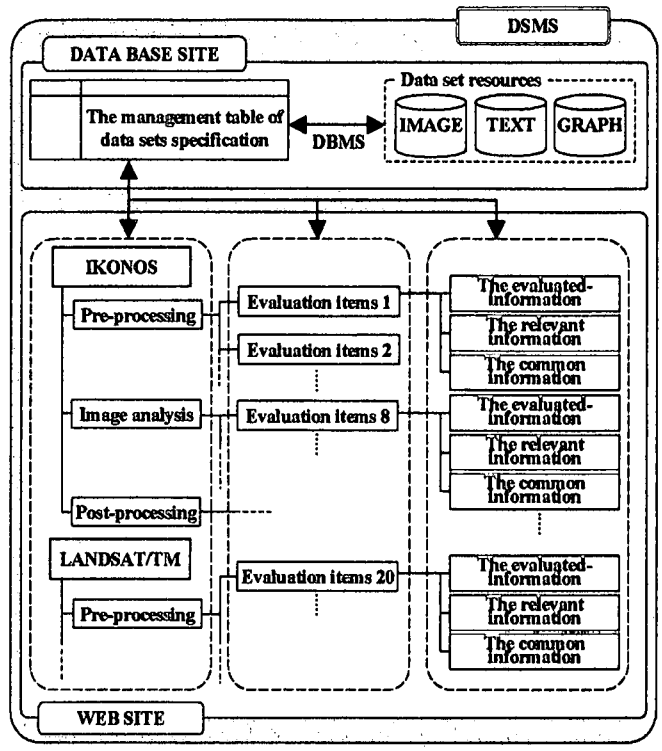

Fig.4 Data set structure

As such, it is one of features of this study that description items are selected to allow presentation of the evaluation information in as much simplified manner as possible for system users. It is set that reference to or utilization of the information other than results of image evaluation can be made at one's choice. Therefore, abundant evaluation information can be shared among users and detailed information is presented at one time. This eliminates such an inconvenience of system utilization that at browsing, it is difficult to pick up only such information one needs.

(3) Data set specification

In order to control continuously results of characteristics evaluation and huge amount of information, maintenance of data set specification are indispensable to exercise control over all the information within the system. In this study, therefore, data set specification with description items as shown in **Table 3** are sorted out by kind of satellite remote sensing sensor and by evaluation items.

As shown in **Fig. 4**, each specification is collectively controlled by the management table of data set specification in the database site (hereafter referred to as DB site). So, the system administrator can grasp the information being transmitted to the WEB immediately. It goes without saying that data set operation is simplified. In addition, information duplicated among evaluation items can be controlled and expansion of information retrieval function is possible. This specification is also helpful for management of the data set resources existing at DB site.

(4) Investigation of information division

Investigation of information items relating to results of characteristics evaluation is reflected to contents of design of the data set. So, information should be selected carefully. In this study, as shown in **Table 2**, three information divisions are established, and handling of information items primarily about results of characteristics evaluation by evaluation item is checked. According to these information divisions, evaluation information is converted to data set easily and it is possible to continuously expand the data set by adding the evaluation table as necessary.

a) Characteristic evaluation information

Characteristics evaluation information is the information obtained by sorting out the results of characteristics evaluation by the evaluation item based on the evaluation table shown in **4.1 (2)**. Since more than two evaluation results are obtained from the same sensor by evaluation object region, it is determined that evaluation results is collectively controlled by kind of satellite.

b) Relevant information

Information referred to or utilized in the step where maintenance of the characteristics evaluation information is sorted out based on the evaluation item unit. Specifically, these are various statistics information obtained by image processing or analysis, flow diagram in which processing methods are summarized, and intermediate data generated in the processing process. Besides, evaluation results of the same evaluation item from different satellite remote sensing data are also shown as relevant information.

c) Common information

Information utilized by each of satellite remote sensing sensor are sorted out. Specifically, these are sensor specification, coverage map and related documents, etc. As for results of initial verification of the satellite observation system, the data observation and operational information disclosed by the development side of the satellite remote sensing sensor are accumulated from those being made available.

5.2 Investigation of accumulation and management of characteristics evaluation information

Data set structure that plays an important role in realizing continual and effective accumulation and management of the characteristics evaluation information is investigated.

(1) Investigation of data set structure

The data set structure of RIC are shown in **Fig. 4**. With this structure, WEB site and DB site are controlled by DSMS that acts as a high-order system.

a) DB site

At DB site, specification of division holder, file name, file creation date and storage data are put into database by the management information (data set specification management information) relating to all the data existing in WEB site and are collectively controlled by evaluation item unit. Further, various resource information and backup data are also controlled by DBMS at DB site.

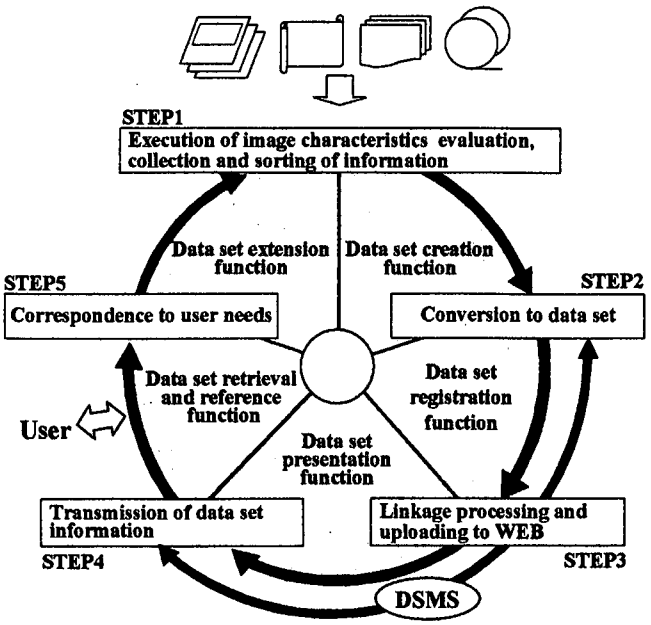

Fig.5 Standardization of data set maintenance procedures

b) WEB site

At the WEB site, folders to store image files are generated by evaluation item unit, and one data set is created by file linkage equipped with relative path relation. Folders of "pre-processing", "image analysis" and "post-processing" showing image processing and analysis method respectively are provided under the folder bearing the name of satellite remote sensing sensor, and folders of each evaluation item are prepared further under this layer. Folder structure is controlled by "every kind of satellite remote sensing sensor". This is one of features of this system and due considerations are given in such that expansion can be made easily when a new sensor is put into operation in the future.

(2) Role of DSMS

By following the data set structure shown in **Fig. 4**, it is possible to control and accumulate the evaluated information with ease by simply accommodating the data in each folder from time to time based on the management information.

In the meantime, this system has such a function that results of comparison of different satellite remote sensing data can be referred to or utilized. Therefore, as shown in **Table 2**, there is such a case where the same evaluation results are controlled with duplicated manner between evaluation items. Since

format of information handled are diversified, a unique function to control the data set becomes necessary to improve efficiency of system renewal work.

Accordingly, it is determined that DSMS be newly introduced for this study. The DSMS is a management function developed uniquely to attain smooth information management and operation by data set unit that is one of features of this system. This is composed of software groups assigned to management of data set specification, conversion of various information into data set or linkage processing, and the function that assists uploading to the WEB site. As shown in **Fig. 5**, in the flow of data set maintenance and operation, this acts as "data set registration function" and "data set presentation function". Introduction of DSMS, in addition to that management and accumulation of huge amount of information can be simplified, processing procedures from information collection to transmission can be standardized by contributing to remarkable reduction of time and labor assigned to system management.

4.3 Investigation relating to maintenance and operation of data set

Fig. 5 shows data set maintenance procedures and various operational functions. Since continuous system operation is attempted in this research and development, procedures of data set maintenance is standardized and five operational functions are adjusted so that these may assist works in each step.

(1) Standardization of data set maintenance procedures

By observing standardized maintenance procedures shown in **Fig 5**, it goes without saying that all works from collection of various information to transmission of evaluation information to WEB can be processed smoothly. Further, it is possible to correspond promptly to user needs or promote renewal work such as maintenance of satellite remote sensing data not uploaded.

STEP 1: Execution of image characteristics evaluation, collection and sorting of information

Image characteristics are evaluated according to the evaluation item and at the same time, various information composing of the data set are collected and sorted by kind of satellite. When a new evaluation item is added or processing or analysis method is changed, program manual is prepared or renewed as necessary, and maintenance and accumulation work of program groups of evaluated information on the image characteristics are promoted concurrently.

STEP 2: Conversion of the data sets

Results of characteristics evaluation and digitized relevant information are stored in the folder provided for kind of satellite and for evaluation item. Generation of data set specification and renewal of management table are made at the same time.

Table 4 Management and operation function of data set

Processing function / Main processing contents
Data set generation function
· Creation of characteristic evaluation information · Creation of relation and common information · Management of the processing analysis program group for characteristic evaluation
Data set registration function
· Management of data set resources(function of DBMS) · Registration and renewal of data set specification management table · Link processing of various information · Upload to WEB of a data set
Data set presentation function
· Control of a system operation · Protection of the data set · Security management of hardware
Data set retrieval and reference function
· Satellite classification reference of the data set · Retrieval by keyword of the data set · Distribution of the data set
Data set expansion function
· User needs investigation · Acquisition of the newest satellite sensor information

STEP 3: Linkage processing and uploading to WEB

Maintenance of the relative path between the information being arranged newly as the data set and existing information is made. Linkage processing is made between various data and uploading to WEB is made. In order to maintain continuity of data set management, uploading history is accumulated as resource management information to reduce burden of renewal work of the information.

STEP 4: Transmission of data set information

After correct system operation is confirmed, data set information is transmitted through the network. Then retrieval of and reference to evaluation information can be made freely from characteristics evaluation information reference environment by using the browser.

STEP 5: Correspondence to user needs

We deal with user needs such as addition of evaluation item and request for evaluation relating to satellite remote sensing data not uploaded, etc. Further, the system administrator makes a survey of operational information of a new satellite remote sensing sensor and relevant information as necessary.

(2) Investigation relating to management function of data set

Roles of various functions are listed in **Table 4**. Their features are explained hereafter by the function.

a) Data set generation function

Various information are digitized and processed until being converted to data set by kind of satellite according to

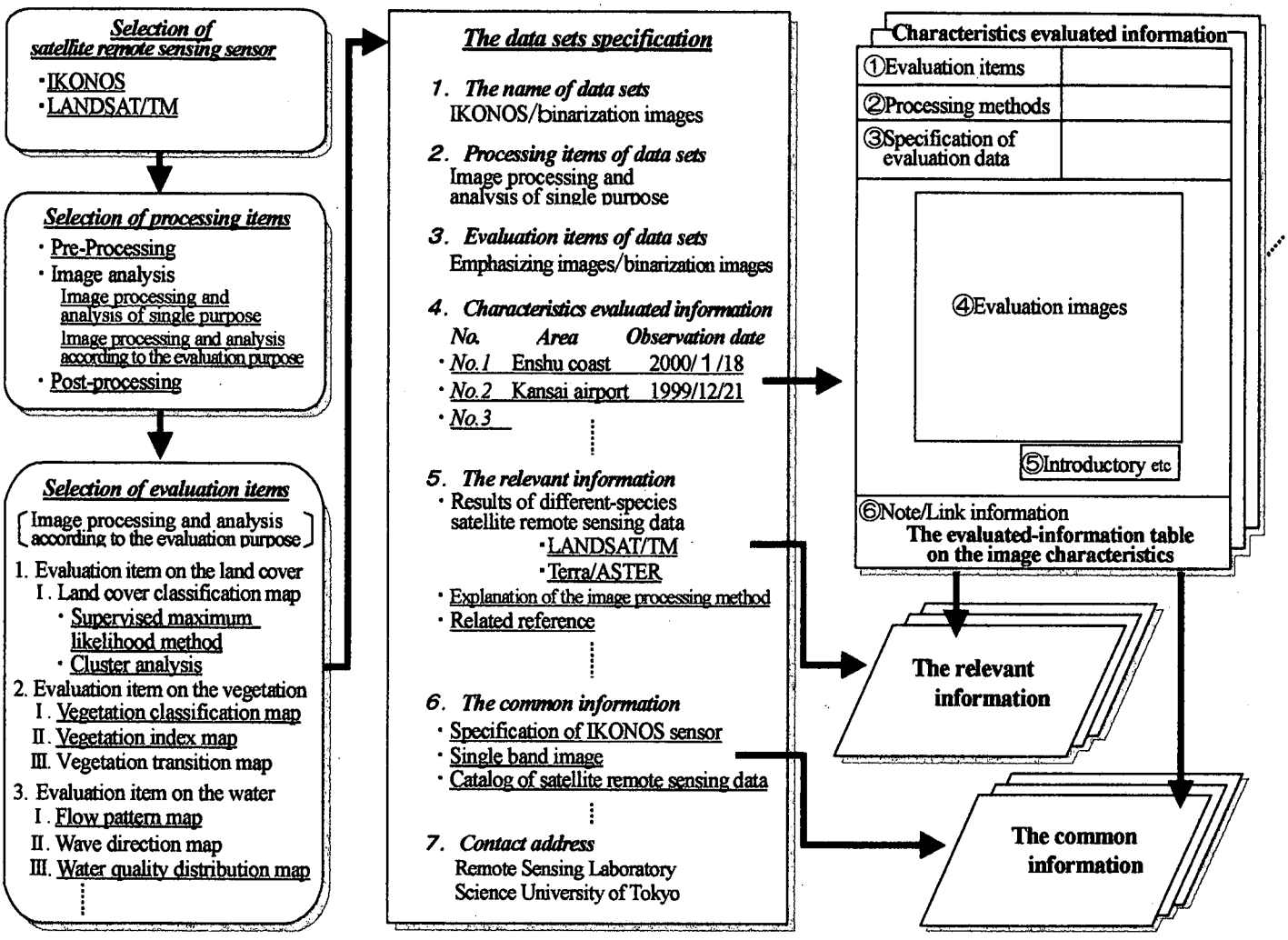

Fig.6 Flow of retrieving the data set

information division. A scanner used for digitization of information shown on papers and various image displaying software used for conversion of storage format and others are fully equipped. In addition, various processing and analysis program execution functions, accumulation and management functions used for evaluation of image characteristics are well maintained.

b) Data set registration function (function of DSMS)

Functions for registration and renewal of data set specification management table and functions to control linkage of various information are well maintained. In order to control data set resource effectively, DBMS is also maintained to allow effective utilization of the information.

c) Data set presentation function (function of DSMS)

WEB server necessary for information transmission to WEB and security management function to check unauthorized access is maintained. Under today's circumstances where information utilization is diversified and acquirement of information is being simplified, it is said that security management is the most important measure.

d) Data set retrieval and reference function

In this system, this function alone can be accessed from characteristics evaluation information reference environment. This is so important in such that good or bad of the system is entirely depending upon this function. Detailed investigation is necessary so that users may utilize this conveniently. (cf. **5.2.**) In this system, three functions - "Data set reference function", "Data set retrieval function", and "Data set registration function" - are maintained. With information registration function, request for information registration by researchers or relevant organizations are dealt with.

e) Data set expansion function

Since this system covers broad range of information, presentation of information meeting all the requirements by users is not possible from the very beginning of system operation. Therefore, aiming at system expansion to absorb more user opinions, such a function is provided that user requirements can be known by electronic mail.

5. System operation

5.1 Flow of data set retrieval

Fig. 6 shows interrelation of information corresponding to total flow of data set retrieval. When connected to this system by http request from characteristics evaluation information reference environment, initial screen as shown in **Plate. 1** appears. Following description explains three retrieval and reference related functions that are maintained in this system.

(1) Data set reference function

When evaluation information should be referred to, desired satellite sensor is selected at right lower portion of the initial screen, and evaluation items to be browsed are narrowed down from the evaluation item selection screen shown in **Plate. 2**. Since such a need may be presented that detailed information of individual satellite remote sensing sensor or data purchasing method alone is referred to immediately, there is a function by which the user can move directly to satellite remote sensing sensor specification.

(2) Data set retrieval function

When one needs to browse the specific satellite remote sensing sensor or evaluation region or characteristics evaluation information by evaluation item, retrieval function of the data set should be selected from INDEX provided at the left of the initial screen. Then retrieval form as shown in **Plate. 3** in. After evaluation item, evaluation region, observation data, etc. are input, narrowing down of information becomes possible.

(3) Data set registration function

As for proposal of new evaluation items and request for characteristics evaluation of the satellite remote sensing sensor not uploaded in this system, request is possible from the data set registration function by the e-mail.

Furthermore, in order to allow system expansion to include more user needs, data receiving and transmission system has now been under development by which information presented by the relevant research institutes or researchers are handled on the WEB.

5.2 Features at data set reference

Since this system handles diversified information, it is probable that when referring to the data set, system user cannot browse the information that the users need to obtain. As countermeasures to this inconvenience, it is stated earlier that selection should be made carefully at the stage of information sorting and collection. Following description lists special consideration points for information reference functions together with examples.

(1) Presentation of specification by data set unit

By selecting the evaluation item, the data set specification as shown in **Fig. 6** appears on the display One of features of this system is that such data set specifications are sorted out by kind of satellite and by evaluation item in order to realize information presentation by data set unit. This feature enables retrieval of and reference to "Characteristics evaluation information, relevant information and common information" through the specification.

(2) Selection of characteristics evaluation information

Since the satellite remote sensing sensor observes a wide range periodically, there are billions of data regions and observation dates that can be input. Besides, there are design specifications such as observation wavebands and spatial resolution peculiar to the satellite remote sensing sensor. In other words, evaluation results of the data are different depending on observation objects.

Therefore, such functions are provided by which results of characteristics evaluation can be referred to from the data set specification by "Evaluation region" and "Data observation date". By sorting out evaluation information with different observation region and observation date from time to time, presentation of detailed image characteristics evaluation information becomes possible.

(3) Reference to characteristics evaluation table

As stated in **5.1 (2)**, in this system, result of characteristics evaluation are arranged in the characteristics evaluation table shown in **Plate 4** by evaluation item. The image processed by various analysis methods is provided at the center of the evaluation table so that it may be read easily. One of features of the evaluation table is that link information item **(Plate. 4: [1])** is provided to allow immediate browsing of the evaluation relevant information. Considerations are given in such that by selecting "Description of processing method," "Sensor specification," and "Statistics value," etc., another browsing screen is booted as shown in **Plate. 5** with which reference to single band image, report or flow diagram is possible. Considerations are given so that relevant or common information can be referred to effectively without revisiting the specification.

(4) Reference to comparative information between different satellite remote sensing data

An example of data comparison between different satellite remote sensing data is shown in **Plate. 6**. It is noticed easily that even in the same evaluation range, spatial resolution is entirely different depending on kind of satellite remote sensing sensors. If comparison by images is made possible, characteristics of the data can be grasped easily without being disturbed by various parameters.

This system is set in such that by selecting "Different

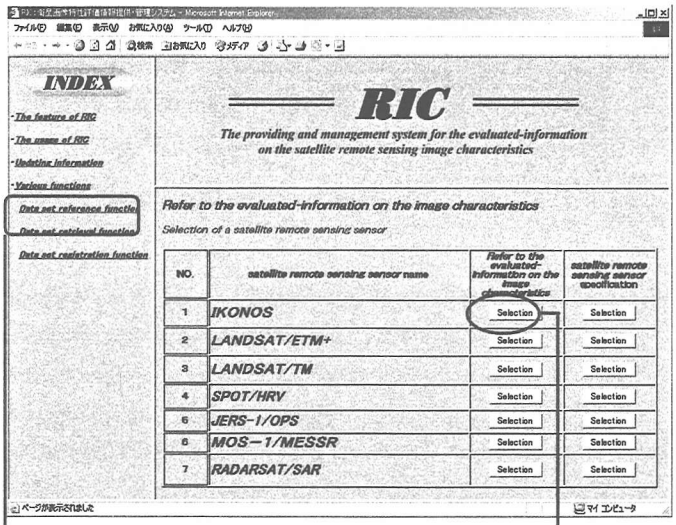

Plate. 1 Main menu of RIC

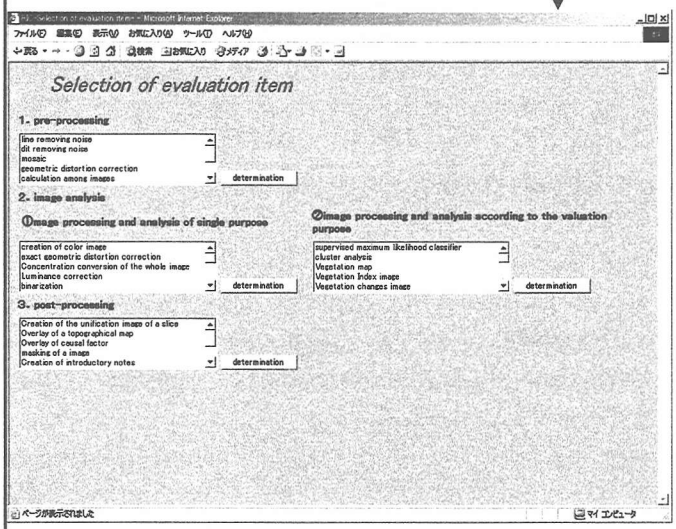

Plate. 2 The evaluation item selection

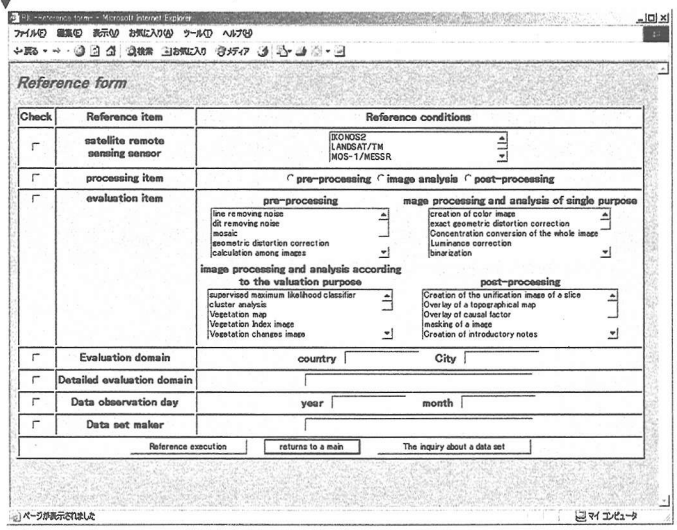

Plate. 3 Retrieval form

Plate. 4 The image characteristics evaluation table (ex. Land cover classification)

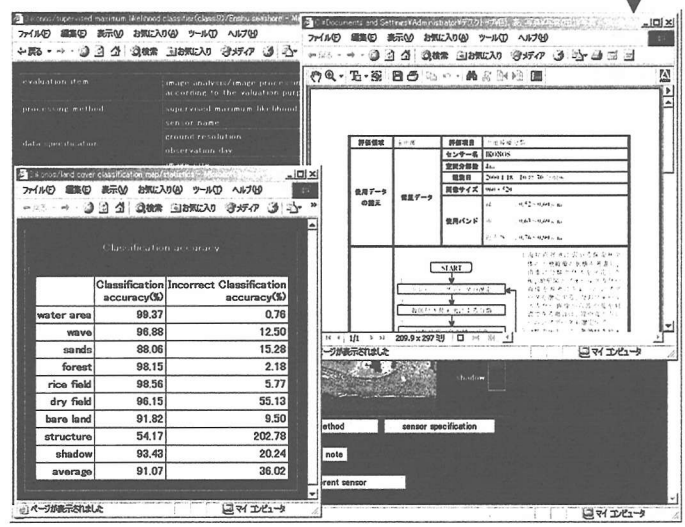

Plate. 5 Browsing the relevant information

Plate. 6 An example of comparison between different satellite remote sensing data

satellite evaluation information" from lower portion of the evaluation table currently displayed, results of evaluation between different satellites remote sensing data in the same evaluation region is displayed. Since in this system, the characteristics evaluation table is available for every evaluation image, it is possible to refer to different satellite remote sensing data simultaneously after more than two browsing screen of this sort are booted.

7. Concluding remarks

Contents of this study can be summarized into following three points:

[1] Necessity of image characteristics evaluation information of satellite remote sensing data

While satellite remote sensing data are diversified, "Necessity of characteristics evaluation of satellite remote sensing data" is pointed out from viewpoints of data users, and importance of characteristics evaluation of the data are sorted. Specifically, every stage of the life cycle of observation and utilization of the satellite remote sensing data are investigated. Based on these investigations, position of information presentation system in this study is made clear (**Fig. 1**), and range of information handled by this research, and basic requirements for the system in accumulating and managing these information by the data set unit are clarified.

[2] Data set management of image characteristics evaluation information

Concepts of management of evaluation information relating to image characteristics as the data set is sorted out by dividing into three information divisions (**Table 2**), and data set structure is also designed. A function to control WEB site data set via management information at data base site (termed DSMS : Data Set Management System) is constructed. This is to allow efficient management and operation of the data set as well.

[3] Establishment of information providing system

Information presentation system is established by which image characteristics evaluation information are converted to data set by kind of satellite and controlled collectively, and everyone can refer easily to the information under Internet environments. This is helpful in the sense of information sharing for the expertise as well as the end-users.

Contrary to expectations, such an approach that characteristics evaluation is made for satellite remote sensing data, and information transmission and management are carried out so that everyone can refer to it easily is overlooked. Today when concomitant use of the next generation satellite remote sensing data with those being accumulated so far is highly expected, requests for presentation and management of the image characteristics evaluation information will surely increase.

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