PROMOTION ACTIVITIES OF ALOS DATA UTILIZATION IN JAXA

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ABSTRACT:

JAXA has been doing the cooperative researches with relevant government office, also with relevant authorities, to promote utilization of ALOS;Advanced Land Observing Satellite data. The ALOS Advanced Land Observing Satellite had launched on January 24th, 2006. ALOS has three sensors which are the PRISM ; 2.5m resolution panchromatic stereo sensor, the AVNIR-2 ; 10m resolution multi spectrum sensor, the PALSAR ; 10-100m resolution L-band synthetic aperture radar, and these working on the 46days repeat cycle sun-synchronous orbit. Some government officials are not familiar the ALOS data and data analysis. So we made study with the aim of the establishment of the way of analyzing it which satisfies their request. We have been doing the vegetation map making, cultivated area investigation, sea ice monitoring, and the topographical map updating with the cooperative research.

1. INTRODUCTION

1.1 General Instructions

JAXA has been doing the cooperative researches with relevant government office, also with relevant authorities, to promote utilization of ALOS data, since early phase of development of ALOS.

The purpose of the cooperative researches is using the ALOS data that come into popular with the government's business and informative and helpful. Therefore, we are doing three steps of researches. The first step is feasibility study, the second step is usage demonstration, and the third step is to evaluate the results which are actually come to useful. We have done the feasibility study and development of tools by means of simulated data of ALOS before the launch. And after the launch, we are doing the usage demonstration, to evaluate the results which are actually come to useful by means of observed data by ALOS.

I report about the activity contents of the cooperative researches with relevant government office which used ALOS data by this report.

2. ALOS SATELLITE

2.1 ALOS satellite

ALOS is the satellite which sophisticated with accumulated technology by development and use of JERS -1 and ADEOS.
ALOS is an Advanced Earth Observing Satellite launched from Tanegashima Space Center on January 24th, 2006.

ALOS has aimed to make the map, and the regional observation, to understand the disaster situation, and to inquire into the resource by collecting the land region observation data of the high-resolution with global scale.
ALOS works the observation operation in the sun-synchronous orbit at the cycle of the 46days.

2.2 On-board missions

ALOS has three on-board sensors as follows.

PRISM ; Panchrimatic Remotesensing Instment for Stereo Mapping
It is a panchromatic sensor, provides 2.5m spatial resolution images. It has three optical systems; forward look and nadir look and backward look, so it can be high-frequency and acquire highly precise topography data.

・AVNIR-2 ; Advanced Visible and Near Infrared Radiometer type2
It is a multi-spectrum sensor with four bands in visible to near-infrared, provides 10m spatial resolution images. It provides better spatial land-coverage maps and land-use classification maps for monitoring regional environments. It has cross-track pointing function, so it can observe the disaster areas quickly. The pointing angle of AVNIR-2 is +44 and -44 degree.

・PALSAR ; Phased Array type L-band Synthetic Aperture Radar
It is an active microwave sensor using L-band frequency to achieve cloud-free and day-and-night land observation. It has three observation mode; Fine, ScanSAR, Polarimetric, provides 10m to 100m spatial resolution images.
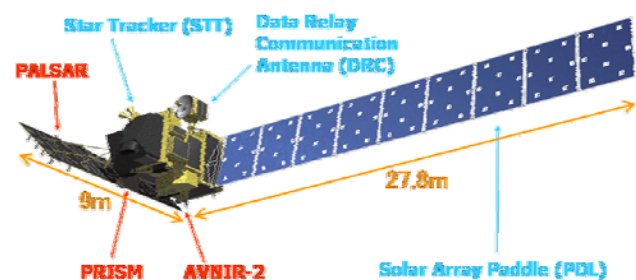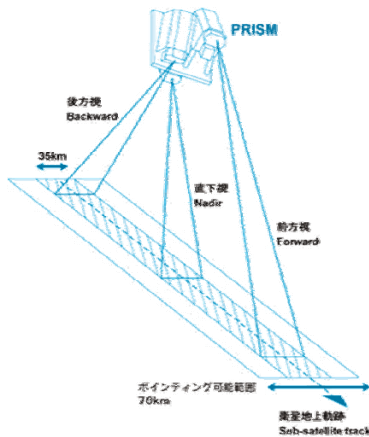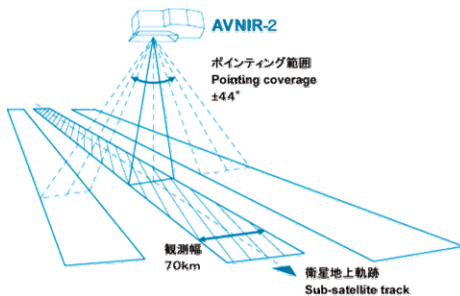
Figure. 2-1 ALOS satellite
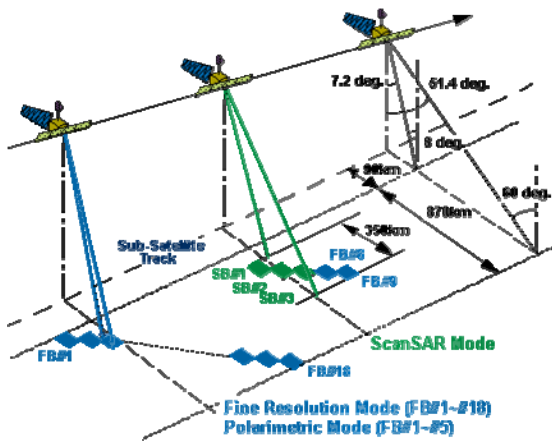

Figure. 2-2 PRISM

Figure. 2-3 AVNIR-2

Figure. 2-4 PALSAR

3. THE CONTENT OF ACTIVITY OF A COOPERATIVE RESEARCH WITH RELEVANT GOVERNMENT OFFICE USING ALOS DATA

JAXA aims at the use expansion of ALOS data and carries out the Ministry of the Environment, the Ministry of Agriculture, Forestry and Fisheries, the Japan Coast Guard, Geographical Survey Institute and collaboration. The purposes of the cooperative researches are using the ALOS data that come into popular with the government's business and informative and helpful. Therefore we are carrying on the cooperative

researches that advancing the step of feasibility study, verify of availability and utilization.

As for the data obtained from ALOS and it, the person in charge of the ministry that executes cooperative researches with JAXA is not well informed. Therefore we examined aiming at the establishment of the method of analysis to satisfy an enforcement purpose and the demand of ministries and government offices. In addition, we have holding the study meeting of the remote sensing technology use to the person in charge of the ministry of the use of the ALOS data so that understanding may deepen.

The purpose and the name of a cooperative study are as follows.

RELEVANT GOVERNMENT OFFICE	SUBSTANCES
Ministry of the Environment	Development of utilization technology for natural environmental preservation baseline investigation by using the ALOS data.
Ministry of Agriculture, Forestry and Fisheries of Japan	Research and development of farm crops production monitor that uses remotesensing technology
Japan Coast Guard	Development of observation technology and research of utilization technology for sea ice monitoring by using the ALOS data
Geographical Survey Institute	Research of grasp the geographic information by using the ALOS data

Table 3-1 Cooperative researches

3.1 The vegetation map maintenance

The Ministry of the Environment(MOE) has been making the vegetation maps of 1:25,000 as a part of basic survey of conservation of natural environment. They had been making the vegetation maps as decipher the aerial photographs based on the regional vegetation information before go to field survey. After that they do the field survey and draw the vegetation maps.

MOE cannot take the aerial photographs in the entire region of interest area every year. Because it needs very big cost to take the aerial photographs. Therefore they use the aerial photographs which including that took by other ministry or local government.

Though there are the aerial photographs which cannot decipher. Because the aerial photographs are old;before the past seven or eight years, and the image of the winter season has many parts of the shadow.

To make the vegetation map is very hard because knowledge and the experience are necessary and they cannot use enough aerial photographs. Thus they need long period for nationwide survey.

It is important that to continue a conventional vegetation map and updating activity. Therefore, we are studying the making of the vegetation map which reduced the number of the classifications to be able to get nationwide survey evenly in a short term in parallel. We examine that to incorporate the use of the observation image of the ALOS in a conventional vegetation map making process. And make use of the characteristic of satellite data; study of efficiency improvement technique of 1/25,000 vegetation map making and study of simple vegetation map in this cooperative research.
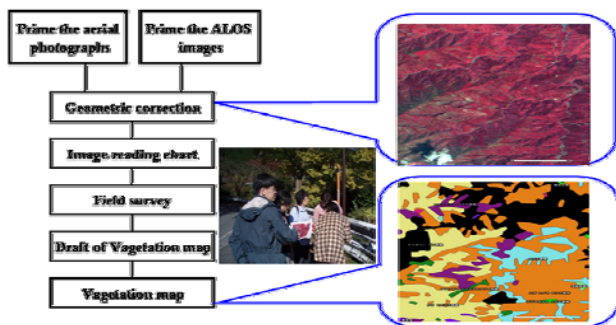

Figure. 3-1 Vegetation mapping flow

3.1.1 Item of study

The main contents of the activities are shown below.
・We provided the satellite data which are spring and autumn to the ministry of environment in FY2006 and FY2008. The area of data selected 13 places from the region in the whole country for the vegetation map maintenance. The field work corporation used the offered data as a decipherment reference image, and we did the use proof for the efficiency improvement of the vegetation map making.
・We made the simple vegetation map for preproduction. It was not only forest or non-forest classification but also evergreen or fallen leaf tree, broad leaf tree or needle leaf tree classified, by efficiency improvement of image analysis.
・We did the development of the tool;Web GIS based, that displayed a satellite image and past vegetation map at the same time on PC.
・ We have updated the maintenance of the tool and data. The purpose of the tool is able to use the satellite image efficiently to making the vegetation map.

◆ **About data used**

We have been using the orthorectified-pansharpned image made from the AVNIR-2 data and the PRISM data, and the AVNIR-2 data.

These used as data and images, in the case of hard copy, used the false-color and true-color.

◆ **Result**

As for these observational data and images and tool, the investigator uses in the locale, and the utility is evaluated.

As a result, effectiveness as the decipherment reference image was confirmed, and the pansharpen image of ALOS came to be used the vegetation map maintenance on business.
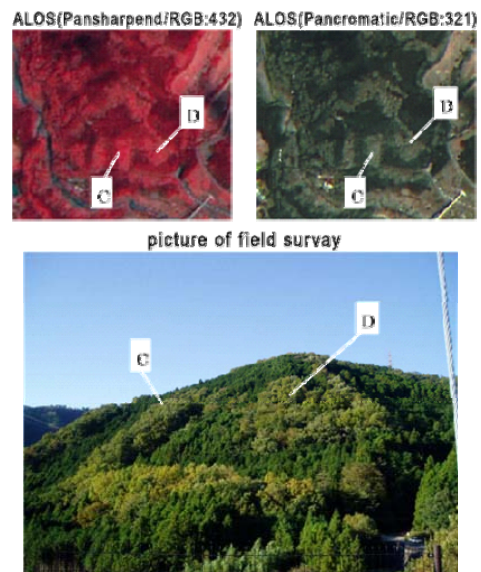

Figure. 3-2 Field survey

3.2 Cultivated area survey

The Ministry of Agriculture, Forestry and Fisheries (MAFF) is doing statistical survey of cultivated area in whole country every year. They had been surveying the cultivated area as decipher the aerial photographs based on the government data before go to field survey. After that they do the field survey and confirm the cultivated area.

Preparation of the materials and the local survey are very formidable business because it surveys to arable land in the Japanese whole country every year.

MAFF cannot take the aerial photographs in the entire region of interest area every year. Because it needs very big cost to take the aerial photographs. Therefore they use the aerial photographs which including that took by other ministry or local government.

There is the place where the document and aerial photograph are poor depending on an area, and they adopt an old image as a document for the past five years.
We performed examination of the image processing techniques to utilize a satellite image as the material which supplemented an aerial photograph in the cultivated area survey by the cooperated study. In addition, not only the survey of the cultivated area that used the satellite data but also the use examination of the crop situation survey that used the satellite data.
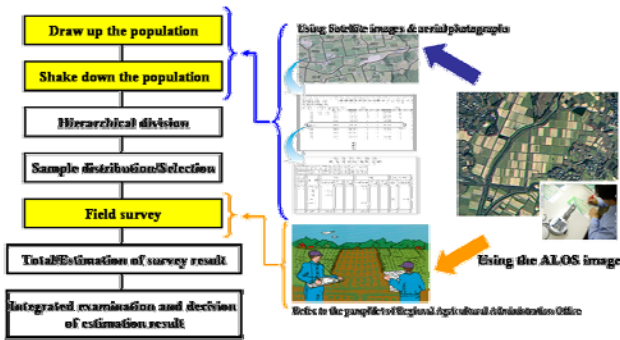
Figure. 3-3 Cultivated area survey flow

3.2.1 Item of study

The main contents of the activities are shown below.

・We studied at five local areas of the whole country because the scale of arable land was different according to the region. Moreover we studied that from large division area to small division area.

・We studied of the image processing technology that enhancement to the edge of cultivated field to confirm the cultivated area precisely.

・We performed the comparison of the error by the difference of the reduced scale of the hard copy as precision confirmation with the actual survey.

・We studied of the paddy-rice planting at a specific region by using the ALOS images.

・We made the document of "Manual for the satellite image users" for support of the satellite image decipherment, and it distributed to the investigator.

3.2.2 About data used

We have been using the orthorectified-pansharpned image made from the AVNIR-2 data and the PRISM data, and the AVNIR-2 data.

We examined that the enhancement processing and the pixel spacing changed to see easily the edge of cultivated area with the pansharpened image.

These used as data and images, in the case of hard copy, used the false-color and true-color.

Figure.3-4   Processed ALOS data

3.2.3 Result

These data and images were evaluated by the investigator to use in the locale survey.

As a result, effectiveness as the decipherment reference image was confirmed, therefore the Pansharpen image of ALOS came to be used to the cultivated area survey.

3.3 Sea ice monitoring

The Japan Coast Guard (JCG) makes the sea ice condition chart for the safety navigation of the sea. Therefore they put out the sea ice condition chart on the internet and FAX at 5 pm. every day in winter season.

The information used for not only safety navigation but also fisherman and tourist agent.
The source data of sea ice condition chart are optical satellite image and aircraft observation data and ship observation data as ever. Therefore it could not confirm the ice condition in case of cloudy weather.

ALOS PALSAR is an active type microwave sensor which can observe regardless of weather conditions.

We analyze the data that the sea of Okhotsk was observed by PALSAR at about 10 am, and send it to JCG by 2 pm. JCG decipher the sea ice condition from analyzed data and they draw the sea ice condition chat and put out the informations on the web site and FAX.

We demonstrated that using the analyzed PALSAR data at JCG, thus can contribute to reducing the day information could not send.
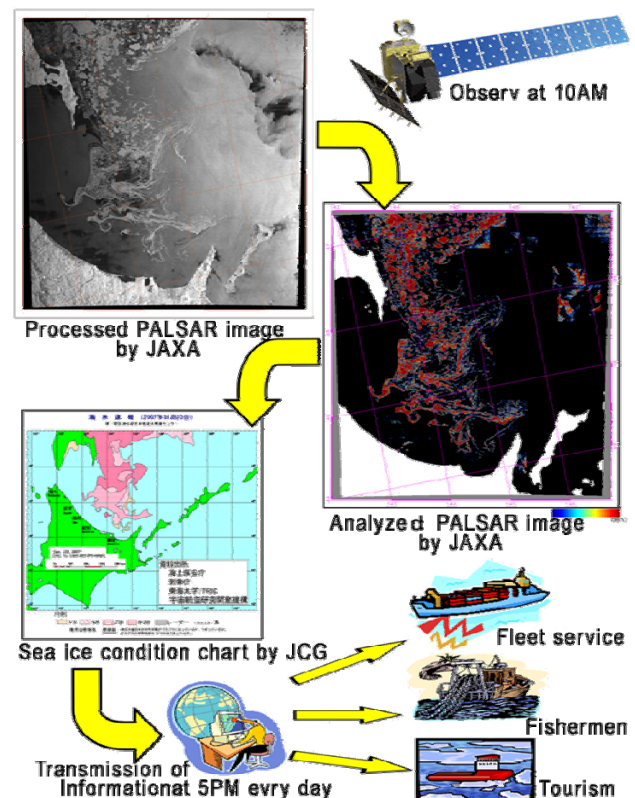

Figure. 3-5 Sea Ice chart flow

3.3.1 Item of study

The main contents of the activities are shown below.

・We constructed the system which analyze the data that the sea of Okhotsk was observed with PALSAR at about 10 am, and send it to JCG by 2 pm with automatically.
・We developed the sea ice mass density image algorithm, and validated for the accuracy improvement.
・We executed the comparison verification with the sea ice observation with aircraft and ice-breaking patrol boat SOYA to tune-up the algorithm.
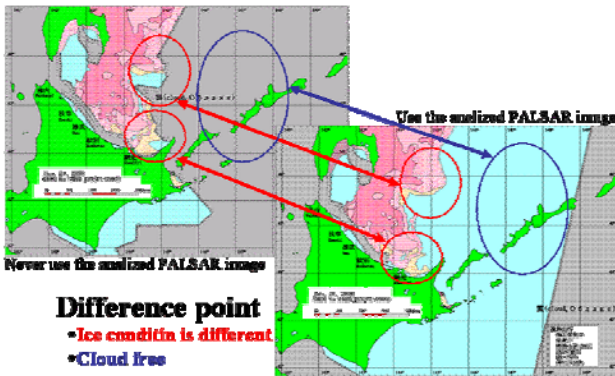・We made the decipherment case collection to facilitate the decipherment of sea ice density image.

Figure. 3-6 Decipherment effect of the sea ice mass density image

3.3.2   About data used

We have been using the sea ice mass density image made from PALSAR data and the PALSAR data.
We used other satellite SAR data to develop the algorithm. Therefore we used the AVNIR-2 data and aerial photographs to tune-up the algorithm.

3.3.3   Result

These analyzed images were evaluated by the decipherment worker.

As a result, those images were adopted as material of the sea ice chart making.
The frequency of usage had improved of those images, to make the sea ice chart. Because it can make automatically even holiday and it is offering it to JCG from last December.

3.4 The topographical map updating

The Geographical Survey Institute (GSI) creating and renewal 1:25,000 scale topographical maps. Moreover they are monitoring the tectonic activities.

In the case of create and renewal 1:25,000 scale topographical maps, they use the aerial photograph of 5 square kilometers for the topographical map renewal as ever.
They are updating the maps of urban areas every 3 years, and mountain areas every 10 or more years. But distant island and mountain areas, which could not easily be reached by aircraft for reasons of distance.

It is necessary to immediately reflect changes in topography, roads, rail lines, airport and place such as a school for the user's convenience.

It aims at the contribution to improvement of frequency of the topographical map update and diastrophism grasp by using the ALOS data in a cooperative research.

3.4.1   Item of study
The main contents of the activities are shown below.
・We studied that analysis of diastrophism model region where PALSAR data was used and making of diastrophism map.
・We studied that renewal 1/25,000 topographical maps that uses PRISM data and trial of real-time correction.
・We studied that to develop the algorithm which makes DEM and the orthographically-projected images to calibrate and validate the ALOS data.
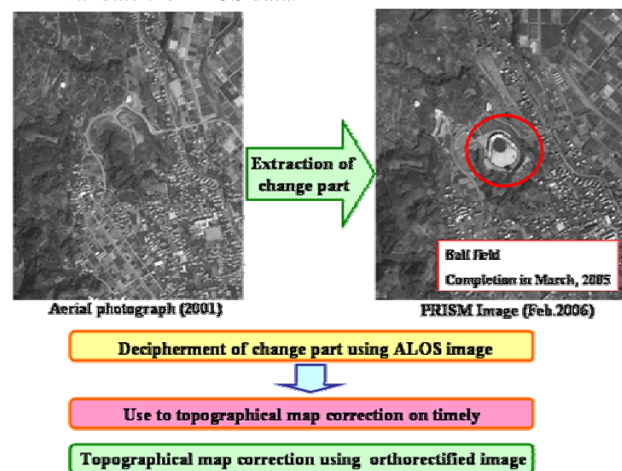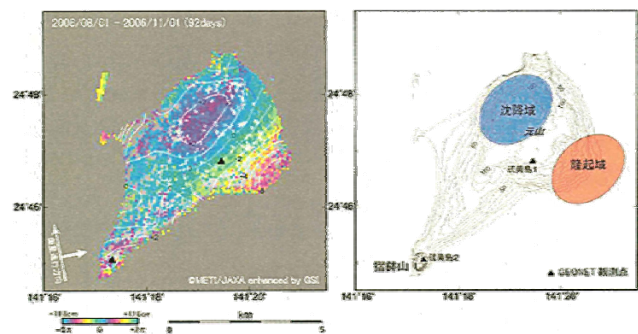

Figure. 3-7 Change in land use

Figure. 3-8 Extraction of geographical features change by SAR-interferometry

3.4.2   About data used
We have been using the AVNIR-2 data, PRISM data, and PALSAR. The ALOS data is processed to higher-order product in the GSI.

3.4.3   Result
ALOS could be observed in comparison with the aerial photograph in a wide area and detect the change features, so that useful for the map renewal.

Actually, some maps were updated by using the ALOS data in our research.

Moreover we were able to grasp minute crustal movement and volcanic activity by analyzing PALSAR data.

4. CONCLUSION AND FUTURE WORK

The conclusions of each cooperative researches are follows.
It was confirmed that the Pansharpen image which combined the high-resolution evaluation panchromatic data of PRISM and the spectral data of AVNIR-2 and made it were effective.
Therefore in the natural environmental preservation base investigation of the Ministry of the Environment and the cultivated area investigation of the Ministry of Agriculture, Forestry and Fisheries, it shifted respectively and it shifted to the stage of the trial and practical use.
In the sea ice condition chart making of the Japan Coast Guard, it is confirmed that PALSAR data can confirm the surface of the sea situation under bad weather and semi-real-time delivery of the data are effective. Thus it is shifting to a practical stage.

It was confirmed that the ALOS data to confirm the modification in renewal of 1/25,000 topographical map by Geographical Survey Institute was effective.
Therefore making the updated information is being shifted to practical use.

After feasibility study, it is expected to shift to the stage for verify of availability and utilization, one by one.

At the stage for utilization, the timing of the observation and the data offer suitable for user's needs becomes important.
We plan to study of data offering to improve the usage effect in utilization steps.

It aims for the ALOS data to be used for utility to a joint research and other business besides; therefore we advance the activity that understands the remote sensing technology further by the person in charge of the ministry.

We are planning to advance the ALOS data promotion activities for generally utilization.

And we plan to demonstrate that satellite data are available for many purposes, to using the GIS technology and data fusion, in order to be realized the successor satellite mission plan.

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