# APPENDIX

# 巻末資料 1　Minutes of Meeting（M/M）

（2011 年 10 月 11 日締結）

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# MINUTES OF MEETING
# FOR
# THE PROJECT FORMULATION ON
# "THE PROJECT FOR ESTABLISHMENT OF INTEGRATED GEOGRAPHIC INFORMATION SYSTEM (GIS) DATABASE FOR MINERAL RESOURCES" PROJECT
# IN THE REPUBLIC OF MALAWI

October 11, 2011
Lilongwe, the Republic of MALAWI

The Project Formulation Team on the above mentioned Project for promotion of the mining industry in the Republic of Malawi (hereinafter referred to as "the Japanese Team") organized by the Japan International Cooperation Agency (hereinafter referred to as the "JICA") and headed by Mr. Hiroshi SUMIYOSHI, visited the Republic of Malawi from 2nd to 11th October 2011.

During its stay in the Republic of Malawi, the Japanese Team had a series of discussions and exchanged views on "the Project for Establishment of Integrated Geographic Information System (GIS) Database for Mineral Resources" (hereinafter referred to as "the Project") with the officials of the Geological Survey Department, Ministry of Natural Resources, Energy and Environment (hereinafter referred to as "the Malawian Team").
Discussions were conducted in a friendly and cordial atmosphere and both Teams agreed to record the following points as summarized conclusions of the discussions.

Mr. Hiroshi SUMIYOSHI
Leader
Project Formulation Team
Japan International Cooperation Agency

Mr. Tomics Kaunda
Controller of Policy and Planning,
Ministry of Natural Resources, Energy and Environment

## 1. Confirmation of Current Situation and Facts

The Japanese Team confirmed the following facts

(a) Current Situation of Mining Sector in Malawi

The Malawi Growth Development Strategy (hereinafter referred to as "MGDS") is the overarching strategy for Malawi from 2006/2007 to 2010/2011. Mining development is one of the nine key priority areas in MGDS I and MGDS II (draft). In MGDS, the exploitation of mineral resources is described as a crucial factor of economic growth and development of Malawi's economy.

The Geological Survey Department (hereinafter referred to as "GSD") under the Ministry of Natural Resources, Energy and Environment (hereinafter referred to as "MNREE") of the Government of the Republic of Malawi (hereinafter referred to as "GoM") has mostly old geological information, most of which was developed during the British Colonial period, and it has not been revised. The Mines and Minerals Act was enacted in 1983 and aims at encouraging private investors to venture in the mining sector. The Act is being revised in order to attract private investment. Large scale mining development has just started recently such as uranium mine in the northern region.

In addition, potential for Rare Earth resources exists in Malawi. GoM expects that exploration and exploitation of these mineral resources can encourage foreign investment and stimulate economic growth in Malawi. Despite its demand in the world, information and data for Rare Earth on Malawi is still insufficient at the moment. The capacity of the Department of Geological Survey is limited and cannot alone undertake such a survey expeditiously.

Against this background, the GoM wishes to cooperate with the Government of Japan (hereinafter referred to as "GoJ") to establish integrated GIS database and enhance capacity of GSD in order to further promote the mining sector in Malawi.

(b) Reasons for the Promotion of the Mining Sector

Although GSD has been collecting geological data and mineral resources information since the 1920's most of this data has not been electronically compiled and archived. GSD realizes that the management of geological information and geological mapping are very important and the dissemination of such information is one of the most effective means to attract private companies.

(c) Feasibility of the Project

GSD has responsibilities related to the mining sector in GoM including;

1) geological mapping and mineral investigation,
2) being a member of the mining licensing committee,
3) reviewing of mining law,
4) management of mineral resources information,
5) inspection of mineral exploration and mining activities

GSD is therefore expected to enhance its capacity in order to better respond to

increased mineral exploration and mining activities.
The Japanese and Malawian Teams agreed that capacity building through geological mapping and compiling geological information are of high priority, and the Project should focus on capacity building of GSD staff.

## 2. Outline of the Project (see in ANNEX - 1 )

The Japanese Team and the Malawian Team discussed and drafted an outline of the Project. Both Teams shared ideas on the tentative Record of Discussions of the Project, and agreed with following points;

(a) Title of the Project
"the Project for Establishment of Integrated Geographic Information System (GIS) Database for Mineral Resources"

(b) Objective of the Project
The main objective of the Project is to develop management capacity of a GIS based mineral resource information system for development and promotion of the mining sector in Malawi.

(c) Area to be covered by the Project
The Project covers the whole area of the Republic of Malawi by Remote Sensing and GIS Database.

(d) Outputs and Activities of the Project
i.) To review and analyze existing data, information and documents related to mining and mineral resources for the compilation of geological maps and construction of GIS based database. Specifically the following information will be required:
- ✓ Geological and Remote sensing data
- ✓ Current situation of mineral exploitation and exploration.
- ✓ Infrastructure and environment information
- ✓ Current situation of equipment and personnel in the GSD
- ✓ Mining Act, investment data from Malawi Investment Promotion Agency (MIPA) and other relevant Acts and policies

ii.) To organize satellite image data through:
- ✓ ASTER data collection, processing and interpretation
- ✓ Compiling of a user guide

iii.) Designing and establishment of a GIS through:
- ✓ Input Remote Sensing processing and interpretation data
- ✓ Input major rivers, mountains, national and province boundaries, cities and towns, etc. to GIS
- ✓ Input Geological maps and mineral resources information to GIS
- ✓ Compilation of the operation and maintenance manual

iv.) Capacity Building to maintain these activities sustainably through On the Job Training (OJT).

(e) Duration of the Project

Duration of the project will be approximately 18 months after the signing of the R/D.

(f) Counterpart Organization

GSD is the lead implementing agency for the Project. GSD will appoint appropriate personnel for the Project by the commencement of the Project. The organization chart is attached as ANNEX – 2.

(g) TOR of Members of the Project Team

- ✓ Leader: Compile Remote Sensing data and other relevant information
- ✓ Geologist: Geological mapping, Mineral assessment, Remote Sensing
- ✓ Geologist: GIS

(h) Personnel assigned from GSD

- ✓ Staff of remote sensing data analysis (5 members of staff)
- ✓ Staff of integrated GIS databases (5 members of staff)
- ✓ 5 Mapping geologists, 3 Geochemists, 1 Petrographer, 1 Mineralogist

## 3. Treatment of equipment in the Project

Necessary equipment for the processing and interpretation of satellite data and to establish the GIS such as GIS software, hardware, satellite data, will be purchased for this project by JICA.

Before installation of the equipment, GSD shall provide the necessary space and facilities for the Project.

## 4. Expected Procedures and Steps for Implementation of the Project

The Japanese Team explained that final decision on the Project design would be subject to relevant reviews by JICA and consultation with concerned officials in the GOJ. After finalization of project design made by GOJ, JICA Malawi Office and the GOM shall sign the Record of Discussions.

ANNEX LIST

# Outline of the Project

**Project Objective:**
**To develop management capacity of a GIS based mineral information system for future development and promotion of the mining sector in Malawi.**

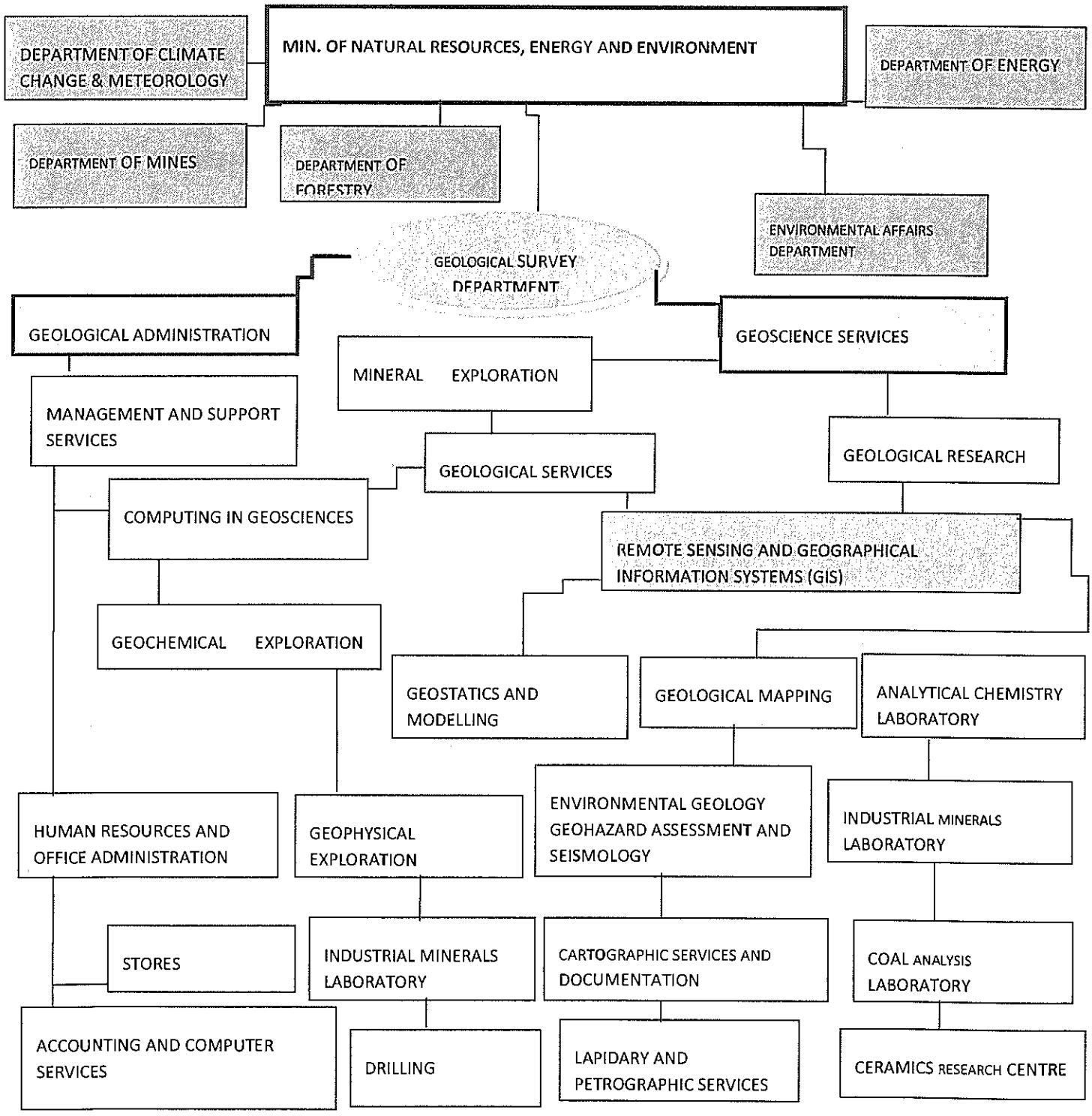
1) To review and analyze existing data, information and documents related to mining and mineral resources for the compilation of geological maps and construction of GIS based database. Specifically the following information will be required:
   - Geological and Remote sensing data
   - Current situation of mineral exploitation and exploration.
   - Infrastructure and environment information
   - Current situation of equipment and personnel in the GSD
   - Mining Act, investment data from Malawi Investment Promotion Agency (MIPA) and other relevant Acts and policies

2) To organize satellite image data through:
   - ASTER data collection, processing and interpretation
   - Compiling of a user guide

3) Designing and establishment of a GIS through:
   - Input Remote Sensing processing and interpretation data
   - Input major rivers, mountains, national and province boundaries, cities and towns, etc. to GIS
   - Input Geological maps and mineral resources information to GIS
   - Compilation of the operation and maintenance manual

4) Capacity Building to maintain these activities sustainably through On the Job Training (OJT).

# Appendix 1: Organisational Structure Chart



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# 巻末資料 2　Record of Discussions（R/D）

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# RECORD OF DISCUSSIONS

# ON

# PROJECT FOR ESTABLISHMENT OF INTEGRATED GEOGRAPHIC INFORMATION SYSTEM (GIS) DATABASE FOR MINERAL RESOURCES

# IN

# THE REPUBLIC OF MALAWI

## AGREED UPON BETWEEN

## MINISTRY OF NATURAL RESOURCES, ENERGY AND ENVIRONMENT

## AND

## JAPAN INTERNATIONAL COOPERATION AGENCY

Lilongwe,18th November,2011]

Mr. Katsuro SAITO
Resident Representative
Malawi Office
Japan International Cooperation Agency

Mr. Ben Botolo
Principal Secretary
Ministry of Natural Resources, Energy and Environment

In response to the official request of the Government of the Republic of Malawi (hereinafter referred to as "the Republic of Malawi") to the Government of Japan, the Japan International Cooperation Agency (hereinafter referred to as "JICA") held a series of discussions with Ministry of Natural Resources, Energy and Environment of the Republic of Malawi (hereinafter referred to as "MNREE") and relevant organizations to develop a detailed plan of "the Project for Establishment of Integrated Geographic Information System (GIS) Database for Mineral Resources" (hereinafter referred to as "the Project").

Both parties agreed the details of the Project and the main points discussed as described in the Appendix 1 and the Appendix 2 respectively.

Both parties also agreed that MNREE, the counterpart to JICA, will be responsible for the implementation of the Project in cooperation with JICA, coordinate with other relevant organizations and ensure that the self-reliant operation of the Project is sustained during and after the implementation period in order to contribute toward social and economic development of the Republic of Malawi.

The Project will be implemented within the framework of the Agreement on Technical Cooperation signed on March 1, 2006 (hereinafter referred to as "the Agreement") and the official letters exchanged on April 27, 2011 and May 4, 2011 between the Embassy of Japan in Malawi (hereinafter referred to as "EOJ") and Ministry of Finance of the Republic of Malawi.

Appendix 1: Project Description
Appendix 2: Minutes of Meetings on the project formulation survey

**Appendix 1**

## PROJECT DESCRIPTION

Both parties confirmed that there is no major change in the Project Description agreed on in the minutes of meetings on the Preparatory Survey on the Project signed on October 11, 2011 (Appendix 2).

## I. BACKGROUND

1. Current Situation of Mining Sector in Malawi

The Malawi Growth Development Strategy (hereinafter referred to as "MGDS") is the overarching strategy for Malawi from 2006/2007 to 2010/2011. Mining development is one of the nine key priority areas in MGDS I and MGDS II (draft). In MGDS, the exploitation of mineral resources is described as a crucial factor of growth and development of Malawi's economy.

The Geological Survey Department (hereinafter referred to as "GSD") under the Ministry of Natural Resources, Energy and Environment (hereinafter referred to as "MNREE") of the Government of the Republic of Malawi (hereinafter referred to as "GoM") has mostly old geological information, most of which was developed during the British Colonial period, and it has not been revised. The Mines and Minerals Act was enacted in 1983 and aims at encouraging private investors to venture in the mining sector. The Act is being revised in order to attract private investment. Large scale mining development has just started recently such as a uranium mine in the northern region.

In addition, mineral potential including Rare Earth resources exists in Malawi. GoM expects that exploration and exploitation of these mineral resources can encourage foreign investment and stimulate economic growth in Malawi. Despite its demand in the world, information and data for Rare Earth on Malawi is still insufficient at the moment. The capacity of GSD is limited and cannot alone undertake such a survey expeditiously.

Against this background, the GoM wishes to cooperate with the Government of Japan (hereinafter referred to as "GOJ") to establish integrated GIS database and enhance capacity of GSD in order to further promote the mining sector in Malawi.

2. Reasons for the Promotion of the Mining Sector

Although GSD has been collecting geological data and mineral resources information since the 1920's most of this data has not been electronically compiled and archived. GSD realizes that the management of geological information and geological mapping are very important and the dissemination of such information is one of the most effective means to attract private companies.

## II. OUTLINE OF THE PROJECT

1. Title of the Project
"Project for Establishment of Integrated Geographic Information System (GIS) Database for Mineral Resources"

2. Expected Goals which will be attained after the Project Completion
(1) Goal of the Proposed Plan
The main objective of the Project is to develop management capacity of a GIS based mineral resource information system for development and promotion of the mining sector in Malawi.

(2) Goal which will be attained by utilising the Proposed Plan
Designing and establishment of a GIS based mineral resource information.

3. Outputs and Activities
(1) To review and analyse existing data, information and documents related to mining and mineral resources for the compilation of geological maps and construction of GIS based database. Specifically the following information will be analysed:
- ✓ Geological and Remote sensing data
- ✓ Current situation of mineral exploitation and exploration.
- ✓ Infrastructure and environment information
- ✓ Current situation of equipment and personnel in the GSD
- ✓ Mining Act, investment data from Malawi Investment Promotion Agency (MIPA) and other relevant Acts and policies

(2) To organise satellite image data through:
- ✓ ASTER data collection, processing and interpretation
- ✓ Compiling of a user guide

(3) To Design and establish a GIS Database through:
- ✓ Input Remote Sensing processing and interpretation data
- ✓ Input major rivers, mountains, national and province boundaries, cities and towns, etc. to GIS
- ✓ Input Geological maps and mineral resources information to GIS
- ✓ Compilation of the operation and maintenance manual

(4) To build capacity of Malawian counterpart personnel on utilization, maintenance and updating of GIS Database through On the Job Training (OJT).

4. Input
(1) Input by JICA
(a) Dispatch of Mission
Leader: Compile Remote Sensing data and other relevant information
Geologist: Geological mapping, Mineral assessment, Remote Sensing
Geologist: GIS
(b) Training of counterpart personnel in Japan
Subject: Methodology of GIS establishment

(c) Machinery and Equipment
Hardware: Personal Computer (5), Printer, Scanner,
Software: Satellite data processing software, GIS software,
Data: ASTER data

In case of importation, the machinery, equipment and other materials under II-4 (1) (c) above will become the property of the Republic of Malawi upon being delivered C.I.F. (cost, insurance and freight) to the Republic of Malawi authorities concerned at the ports and/or airports of disembarkation.

Input other than indicated above will be determined through mutual consultations between JICA and MNREE during the implementation of the Project, as necessary.

(2) Input by MNREE

MNREE will take necessary measures to provide at its own expense:

(a) Services of MNREE's counterpart personnel and administrative personnel as referred to in II-5;
(b) Suitable office space with necessary furniture;
(c) Supply or replacement of machinery, equipment, instruments, vehicles, tools, spare parts and any other materials necessary for the implementation of the Project other than the equipment provided by JICA;
(d) Means of transport and travel allowances for the members of the JICA missions for official travel within the Republic of Malawi whenever they are invited by the Government of Malawi;
(e) Suitable furnished accommodation for the members of JICA missions and their families;
(E.g Information as well as support for suitable accommodation for the members of JICA missions and their families)
(f) Information as well as support in obtaining medical services;
(g) Credentials or identification cards;
(h) Available data (including maps and photographs) and information related to the Project;
(i) Running expenses necessary for the implementation of the Project;
(j) Expenses necessary for transportation within the Republic of Malawi of the equipment referred to in II-4 (1) as well as for the installation, operation and maintenance thereof; and
(k) Necessary facilities to the members of JICA missions for the remittance as well as utilisation of the funds introduced into the Republic of Malawi from Japan in connection with the implementation of the Project
(l) Necessary information among other developing partners (eg. the World Bank ) as they carry out their mining related activities and projects.

5. Implementation Structure

The roles and assignments of relevant organisations are as follows:

(1)MNREE

(a) Project Director

The Principal Secretary of MNREE will be assigned as the Project Director. The Project Director will be responsible for overall management of the Project.

(b) Project Manager

The Director of GSD will be assigned as the Project Manager. The Project Manager will be responsible for administration and implementation of the Project.

(c) Counterpart Personnel

Counterpart Personnel with following expertise will be assigned

- Remote sensing data analysis
- GIS databases
- Mapping Geologist

(d) Administrative Personnel

- Secretaries
- Other necessary administrative personnel

(2) JICA missions

The members of JICA missions will give necessary technical guidance, advice and recommendations to MNREE on any matters pertaining to the implementation of the Project.

6. Project Site and Beneficiaries

The Project covers the whole area of the Republic of Malawi by Remote Sensing and GIS Database.

7. Duration

Duration of the project will be approximately 18 months after the signing of the R/D. Tentative Plan of Operation of the project is detailed in Annex-1attached herewith.

8. Reports

JICA will prepare and submit the following reports to the MNREE in English. Tentative submission time is described in Annex-1attached herewith.

(1) 10 copies of Inception Report at the commencement of the 1st work period in the Republic of Malawi
(2) 10 copies of Progress Report during the 2nd work period in the Republic of Malawi
(3) 10 copies of Interim Report during the 3rd work period in the Republic of Malawi
(4) 10 copies of Draft Final Report at the end of the last work period in the Republic of Malawi
(5) 10 copies of Final Report within one (1) month after the receipt of the comments on the Draft Final Report

9. Environmental and Social Considerations

(1) MNREE agreed to abide by 'JICA Guidelines for Environmental and Social Considerations' in order to ensure that appropriate considerations will be made for the environmental and social impacts of the Project.

## III. UNDERTAKINGS OF MNREE AND the Republic of Malawi

1. MNREE and the Republic of Malawi will take necessary measures to:

   (1) ensure that the technologies and knowledge acquired by the Republic of Malawi nationals as a result of Japanese technical cooperation contributes to the economic and social development of the Republic of Malawi, and that the knowledge and experience acquired by the personnel of the Republic of Malawi from technical training as well as the equipment provided by JICA will be utilized effectively in the implementation of the Project; and

   (2) grant privileges, exemptions and benefits to the members of JICA missions referred to in II-5 (1) above and their families, which are no less favorable than those granted to experts and members of the missions and their families of third countries or international organisations performing similar missions in the Republic of Malawi.

2. MNREE and the Republic of Malawi will take necessary measures to:

   (1) provide security-related information as well as measures to ensure the safety of members of JICA missions;
   (2) permit the members of JICA missions to enter, leave and sojourn in the Republic of Malawi for the duration of their assignments therein and exempt them from foreign registration requirements and consular fees.
   (3) exempt the members of JICA missions from taxes and any other charges on the equipment, machinery and other material necessary for the implementation of the Project;
   (4) exempt the members of JICA missions from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to them and/or remitted to them from abroad for their services in connection with the implementation of the Project; and
   (5) meet taxes and any other charges on the equipment, machinery and other material, referred to in II-5 above, necessary for the implementation of the Project.

3. MNREE and the Republic of Malawi will bear claims, if any arises, against the members of JICA missions resulting from, occurring in the course of, or otherwise connected with, the discharge of their duties in the implementation of the Project, except when such claims arise from gross negligence or willful misconduct on the part of the members of the JICA missions.

## IV. EVALUATION

JICA will conduct the following evaluations and surveys to mainly verify sustainability and impact of the Project and draw lessons. MNREE is required to provide necessary support for them.

1. Ex-post evaluation three (3) years after the project completion, in principle
2. Follow-up surveys on necessity basis

## V. PROMOTION OF PUBLIC SUPPORT

For the purpose of promoting support for the Project, MNREE will take appropriate measures to make the Project widely known to the people of the Republic of Malawi.

## VI. MUTUAL CONSULTATION

JICA and MNREE will consult each other whenever any major issues arise in the course of Project implementation.

## VII. AMENDMENTS

The record of discussions may be amended by the minutes of meetings between JICA and MNREE.

The minutes of meetings will be signed by authorized persons of each side who may be different from the signers of the record of discussions.

Annex -1 Tentative Plan of Operation
Annex -2 Outline of Division of Technical Undertaking

**Project Plan of operation (tentative)**

| **Month** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Example of Calendar Year** | 2011 | | | | | | | | 2012 | | | | | | 2013 | | | | | | |
| | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| **≪Logisics≫** | | | | | | | | | | | | | | | | | | | | | |
| Selection of the Japanese consultant by open tender after the signing of the R/D. | | | | | | | | | | | | | | | | | | | | | |
| Procurement of the necesarry equipment | | | | | | | | | | | | | | | | | | | | | |
| **≪Outputs≫** | | | | | | | | | | | | | | | | | | | | | |
| 1) To review and analyse existing data, information and documents related to mining and mineral resources for the compilation of geological maps and construction of GIS based database. | | | | | | | | | | | | | | | | | | | | | |
| 2) To organise satellite image data. | | | | | | | | | | | | | | | | | | | | | |
| 3) To Design and establish a GIS Database. | | | | | | | | | | | | | | | | | | | | | |
| 4)To build capacity of Malawian counterpart personnel on utilization, maintenance and updating of GIS Database through On the Job Training (OJT). | | | | | | | | | | | | | | | | | | | | | |
| **≪Example of the timing of the submission of the report≫** | | | | | | | | | | | | | | | | | | | | | |

Annex-2

**Outline of Division of Technical Undertaking**

| Outputs | JICA Undertaking | GSD Undertaking |
|---|---|---|
| 1) To review and analyse existing data, information and documents related to mining and mineral resources for the compilation of geological maps and construction of GIS based database. | Technical assistance for data collection and analysis | Data collection and analysis |
| 2) To organise satellite image data. | Technical assistance for data collection, processing and analysis through OJT. | Data collection, processing and analysis |
| 3) To Design and establish a GIS Database. | Technical assistance for data input and revision of database through OJT.<br>Technical assistance for designing the database through OJT. | Data input and revision of database related to mining sector<br>Design the database related to mining sector |

# 巻末資料 3　Inception Meeting

（2012 年 4 月 10 日付，於ゾンバ GSD）

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# Minutes of the Inception Meeting

for

The Project for Establishment of Integrated Geographic Information System (GIS) Database for Mineral Resources

Date of the Meeting : 5th April, 2012

Place of the Meeting : Geological Survey Department Headquarter in Zomba

Attendee : see the attendee list attached

10th April 2012

Zomba, the Republic of Malawi

Dr. Leonard S. N. Kalindekafe

Director

Geological Survey Department

(GSD)

Mr. Onuma Takumi

JICA Project Leader

Sumiko Resources Exploration

& Development Co., Ltd.

(SRED)

## 1. Opening speech of the Inception Meeting by Dr. Hosoi, JICA Headquarter

(1) Introduction of the outline of the project

This is the first meeting of the project. The project team will begin the actual work in June. Till then, the GSD has to choose trainees and prepare a computer room, office, electric installation, air conditioner and other facilities for the project. The project team has to prepare equipments for the project such as personal computers (C/P), printer and software. The project consists of satellite data analysis of all over the area of Malawi, establishment of GIS database and technology transfer.

(2) Introduction of the project team members

The members belong to Sumiko Resources Exploration & Development Co., Ltd.
Mr. Onuma is a team reader, Mr. Takeda is in charge of remote sensing and Mr. Kobayashi is in charge of GIS.

## 2. Greetings by Dr. Kalindekafe, Director of GSD

(1) Message of thanks

Thank Dr. Hosoi for the introduction of the project. The GSD and the project team just started the project. The project which covers all over Malawi unlike the JOGMEC project will produce good results. The project which is arranged by Japanese government and Malawi government contributes a great deal to Malawi. I hope attendees of GSD members ask questions positively in this meeting. After this one year, the project will be improving to the participants of the project, GSD and finally Malawi.

(2) Introduction of the members of GSD

Ten participants were introduced. (see the attendee list attached)

## 3. Explanation of the project by Mr. Onuma, project team leader

(1) Outline of Project Implementation

a. Basic Concepts for Project Implementation
b. Background of the Project
c. Objectives of the Project
d. Outputs of the Project
e. Time Schedule of the Project

(2) Basic Policies for Implementation of the Project
  a. Basic Policies of Technical Aspects
  b. Basic Policies of Operational Aspects
(3) Method of Project Implementation
  a. Work Items
  b. Work Implementation Method
  c. Work Plan
  d. Personnel Plan
  e. Work Assignments of Study Team Members
  f. Equipment and Materials Necessary for the Works in Malawi
  g. Other Items (Reference Literatures and Websites)

## 4. Question and Answer Session

Q (Kalindekafe) : Malawi has not yet signed EITI which is showed in the 6th sentence of Output 1.
A (Onuma) : The project team understands it and explains EITI to C/P.

Q (Onuma) : How many persons were trained at the remote sensing center in Botswana?
A (Kalindekafe) : Seven persons. Two of them are not here for getting master degree or training at mining company.

Q (C/P) : PALSAR is no longer working.
A (Onuma) : Plenty of ASTER and PALSAR data have already been observed. The project team selects most suitable data from the archive and provides them.

Q (C/P) : Is LANDSAT data analysis included in OJT as well as ASTER data analysis ?
Q (Kalindekafe) : After the end of the project, as the GSD cannot purchase ASTER data, the GSD requests that LANDSAT data analysis would be included in OJT.
A (Onuma) : The project team will include LANDSAT data analysis in OJT.

Q (C/P) : The participants of training at JOGMEC remote sensing center in Botswana did the atmospheric correction by ACORN. Is ACORN used in this project ?
A (Onuma) : I think the atmospheric correction is not so important against ASTER

data. The project team will ask Dr. Takeda of JOGMEC Botswana about the use of ACORN and consider the use of atmospheric correction if necessary.

Q (Kalindekafe) : The GSD thanks to receive equipments and technical transfer in this project. The laboratory of GSD has insufficient facilities. If the equipments in laboratory and the technology transfer for geochemistry would be provided, the GSD is very happy. Is this matter the expansion of this project or a new project.

A (Hosoi) : This must be a new project. Please consider it positively.

Q (Kalindekafe) : The main exploration in Malawi is recently rare earth elements. However, the laboratory of GSD can not analyze rare earth elements.

A (Onuma) : The project team wants such information. The team leader can describe it in the report and then JICA will consider it.

Q (Onuma) : How many person can use ENVI among participants ?

A (C/P) : Three persons. But, the GSD has no license of ENVI software.

Q (Onuma) : Do you remember how to use ENVI ?

A (C/P) : Yes.

Q (Onuma) : Are there any GIS data about geology and mineral resources ?

A (C/P) : A little bit.

Q (Onuma) : How many person can use ArcGIS ?

A (C/P) : All persons can use GIS.

Q (C/P) : Blackout often happens in Zomba. Is there any provision ?

A (Onuma) : UPSs are provided against blackout.

Q (C/P) : How long does it work ?

A (Onuma) : It works for the time to do shutdown the PC.

Q (C/P) : Can JICA provide generator ?

A (Hosoi) : The GSD has to provide a computer room with facilities such as air conditioner, electrical installation as described in M/M and R/D.

A (Tazawa) : Generator has a fuel problem. There is an option to use battery and inverter. This is a good opportunity for members of GSD to demand the budget of these equipments for next fiscal year.

Q (Hosoi) : Is this meeting room available as the room to be installed 5 personal computers and OJT ?

A (Kalindekafe) : Yes.

## 5. Closing comment by Dr. Hosoi, JICA HQ

The Inception Meeting gives us a great benefit. I thank everyone. This meeting finishes now. Please continue the discussion and exchange ideas each other, and prepare for exact start of June until the project team leaves on 11th April.

## 6. Closing comment by Dr. Kalindekafe, GSD

The GSD thanks the project team very much for this meeting. The GSD promises that the project team has 100% cooperation, because we are keen for this project. The GSD hopes that this project is the beginning of other projects of future.

# Participant List

| Name | Position |
|---|---|
| Geological Survey Department (GSD) | |
| Leonard S. N. Kalindekafe | Director |
| Annock G. Chiwona | Principal Geologist |
| Charies B. Missi | Senior Geochemist |
| Samuel Sakhuta | Geologist |
| Stewart Ngalonde | Geologist |
| Harrison Mtumbuka | Geologist |
| Hilton Banda | Geologist |
| Dyson Moses | Geologist |
| Chikondi Chisenga | Geologist |
| Hendrix Kaonga | Geologist |
| Patrick R. Chindandali | Senior Seismology Technician |
| Japan International Cooperation Agency (JICA) | |
| Yoshitaka Hosoi | Senior Advisor, JICA Headquarter |
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# 巻末資料 4　衛星データ解析のマニュアル

裏白

# Satellite Data Analysis Processing Manual



Satellite Data Analysis JICA GIS Project

## Index



Sumiko Resources Exploration & Development Co., Ltd.

ASTER data analysis

JOB00-1

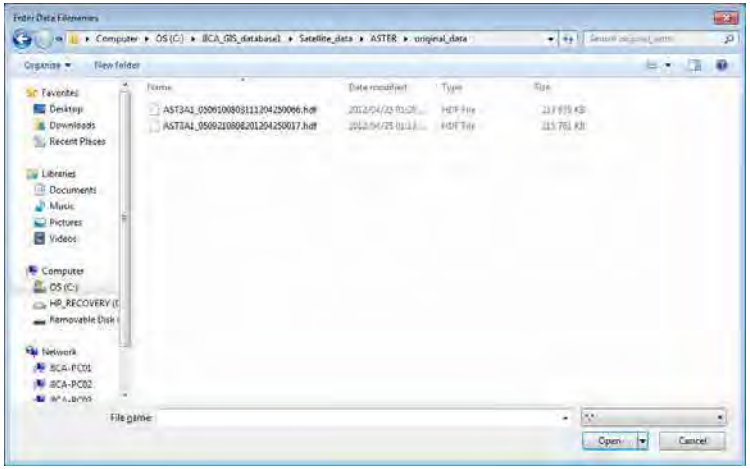
+ Job content: Create a color composite image (RGB=B3,B2,B1) of ASTER VNIR data

+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥original_data

+ Input filename: (example: AST3A1_0506100803111204250066.hdf)

"¥" means back slash.

- Click "File" on main menu bar.
- Select and click "Open Image File".
- "Enter Data Filenames" window appears.




- Choose and find the input data folder in the window.
- Select and click the input ASTER data file in the window.

Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥original_data

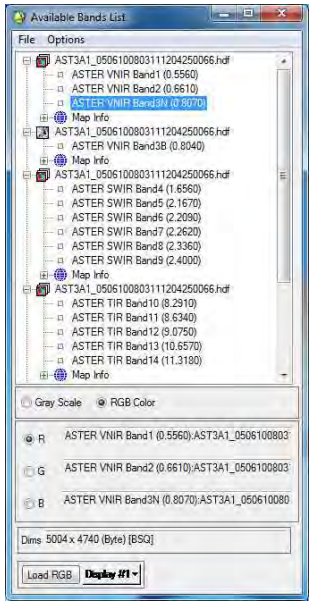
(example: AST3A1_0506100803111204250066.hdf)

- Selected data filename appears in the "File Name" box.
- Click "Open" box in the window.



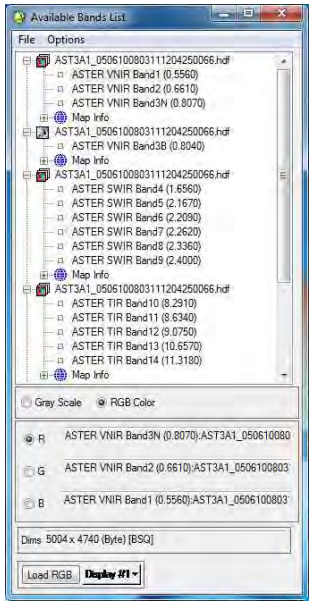


- Selected ASTER data is read into ENVI and appears in the "Available Bands List" window.




- Click "RGB color" circle shown in lower part of the "Available Bands List" window.
- R/G/B circles and description boxes appear in the lower part of the window.
- When the "R circle" is selected (ticked), click "ASTER VNIR Band3N".
- After the click above, the "G circle" is automatically ticked.
- When the "G circle" is selected (ticked), click "ASTER VNIR Band2".
- After the click above, the "B circle" is automatically ticked.
- When the "B circle" is selected (ticked), click "ASTER VNIR Band1".
- After the click above, the "R circle" is automatically ticked again.

- Make sure that Band3N is shown in the “R box”, Band2 in the “G box” and Band1 in the “B box”.

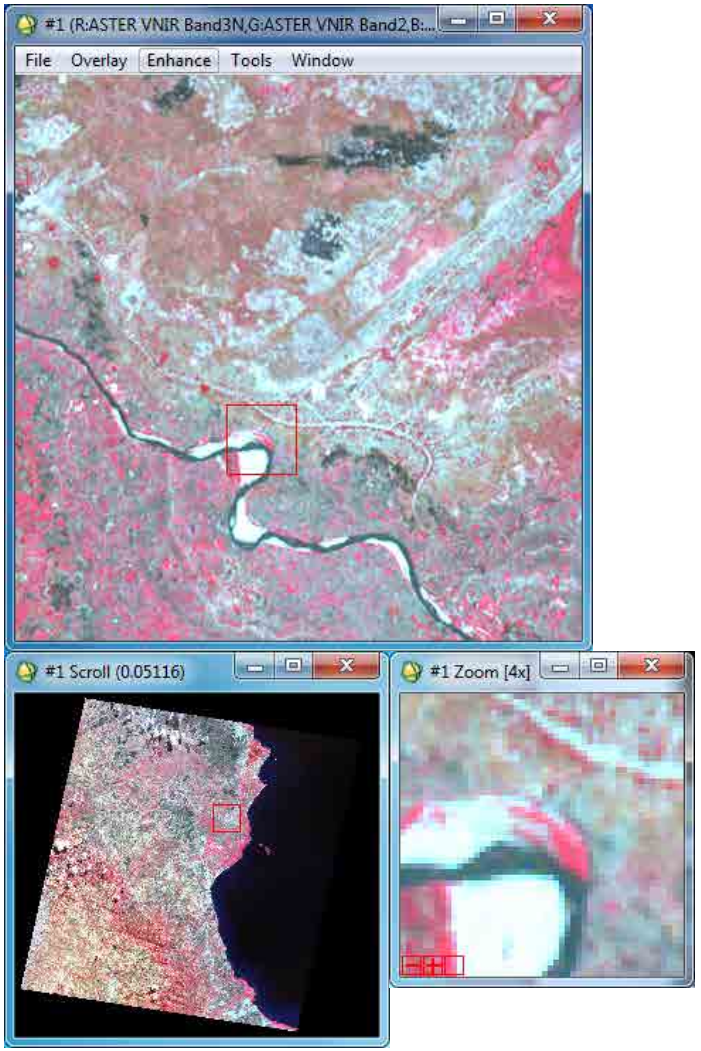



- Click “No Display” box in the bottom of the window.
- Select and click “New Display”.
- Click “Load RGB” box in the bottom of the window.





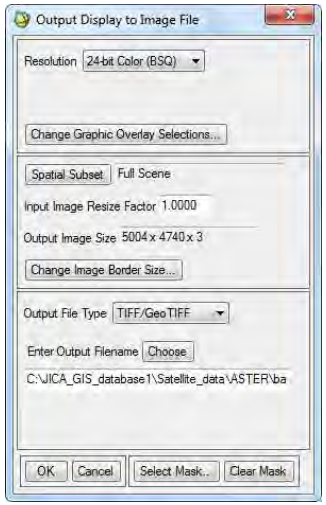
- Three kinds of window “Image / Scroll / Zoom” appear.
- A color composite (false color) image (RGB=B3,B2,B1) of ASTER VNIR data is created.



JOB00-2

+ Job content: Save the color composite image (RGB=B3,B2,B1) of ASTER VNIR data
+ Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥band_comp¥B3_B2_B1
+ Output filename: (example: AST_L3A_c08r04_B3_2_1_base.tif)

- Click “File” on display menu bar.
- Select “Save Image As” and then select and click “Image File…”.
- “Output Display to Image File” window appears.

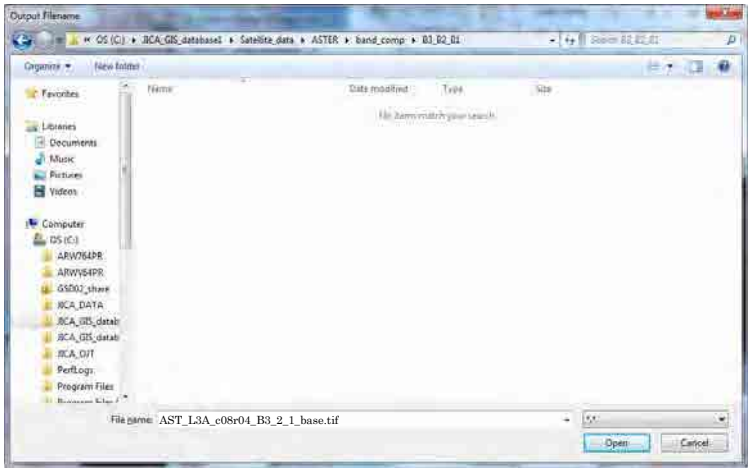



- Select “TIFF/GeoTIFF” in the “Output File Type” box.
- Click “Choose” box to enter output filename.





- “Output Filename” window appears.




- Choose output file folder and then enter output filename in the “Filename” box.

Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥band_comp¥B3_B2_B1
Output filename (example: AST_L3A_c08r04_B3_2_1_base.tif)

NOTE: To create filename, refer the list of GRANULE ID of ASTER data.

In this case, input filename and output filename are as follows.

+ Input filename: (example: AST3A1_0506100803111204250066.hdf)
+ Output filename: (example: AST_L3A_c08r04_B3_2_1_base.tif)

How to create filename

- Find filename “AST3A1_0506100803111204250066” in the list of GRANULE ID of ASTER data.
- See column and row correspond to “AST3A1_0506100803111204250066”
- Confirm the column is 8 and the row is 4.
- Create filename “AST_L3A_c08r04”.
- Append “_B3_2_1_base.tif”.
- Filename “AST_L3A_c08r04_B3_2_1_base.tif” is created.

- Click “Open” box in the window.
- Entered output filename appears in the “Enter Output Filename” box of the “Output Display to Image File” window.
- Click “OK” box in the window.
- “AST_L3A_B3_2_1_base.tif” file is saved in the “¥ASTER¥band_comp¥B3_B2_B1” folder.

JOB01

+ Job content: Resize the resolution (15m) of the VNIR data to the same resolution (30m) as the SWIR data

+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥original_data

+ Input filename: (example: AST3A1_0506100803111204250066.hdf)

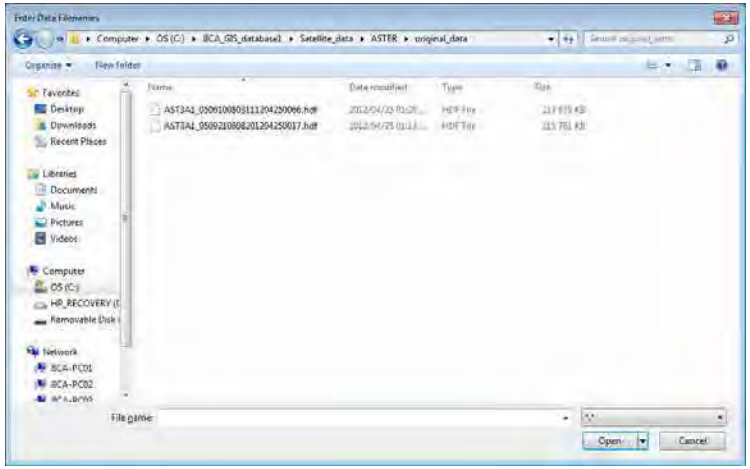
+ Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp

+ Output filename: (example: AST_L3A_c08r04_VNIR.img)

- Click “File” on main menu bar.

- Select and click “Open Image File”.

- “Enter Data Filenames” window appears.




- Choose and find the input data folder in the window.

- Select and click the input ASTER data file in the window.

Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥original_data

(example: AST3A1_0506100803111204250066.hdf)

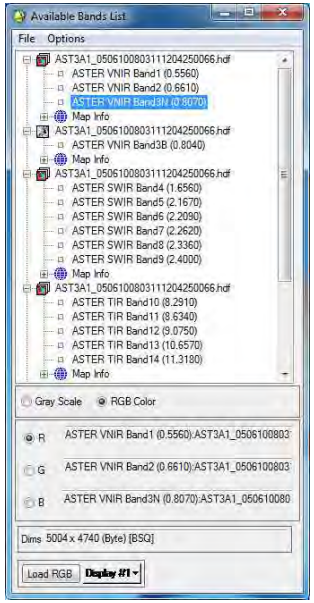
- Selected data filename appears in the “File Name” box.

- Click “Open” box in the window.





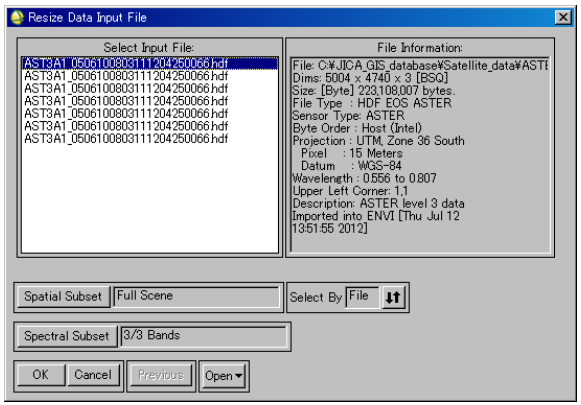
- Selected ASTER data is read into ENVI and appears in the “Available Bands List” window.




- Click “Basic Tools” on main menu bar.

- Select and click “Resize Data”.

- “Resize Data Input File” window appears.




- Select the 1st of “AST3A1_0506100803111204250066.hdf” in the “Resize Data Input File” window.

- Click “OK” box in the window.
- “Resize Data Parameters” appears.
- Click “Set Output Dims by Pixel Size” box.
- “Output Dims via Pixel Size” window appears.
- Enter value “30” in the “Output X Pixel Size” box of "30" of Output Dims via Pixel Size” window.
- Enter value “30” in the “Output Y Pixel Size” box of "30" of Output Dims via Pixel Size” window.
- Click “OK” box in the window.
- Click “Resampling” box and Select “Pixel Aggregate”.
- Click “Choose” box to enter output filename.
- “Output Filename” window appears.
- Choose output file folder and then enter output filename in the “Filename” box.

Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp

Output filename (example: AST_L3A_c08r04_VNIR.img)

NOTE: To create filename, refer the list of GRANULE ID of ASTER data.

In this case, input filename and output filename are as follows.

+ Input filename: (example: AST3A1_05061008031112042500 66.hdf)
+ Output filename: (example: AST_L3A_c08r04_VNIR.img)

How to create filename

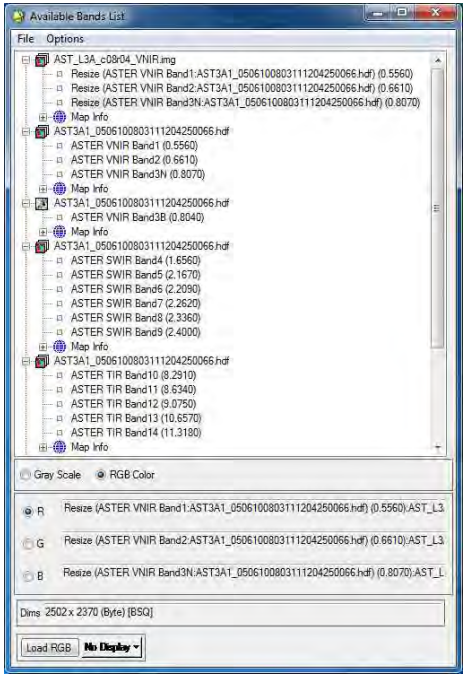
- Find filename “AST3A1_05061008031112042500 66” in the list of GRANULE ID of ASTER data.
- See column and row correspond to “AST3A1_05061008031112042500 66”
- Confirm the column is 8 and the row is 4.
- Create filename “AST_L3A_c08r04”.
- Append “_VNIR.img”.
- Filename “AST_L3A_c08r04_ VNIR.img” is created.

- Click “Open” box in the window.
- Entered output filename appears in the “Enter Output Filename” box of the “Resize Data Parameters” window.
- Click “OK” box in the window.
- “Resizie data” window appears while processing and closes after processing automatically.





- Created Resized data appears in the “Available Bands List” window.



JOB02

+ Job content: Integrate the 3 VNIR bands (1,2,3) with the 6 SWIR bands (4,5,6,7,8,9) to create data of 9 bands

+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥original_data

+ Input filename: (example: AST3A1_0506100803111204250066.hdf)

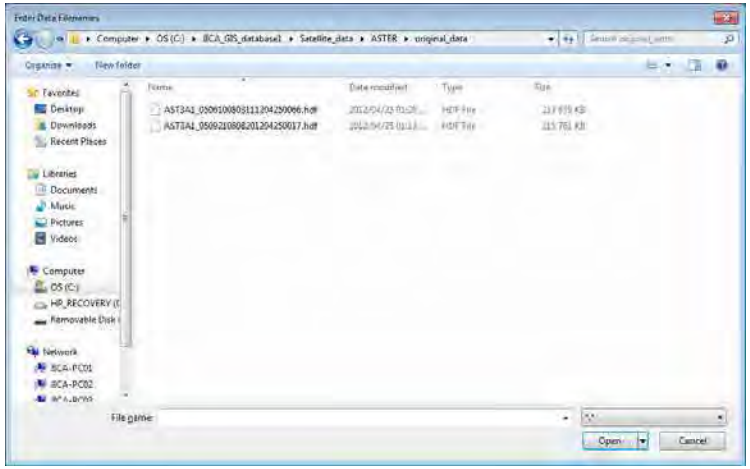
+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp

+ Input filename: (example: AST_L3A_c08r04_VNIR.img)

+ Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp

+ Output filename: (example: AST_L3A_c08r04_BB9.img)

- Click “File” on main menu bar.
- Select and click “Open Image File”.
- “Enter Data Filenames” window appears.




- Choose and find the input data folder in the window.
- Select and click the input ASTER data file in the window.

Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥original_data

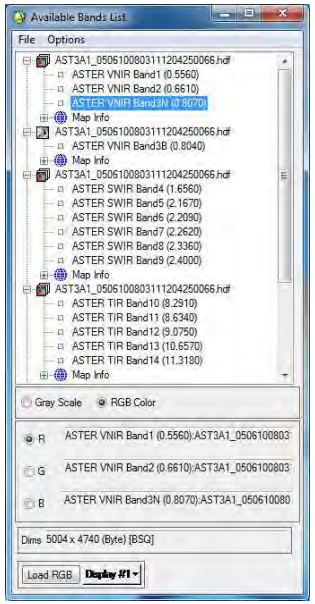
(example: AST3A1_0506100803111204250066.hdf)

- Selected data filename appears in the “File Name” box.
- Click “Open” box in the window.





- Selected ASTER data is read into ENVI and appears in the “Available Bands List” window. (post captured window here)



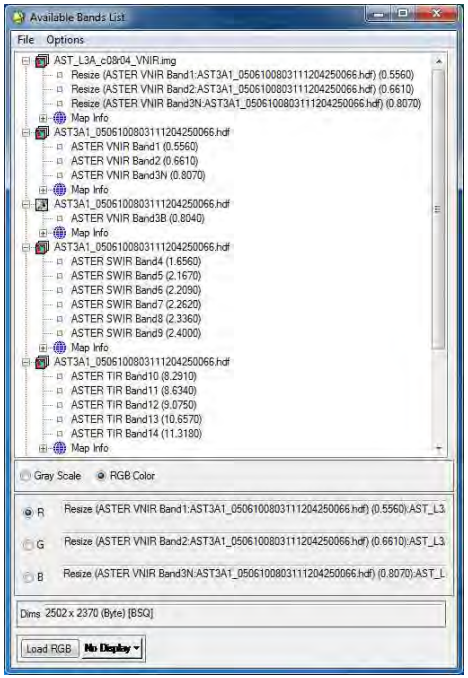

- Click “File” on main menu bar.
- Select and click “Open Image File”.
- “Enter Data Filenames” window appears.
- Choose and find the input data folder in the window.
- Select and click the input ASTER data file in the window.

Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp

(example: AST_L3A_c08r04_VNIR.img)

- Selected data filename appears in the “File Name” box.
- Click “Open” box in the window.

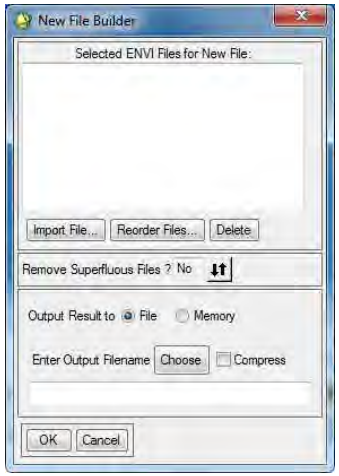
- Selected ASTER data is read into ENVI and appears in the “Available Bands List” window.



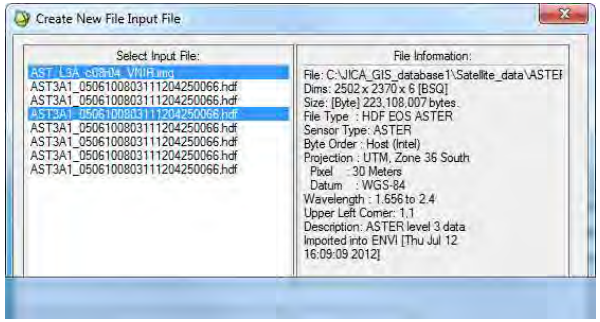





- Click “File” on main menu bar.
- Select “Save File As”, then select and click “ENVI standard”.
- “New File Builder” window appears.




- Click “Import File” box.
- “Create New File Input File” window appears.




- Select “AST_L3A_c08r04_VNIR.img" and the 3rd of "AST3A1_0506100803111204250066.hdf” in the “Select Input File” box.

NOTE: Select and click files with holding down Ctrl key.

- Click “OK” box in the window.

- Make sure that "AST_L3A_c08r04_VNIR.img" is shown at the 1st line and "AST3A1_0506100803111204250066.hdf" is shown at the 2nd line in the “Selected ENVI File for New File” box of the “New File Builder” window.


- Click “Choose” box to enter output filename.
- “Output Filename” window appears.
- Choose output file folder and then enter output filename in the “Filename” box.

Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp

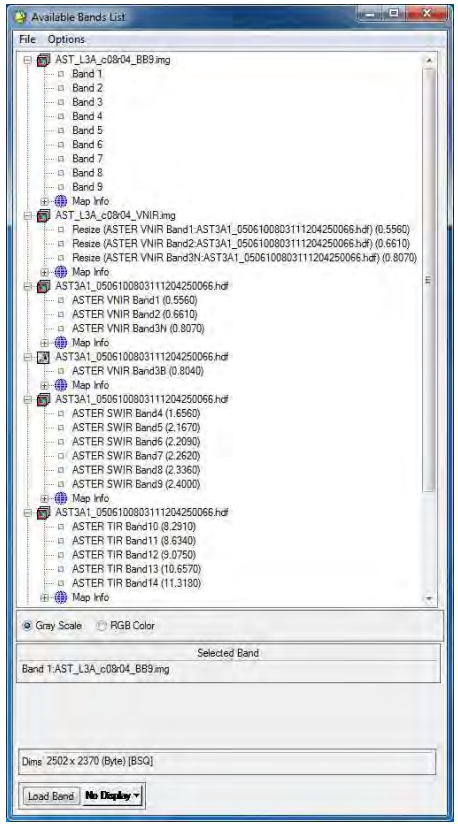
Output filename (example: AST_L3A_c08r04_BB9.img)

- Click “Open” box in the window.
- Entered output filename appears in the “Enter Output Filename” box of the “New File Builder” window.
- Click “OK” box in the window.
- “Create New File” window appears while processing and closes after processing.





- Created Integrated data (9 bands) appears in the “Available Bands List” window.



JOB03-1

+ Job content: Build mask for areas where no data exists in all 9 bands (create data only in the areas where data exist)
+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp
+ Input filename: (example: AST_L3A_c08r04_BB9.img)

+ Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp
+ Output filename: (example: AST_L3A_c08r04_BB9_mask.img)

- Click “File” on main menu bar.
- Select and click “Open Image File”.
- “Enter Data Filenames” window appears.
- Choose and find the input data folder in the window.
- Select and click the input ASTER data file in the window.

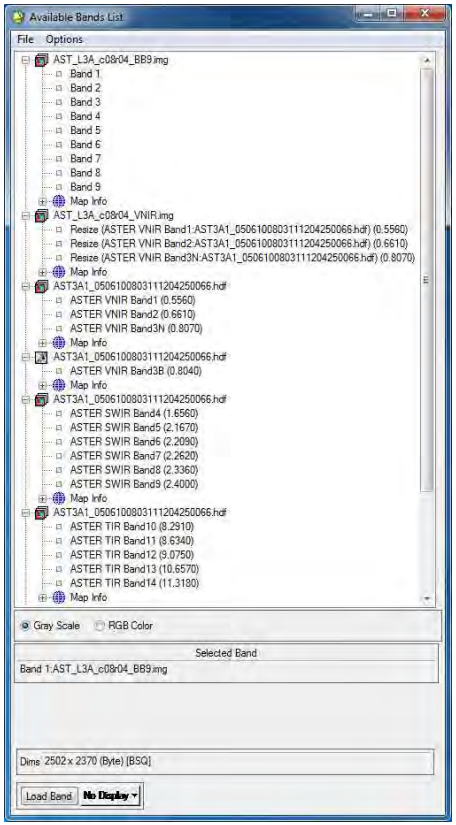
Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp
(example: AST_L3A_c08r04_BB9.img)

- Selected data filename appears in the “File Name” box.
- Click “Open” box in the window.

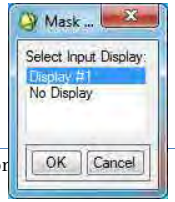




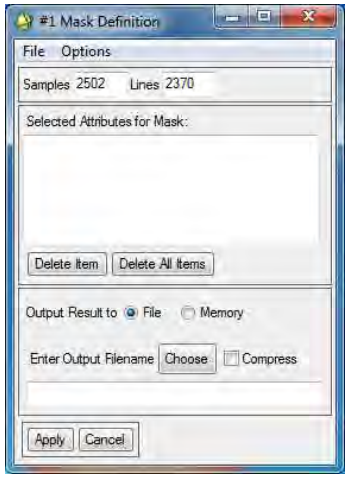
- Selected ASTER data is read into ENVI and appears in the “Available Bands List” window.



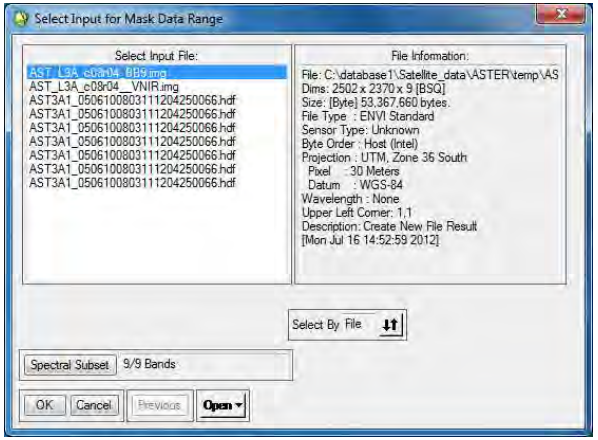

- Click “Gray Scale” circle.
- Click “No Display” box in the bottom of the window.
- Select and click “New Display”.
- Select band 1 of "AST_L3A_c08r04_BB9.img" in the “Available Bands List” window.
- Click “Load Band” box to display ASTER image on Display #1
- Three kinds of window “Image / Scroll / Zoom” appear.
- Click “Basic Tools” on main menu bar.
- Select “Masking”, then select and click “Build Mask”.
- “Mask Definition” window appears.



- Select “Display #1” in the “Select Input Display:” box of the “Mask Definition” window.
- Click “OK” box.
- “#1 Mask Definition” window appears.




- Click “Options” on the “#1 Mask Definition” menu bar.
- Select and Click “Import Data Range”.
- “Select Input for Mask Data Range” window appears.

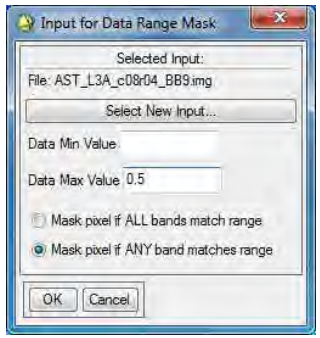



- Select "AST_L3A_c08r04_BB9.img" in the “Select Input File:” box.
- Click “OK” box.





- “Input for Data Range Mask” window appears.



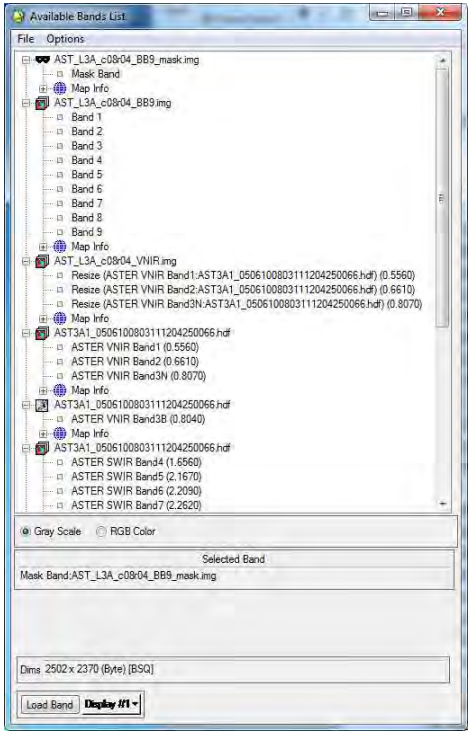

- Enter value “0.5” in the “Data Max Value” box.
- Click “Mask pixel if ANY band match range” circle.
- Click “OK” box.
- Click “Options” on the “#1 Mask Definition” menu bar.
- Select and Click “Selected Areas off”.
- Click “Choose” box to enter output filename.
- “Output Filename” window appears.
- Choose output file folder and then enter output filename in the “Filename” box.

Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp

Output filename (example: AST_L3A_c08r04_BB9_mask.img)

- Click “Open” box in the window.
- Entered output filename appears in the “Enter Output Filename” box of the “#1 Mask Definition” window.
- Click “Apply” box in the window.
- “Build Binary Mask” window appears while processing and closes after processing automatically.

- Created mask band appears in the “Available Bands List” window.
- Click “Cancel” box in the “#1 Mask Definition”.







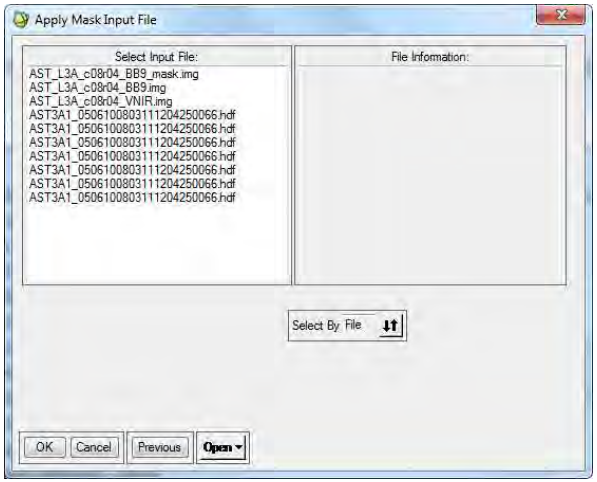

JOB03-2

+ Job content: Apply BB9_mask to BB9 image to eliminate bad pixels for analysis
+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp
+ Input filename: (example: AST_L3A_c08r04_BB9.img)
+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp
+ Input filename: (example: AST_L3A_c08r04_BB9_mask.img)

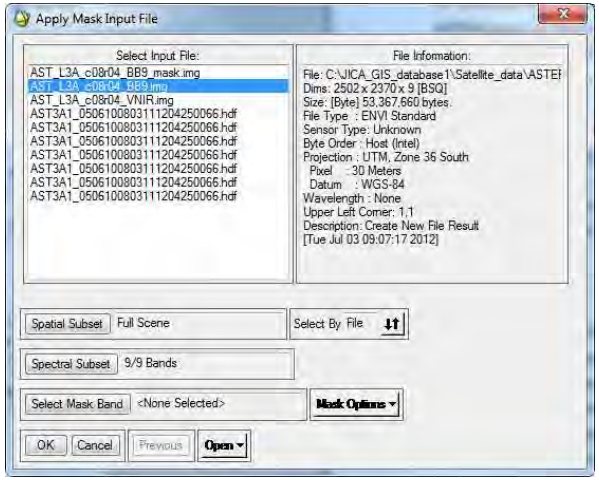
+ Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥analysis_data
+ Output filename: (example: AST_L3A_c08r04_B1B9.img)

- Click “Basic Tools” on main menu bar.
- Select “Masking”, then select and click “Apply Mask”.

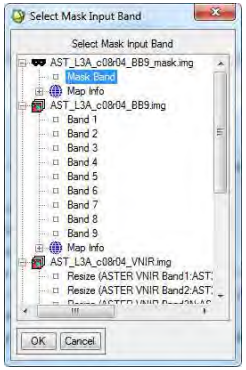
“Apply Mask Input File” window appears.



- Select “AST_L3A_c08r04_BB9.img” in the “Select Input File:” box.




- Click “Select Mask Band” box.
- “Select Mask Input Band” window appears.

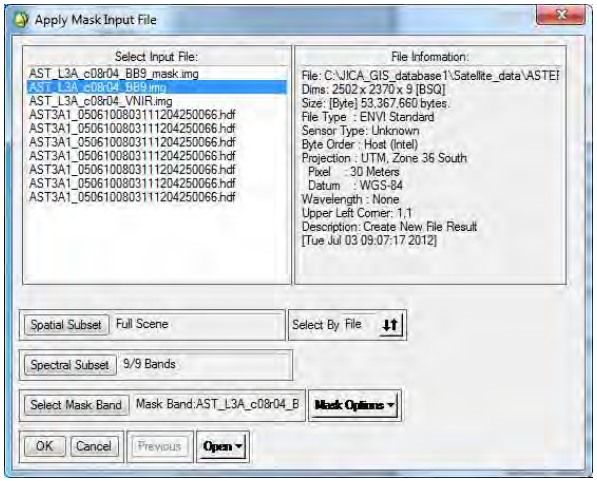



- Select Mask Band of “AST_L3A_c08r04_BB9_mask.img” in the “Select Mask Input Band” box.
- Click “OK” box.

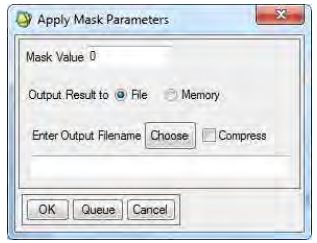




- Make sure that “AST_L3A_c08r04_BB9.img” is selected in the “Select Input File:” box and Mask Band of “AST_L3A_c08r04_BB9_mask.img” is shown in the “Select Mask Input Band” box.




- Click “OK” box in the “Apply Mask Input File” window.
- “Apply Mask Parameters” window appears.



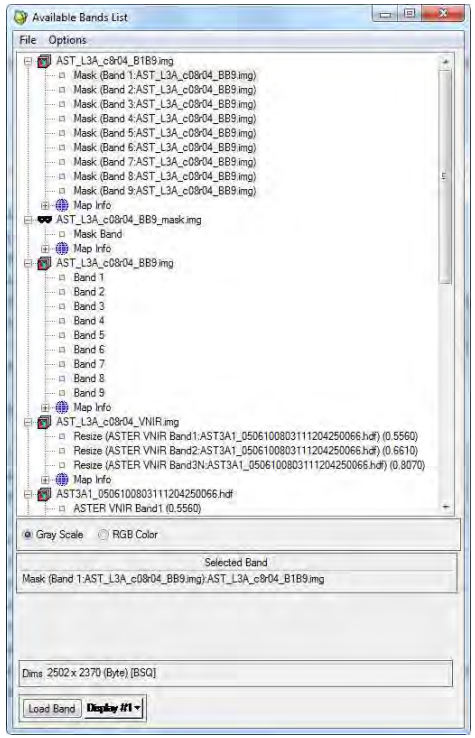

- Click “Choose” box to enter output filename.
- “Output Filename” window appears.
- Choose output file folder and then enter output filename in the “Filename” box.

Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥analysis_data

Output filename (example: AST_L3A_c08r04_B1B9.img)

- Click “Open” box in the window.
- Entered output filename appears in the “Enter Output Filename” box of the “#1 Mask Definition” window.
- Click “OK” box in the window.
- “Apply Mask” window appears while processing and closes after processing automatically.

- Created B1B9 data appears in the “Available Bands List” window.








JOB04

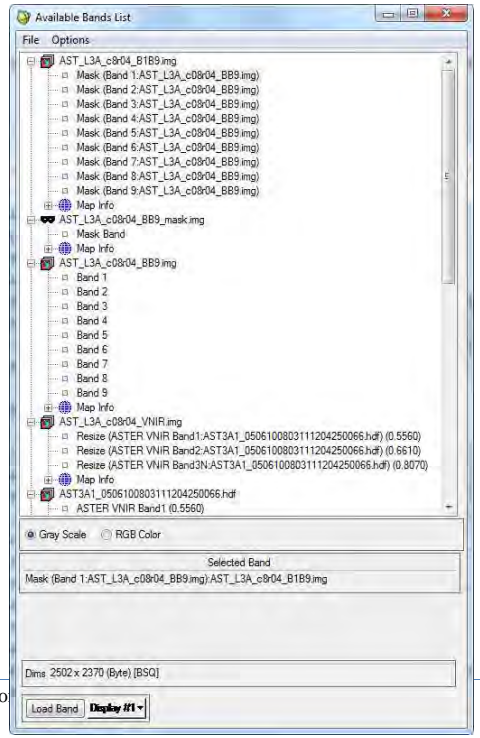
+ Job content: Calculate the normalized difference vegetation index (NDVI)
+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥analysis_data
+ Input filename: (example: AST_L3A_c08r04_B1B9.img)

+ Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp
+ Output filename: (example: AST_L3A_c08r04_NDVI.img)

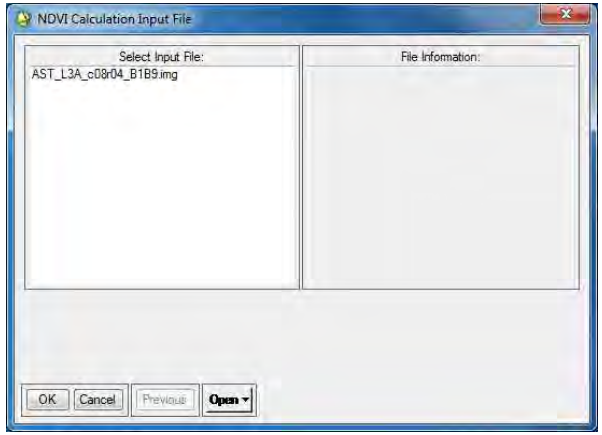
- Click “File” on main menu bar.
- Select and click “Open Image File”.
- “Enter Data Filenames” window appears.
- Choose and find the input data folder in the window.
- Select and click the input ASTER data file in the window.

Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥analysis_data
(example: AST_L3A_c08r04_B1B9.img)

- Selected data filename appears in the “File Name” box.
- Click “Open” box in the window.
- Selected ASTER data is read into ENVI and appears in the “Available Bands List” window.



- Click “Transform” on main menu bar.
- Select and click “NDVI”.
- “NDVI Calculation Input” window appears.




- Select "AST_L3A_c08r04_B1B9.img" in the “File Select Input File:” box.
- Click “OK” box in the window.
- “NDVI Calculation Parameters” window appears.


-Click "Input File Type” box and Select “SPOT”
- Click “Choose” box to enter output filename.
- “Output Filename” window appears.
- Choose output file folder and then enter output filename in the “Filename” box.

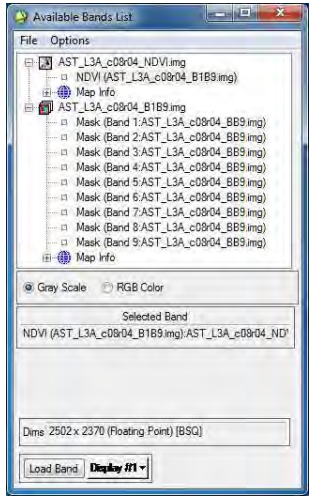
Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp





Output filename (example: AST_L3A_c08r04_NDVI.img)

- Click “Open” box in the window.
- Entered output filename appears in the “Enter Output Filename” box of the “NDVI Calculation Input” window.
- Click “OK” box in the window.
- Created NDVI data appears in the “Available Bands List” window.

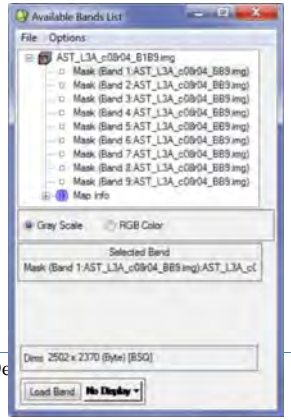


JOB05-1: Vegetation mask
JOB05-2: Water mask
JOB05-3: Could mask
JOB05-4: Shadow of cloud mask
JOB05-5: Integrate all masks
JOB05-6: Build integrated mask
JOB05-7: Apply integrated mask

JOB05-1: Vegetation mask
+ Job content: Build vegetation mask.
+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥analysis_data
+ Input filename: (example: AST_L3A_c08r04_B1B9.img)
+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp
+ Input filename: (example: AST_L3A_c08r04_NDVI.img)

+ Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp
+ Output filename: (example: AST_L3A_c08r04_NDVI_mask.img)

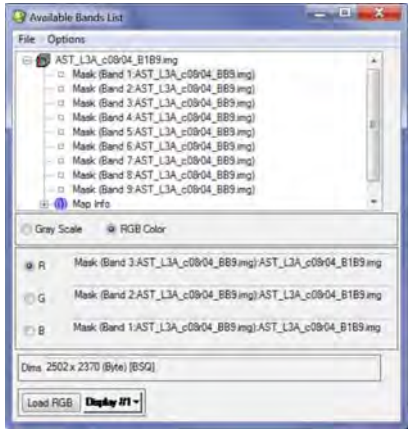
- Click “File” on main menu bar.
- Select and click “Open Image File”.
- “Enter Data Filenames” window appears.
- Choose and find the input data folder in the window.
- Select and click the input ASTER data file in the window.
Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥analysis_data
(example: AST_L3A_c08r04_B1B9.img)
- Selected data filename appears in the “File Name” box.
- Click “Open” box in the window.
- Selected ASTER data is read into ENVI and appears in the “Available Bands List” window.





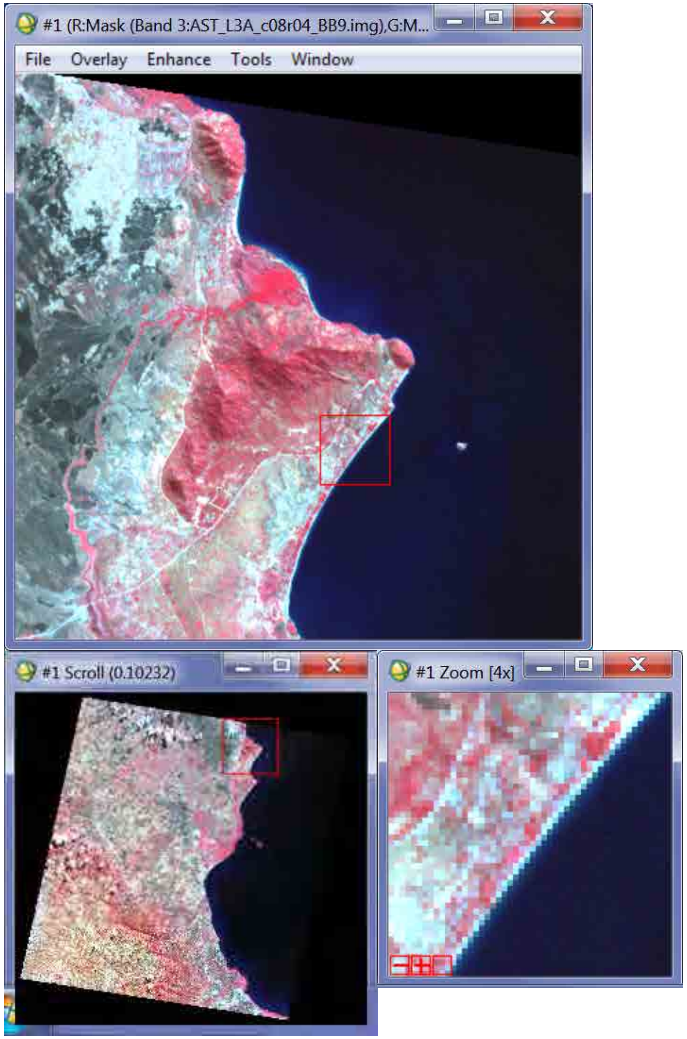



- Click “RGB color” circle shown in lower part of the “Available Bands List” window.
- R/G/B circles and description boxes appear in the lower part of the window.
- When the “R circle” is selected (ticked), click “Band 3”.
- After the click above, the “G circle” is automatically ticked.
- When the “G circle” is selected (ticked), click “Band 2”.
- After the click above, the “B circle” is automatically ticked.
- When the “B circle” is selected (ticked), click “Band 1”.
- After the click above, the “R circle” is automatically ticked again.
- Make sure that Band 3 is shown in the “R box”, Band 2 in the “G box” and Band 1 in the “B box”.




- Click “No Display” box in the bottom of the window.
- Select and click “New Display”.
- Click “Load RGB” box in the bottom of the window.

- Three kinds of window “Image / Scroll / Zoom” appear.
- A color composite (false color) image (RGB=B3,B2.B1) of ASTER data is created in the “#1 display”.




- Click “File” on main menu bar.
- Select and click “Open Image File”.
- “Enter Data Filenames” window appears.
- Choose and find the input data folder in the window.

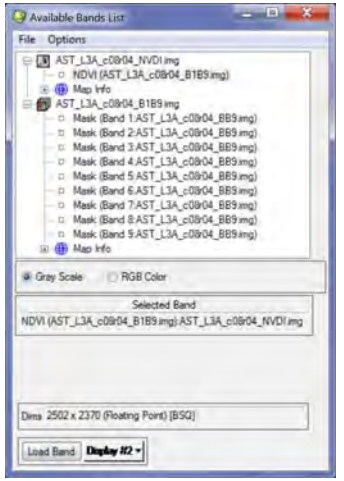




- Select and click the input NDVI.img file in the window.

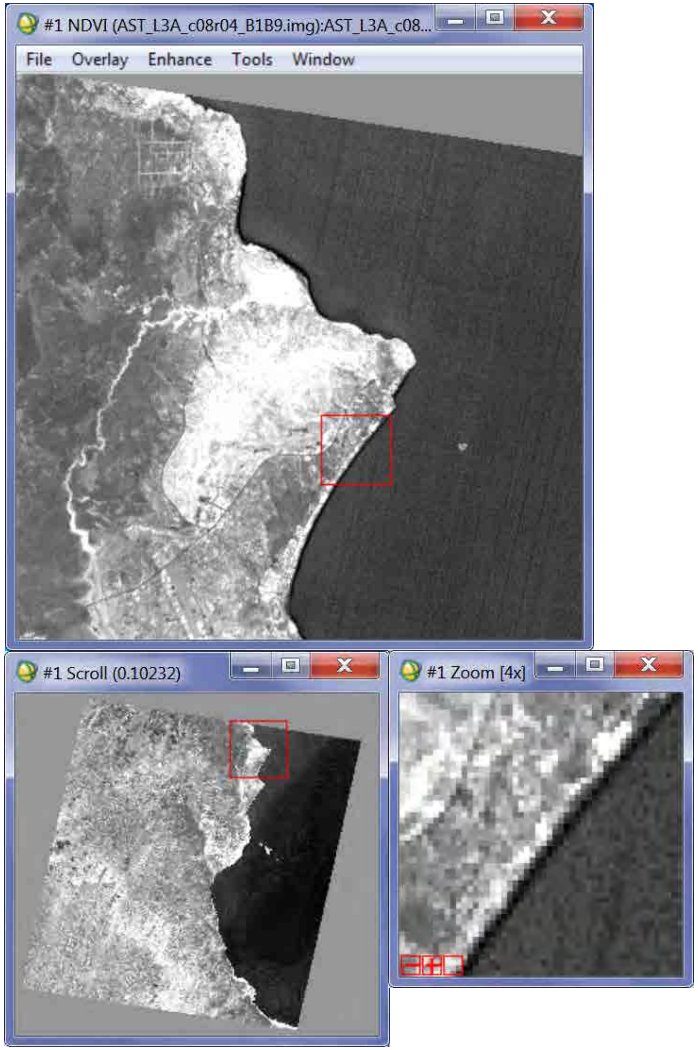
(example: AST_L3A_c08r04_NDVI.img)

- Selected data filename appears in the “File Name” box.
- Click “Open” box in the window.
- Selected ASTER data is read into ENVI and appears in the “Available Bands List” window.




- Click “Gray Scale” circle shown in lower part of the “Available Bands List” window.
- After the click above, select “NDVI(AST_L3A_c08r04_B1B9.img)”.
- Make sure that “NDVI” is shown in the “Selected Band” box.
- Click “Display #1” box in the bottom of the window.
- Select and click “New Display”.
- Click “Load Band” box in the bottom of the window.

- Three kinds of window “Image / Scroll / Zoom” appear.
- A NDVI image is created in the “#2 display”.

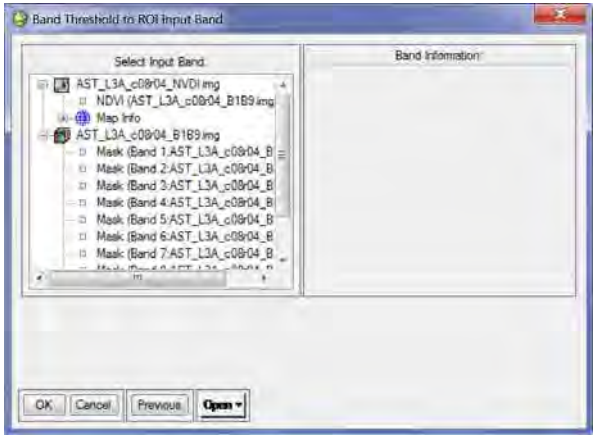







- Click “Overlay” on the “#2 NDVI display” menu bar.
- Select and click “Region of Interest”.
- “#2 ROI Tool” window appears.


- Click “off” circle shown in upper part of the “#2 ROI Tool” window.
- Click “Options” on the “#2 ROI Tool” menu bar.
- Select and click “Band Threshold to ROI”.
- “Band Threshold to ROI Input Band” window appears.




- Select “NDVI.img” in the “Select Input Band” box and click “OK” box.

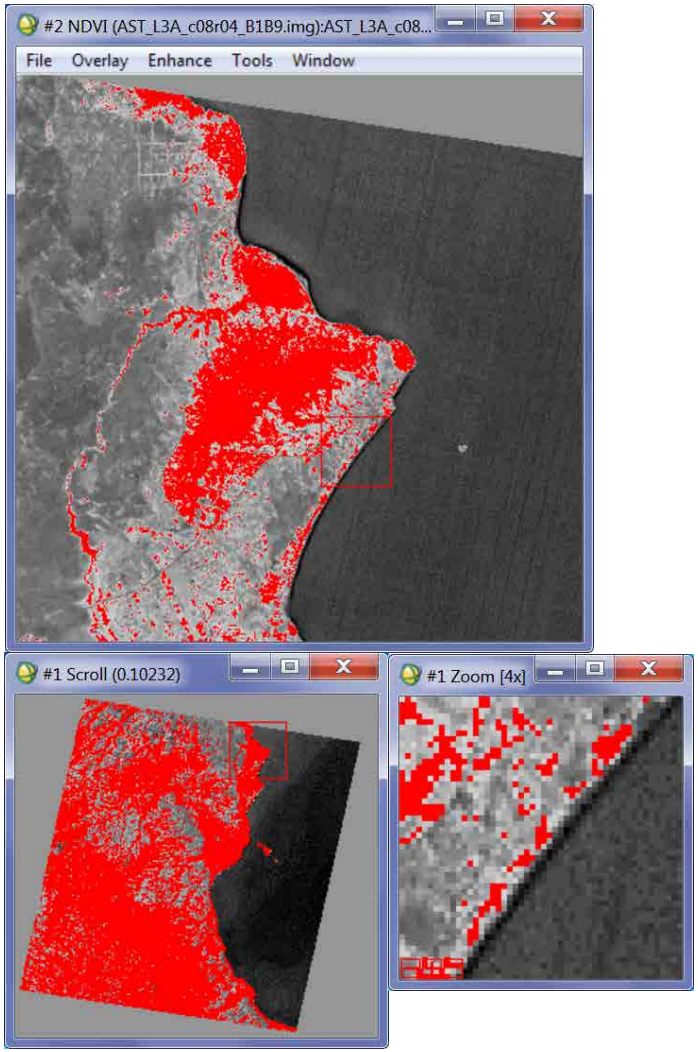
- "Band Threshold to ROI Parameters" window appears.


- Enter initial value "0.15" in the "Min Thresh Value" box and click "OK" box.
(Refer HINT [page 12] to decide initial value.)
- "ENVI Question" window appears and click "Yes" box to continue.


- Thresh(AST~NDVI) is added in the "ROI name" box of the "#2 ROI Tool" window and ROI is displayed in red color on #2 NDVI display.

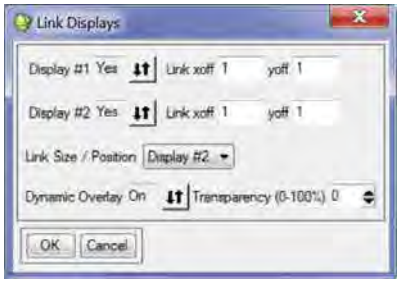





- Click "Tools" on menu bar of the #2 Band Math display.
- Select "Link" and then select and click "Link Displays" to compare #1 and #2 display.

- "Link Displays" window appears.




- Confirm "Yes" in the "Display #1" box and "Yes" in the "Display #2" box
- If "No", click arrow box next to "No" to change "No" to "Yes".
- After confirming, click "OK" box.

**- Check vegetation areas in display #1 are covered by red ROI in display #2 correctly.** good

not good

If not correct,

- Select "Thresh(AST~NDVI)" in the "ROI Name" box of #2 ROI Tool window.
- Click "Delete ROI" box to delete the entry of the "Thresh(AST~NDVI)"
- Click "Options" on the "#2 ROI Tool" menu bar.
- Select and click "Band Threshold to ROI".
- "Band Threshold to ROI Input Band" window appears.
- Select "Band Math of NDVI.img" in the "Select Input Band" box and click "OK" box.
- "Band Threshold to ROI Parameters" window appears.

next page

In case of too much coverage of ROI

- Enter value more than 0.15 in the "Min Thresh Value" box and click "OK" box.

In case of too little coverage of ROI

- Enter value less than 0.15 in the "Min Thresh Value" box and click "OK" box.

- "ENVI Question" window appears and click "Yes" box to continue.
- ROI is displayed in red color on #2 NDVI display and Thresh(AST~NDVI) is added in the "ROI name" box of the "#2 ROI Tool" window.

- Check again vegetation areas in display #1 are covered by red ROI in display #2 correctly.

Continue from "If not" above-mentioned to here till getting good results. Trial and error is needed.





If correct, - Click "Tools" on #2 display menu bar.

- Select and click "Build Mask".
- "#2 Mask Definition" window appears.


- Click "Options" on menu bar of the "#2 Mask Definition" window
- Select and click "Import ROIs".
- "Mask Definition Input ROIs" window appears.

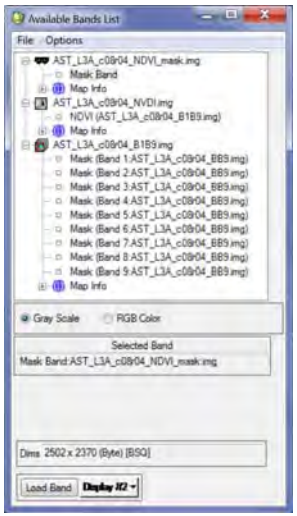

- Select "Thresh (AST~NDVI)" in the "ROIs for Mask Definition" box of the "Mask Definition Input ROIs" window.
- Click "OK" box.
- Click "Options" on the "#2 Mask Definition" menu bar.
- Select "Selected Areas Off".
- Click "Choose" box of the "#2 Mask Definition" window to enter output filename.
- "Output Filename" window appears.

- Choose output file folder and then enter output filename in the “Filename” box.

Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp

(example: AST_L3A_c08r04_NDVI_mask.img)

- Click “Open” box in the window.
- Entered output filename appears in the “Enter Output Filename” box of the “#2 Mask Definition” window.
- Click “Apply” box in the window.
- “NDVI_mask.img” file is created and appears in the “Available Bands List” window.




- Click “Cancel” box of the “#2 Mask Definition” to close the window.

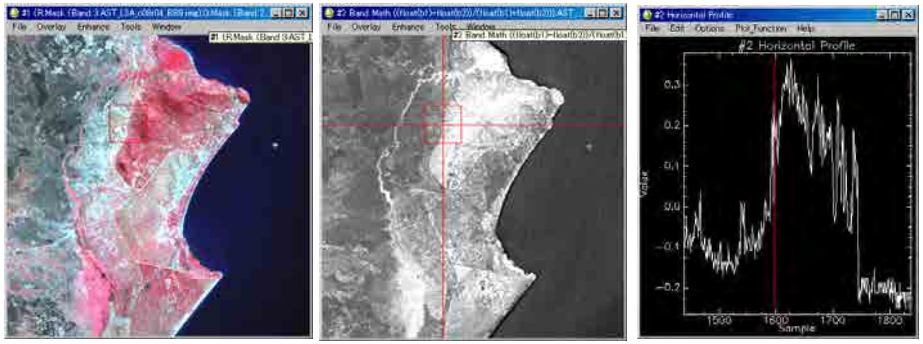




HINT: How to decide initial value of NDVI threshold.

- Check the distribution of NDVI value between vegetation areas and non vegetation areas

The figure below shows false color image (left) and NDVI image (middle) and X profile of NDVI on the red horizontal line (right).




At the border of vegetation areas in the red rectangle, the value of NDVI changes from -0.1 to 0.3.

In this example image, threshold value “0.15” of NDVI is selected as the initial value.

Function of “X Profile”: Tools-Profiles-X Profile on the “#2 Band Math display” menu bar

JOB05-2: Water mask

+ Job content: Build water mask.

+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥analysis_data

+ Input filename: (example: AST_L3A_c08r04_B1B9.img)

+ Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp

+ Output filename: (example: AST_L3A_c08r04_water_mask.img)

- Click “File” on main menu bar.
- Select and click “Open Image File”.
- “Enter Data Filenames” window appears.
- Choose and find the input data folder in the window.
- Select and click the input ASTER data file in the window.

Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥analysis_data

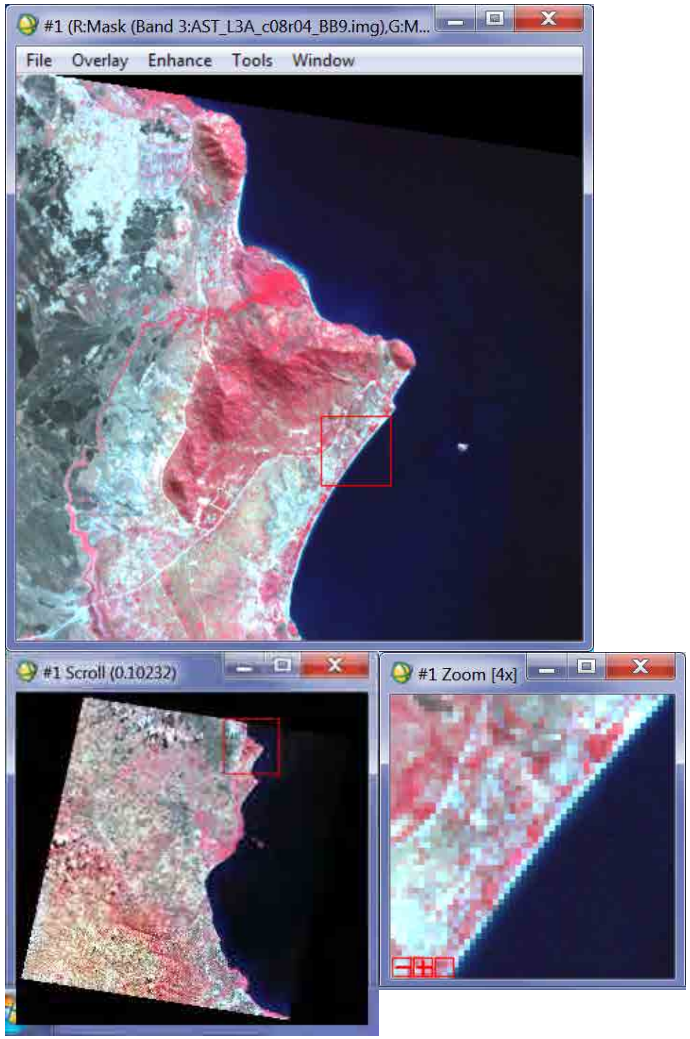
(example: AST_L3A_c08r04_B1B9.img)

- Selected data filename appears in the “File Name” box.
- Click “Open” box in the window.
- Selected ASTER data is read into ENVI and appears in the “Available Bands List” window.
- Click “RGB color” circle shown in lower part of the “Available Bands List” window.
- R/G/B circles and description boxes appear in the lower part of the window.
- When the “R circle” is selected (ticked), click “Band 3”.
- After the click above, the “G circle” is automatically ticked.
- When the “G circle” is selected (ticked), click “Band 2”.
- After the click above, the “B circle” is automatically ticked.
- When the “B circle” is selected (ticked), click “Band 1”.
- After the click above, the “R circle” is automatically ticked again.
- Make sure that Band 3 is shown in the “R box”, Band 2 in the “G box” and Band 1 in the “B box”.
- Click “No Display” box in the bottom of the window.
- Select and click “New Display”.
- Click “Load RGB” box in the bottom of the window.



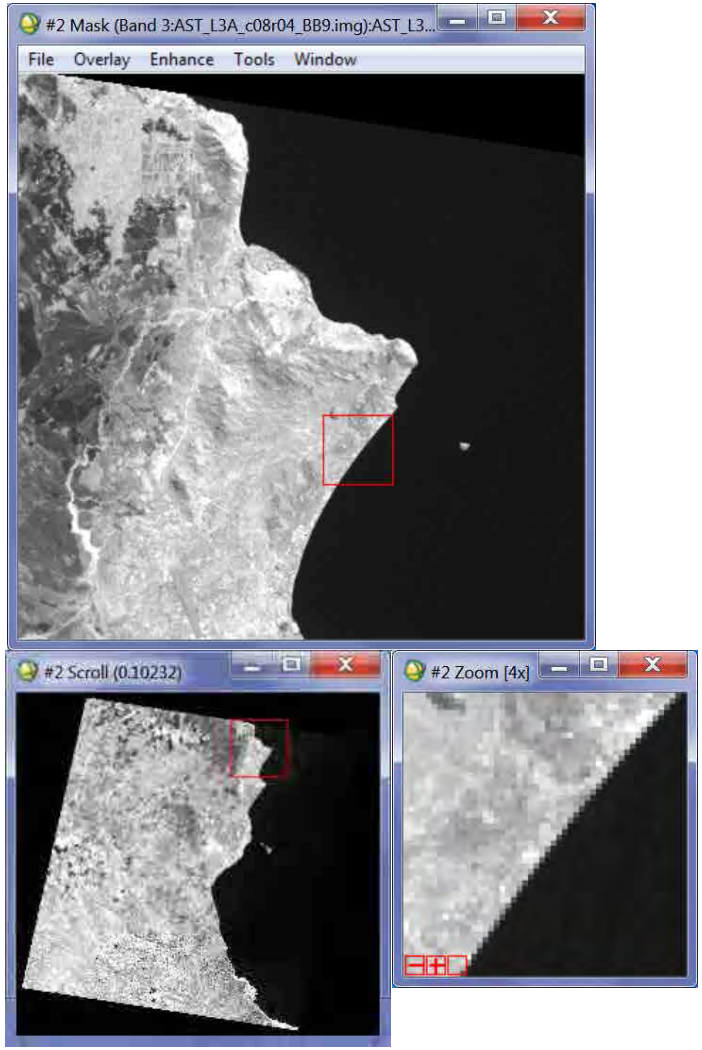


- Three kinds of window “Image / Scroll / Zoom” appear.
- A color composite (false color) image (RGB=B3,B2.B1) of ASTER data is created in the “#1 display”.




- Click “Gray Scale” circle shown in lower part of the “Available Bands List” window.
- After the click above, select “Band 3”.
- Make sure that “Band 3” is shown in the “Selected Band” box.
- Click “Display #1” box in the bottom of the window.

- Select and click “New Display”.
- Click “Load Band” box in the bottom of the window.
- Three kinds of window “Image / Scroll / Zoom” appear.
- Band1 image is created in the “#2 display”.

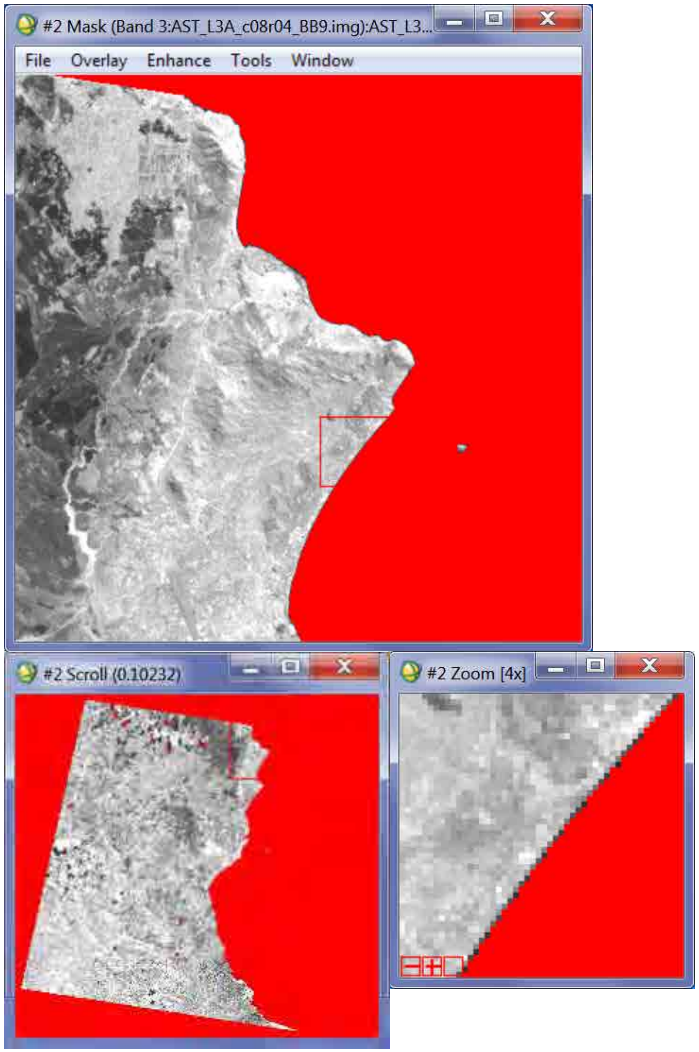







- Click “Overlay” on the “#2 display” menu bar.
- Select and click “Region of Interest”.
- “#2 ROI Tool” window appears.
- Click “off” circle shown in upper part of the “#2 ROI Tool” window.
- Click “Options” on the “#2 ROI Tool” menu bar.
- Select and click “Band Threshold to ROI”.
- “Band Threshold to ROI Input Band” window appears.
- Select “Band 3 of B1B9.img” in the “Select Input Band” box and click “OK” box.
- “Band Threshold to ROI Parameters” window appears.


- Enter initial value “18” in the “Max Thresh Value” box and click “OK” box.
(Refer HINT [page 20] to decide initial value.)
- “ENVI Question” window appears and click “Yes” box to continue.
- Thresh(AST~B1B9.img) is added in the “ROI name” box of the “#2 ROI Tool” window and ROI is displayed in red color on #2 Band 3 display.








- Click “Tools” on menu bar of the #2 Band 3 display.
- Select “Link” and then select and click “Link Displays” to compare #1 and #2 display.
- “Link Displays” window appears.
- Confirm “Yes” in the “Display #1” box and “Yes” in the “Display #2” box
- If “No”, click arrow box next to “No” to change “No” to “Yes”.
- After confirming, click “OK” box.

**- Check water areas in display #1 are covered by red ROI in display #2 correctly.**

If not correct,
- Select “Thresh(AST~B1B9.img)” in the “ROI Name” box of #2 ROI Tool window.
- Click “Delete ROI” box to delete the entry of the “Thresh(AST~ B1B9.img)”
- Click “Options” on the “#2 ROI Tool” menu bar.
- Select and click “Band Threshold to ROI”.
- “Band Threshold to ROI Input Band” window appears.
- Select “Band 3 of B1B9.img” in the “Select Input Band” box and click “OK” box.
- “Band Threshold to ROI Parameters” window appears.

In case of too much coverage of ROI
- Enter value less than 18 in the “Max Thresh Value” box and click “OK” box.

In case of too little coverage of ROI
- Enter value more than 18 in the “Max Thresh Value” box and click “OK” box.

- “ENVI Question” window appears and click “Yes” box to continue.
- ROI is displayed in red color on #2 Band 3 display and Thresh(AST~ B1B9.img) is added in the “ROI name” box of the “#2 ROI Tool” window.

- Check again water areas in display #1 are covered by red ROI in display #2 correctly.

Continue from “If not” above-mentioned to here till getting good results. Trial and error is needed.

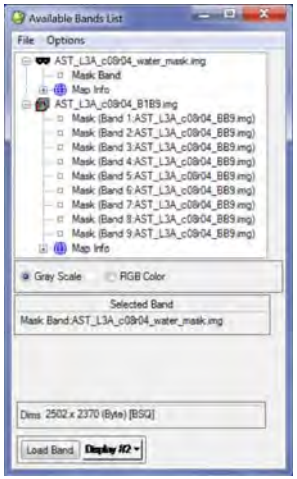
If correct, - Click “Tools” on #2 display menu bar.
- Select and click “Build Mask”.
- “#2 Mask Definition” window appears.
- Click “Options” on menu bar of the “#2 Mask Definition” window
- Select and click “Import ROIs”.
- “Mask Definition Input ROIs” window appears.

- Select “Thresh (AST~ B1B9.img)” in the “ROIs for Mask Definition” box of the “Mask Definition Input ROIs” window.
- Click “OK” box.
- Click “Options” on the “#2 Mask Definition” menu bar.
- Select “Selected Areas Off”.
- Click “Choose” box of the “#2 Mask Definition” window to enter output filename.
- “Output Filename” window appears.
- Choose output file folder and then enter output filename in the “Filename” box.

Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp

(example: AST_L3A_c08r04_water_mask.img)

- Click “Open” box in the window.
- Entered output filename appears in the “Enter Output Filename” box of the “#2 Mask Definition” window.
- Click “Apply” box in the window.
- “water_mask.img” file is created and appears in the “Available Bands List” window.




- Click “Cancel” box of the “#2 Mask Definition” to close the window.

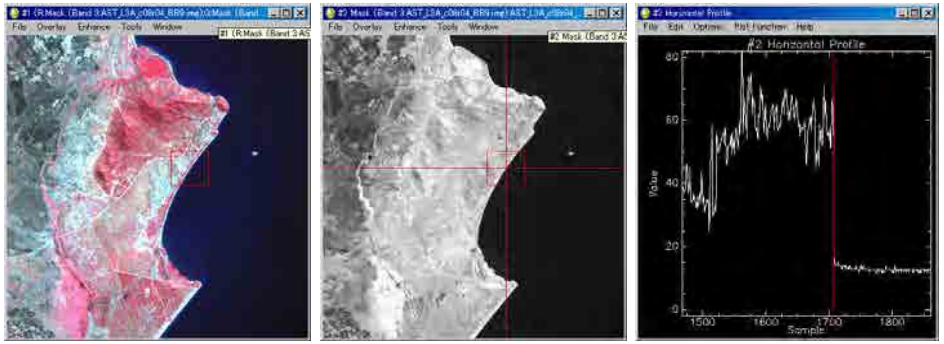




HINT: How to decide initial value of water threshold.

- Check the distribution of water value between water areas and non water areas

The figure below shows false color image (left) and Band 3 image (middle) and X profile of Band 3 image on the red horizontal line (right).




On the water areas in X Profile, the value of water shows less than 18.

In this example image, threshold value “18” of water is selected as the initial value.

Function of ”X Profile”: Tools-Profiles-X Profile on the “#2 Band 3 display” menu bar

JOB05-3: Could mask

+ Job content: Build cloud mask.

+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥analysis_data

+ Input filename: (example: AST_L3A_c08r04_B1B9.img)

+ Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp

+ Output filename: (example: AST_L3A_c08r04_cloud_mask.img)

- Click “File” on main menu bar.
- Select and click “Open Image File”.
- “Enter Data Filenames” window appears.
- Choose and find the input data folder in the window.
- Select and click the input ASTER data file in the window.

Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥analysis_data

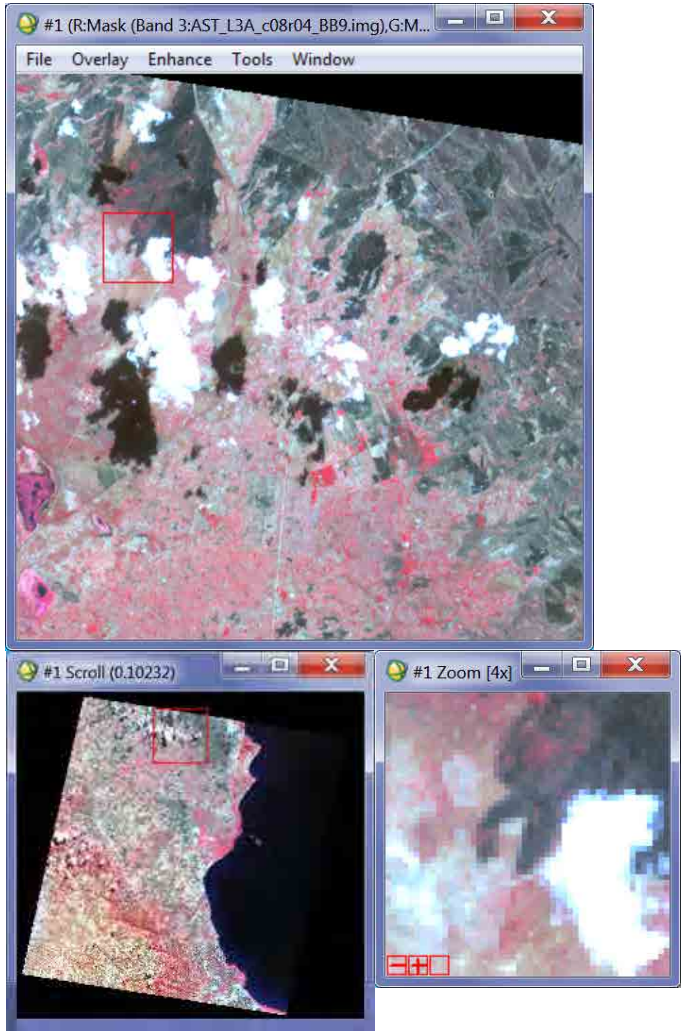
(example: AST_L3A_c08r04_B1B9.img)

- Selected data filename appears in the “File Name” box.
- Click “Open” box in the window.
- Selected ASTER data is read into ENVI and appears in the “Available Bands List” window.
- Click “RGB color” circle shown in lower part of the “Available Bands List” window.
- R/G/B circles and description boxes appear in the lower part of the window.
- When the “R circle” is selected (ticked), click “Band 3”.
- After the click above, the “G circle” is automatically ticked.
- When the “G circle” is selected (ticked), click “Band 2”.
- After the click above, the “B circle” is automatically ticked.
- When the “B circle” is selected (ticked), click “Band 1”.
- After the click above, the “R circle” is automatically ticked again.
- Make sure that Band 3 is shown in the “R box”, Band 2 in the “G box” and Band 1 in the “B box”.
- Click “No Display” box in the bottom of the window.
- Select and click “New Display”.
- Click “Load RGB” box in the bottom of the window.



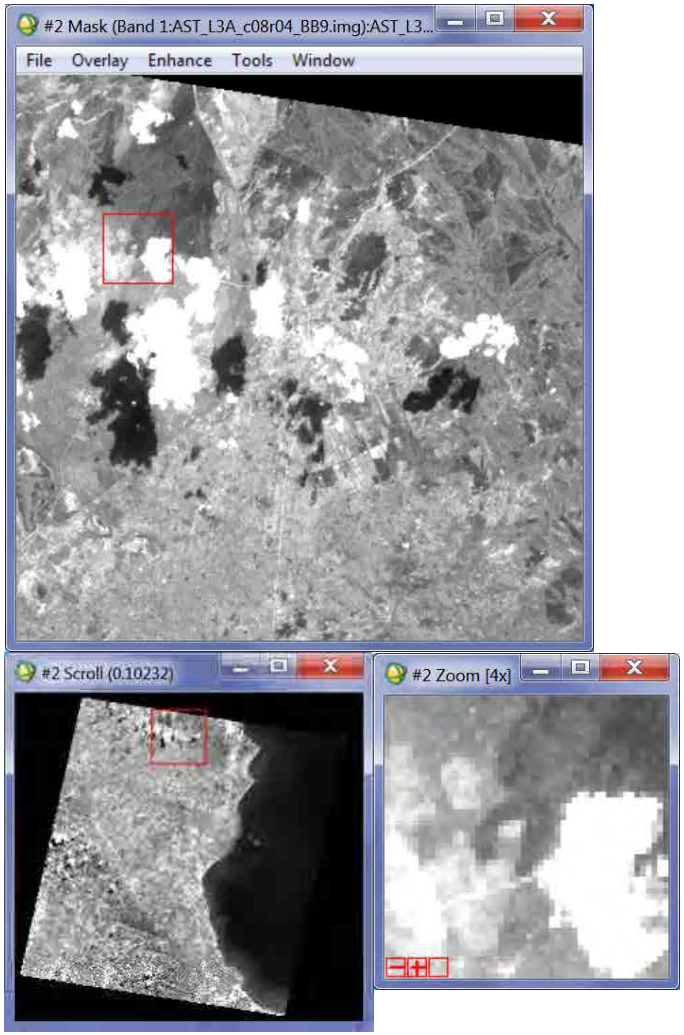


- Three kinds of window “Image / Scroll / Zoom” appear.
- A color composite (false color) image (RGB=B3,B2.B1) of ASTER data is created in the “#1 display”.




- Click “Gray Scale” circle shown in lower part of the “Available Bands List” window.
- After the click above, select “Band 1”.
- Make sure that “Band 1” is shown in the “Selected Band” box.
- Click “Display #1” box in the bottom of the window.

- Select and click “New Display”.
- Click “Load Band” box in the bottom of the window.
- Three kinds of window “Image / Scroll / Zoom” appear.
- Band1 image is created in the “#2 display”.

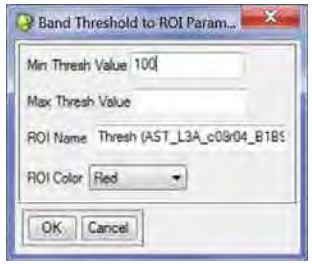



- Click “Overlay” on the “#2 display” menu bar.
- Select and click “Region of Interest”.

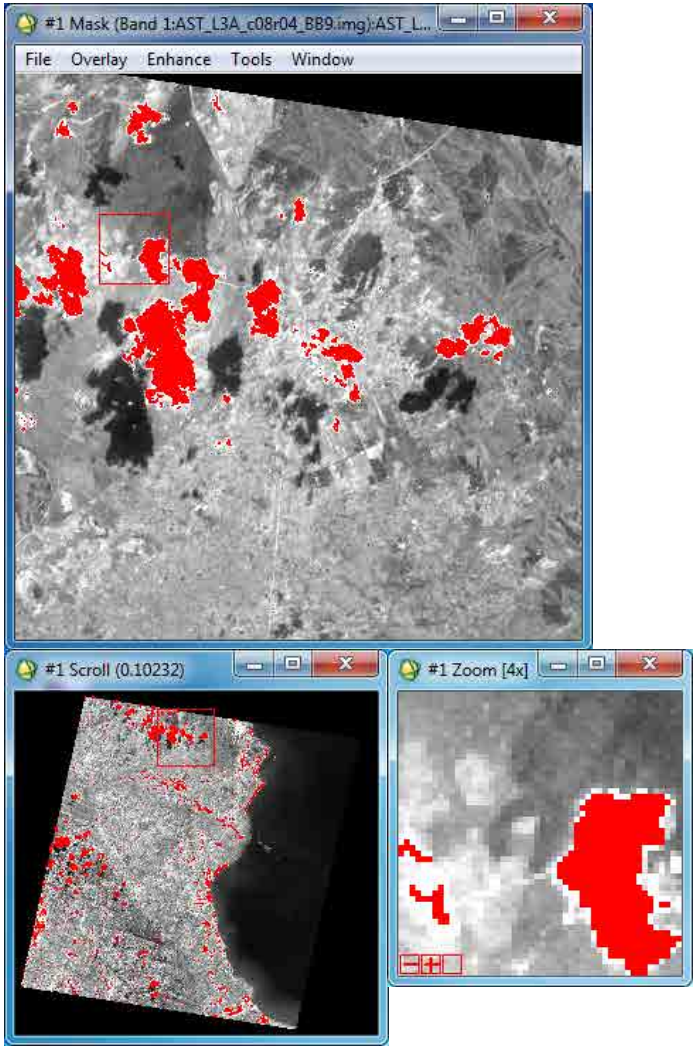




- “#2 ROI Tool” window appears.
- Click “off” circle shown in upper part of the “#2 ROI Tool” window.
- Click “Options” on the “#2 ROI Tool” menu bar.
- Select and click “Band Threshold to ROI”.
- “Band Threshold to ROI Input Band” window appears.
- Select “Band 1 of B1B9.img” in the “Select Input Band” box and click “OK” box.
- “Band Threshold to ROI Parameters” window appears.




- Enter initial value “100” in the “Min Thresh Value” box and click “OK” box.
(Refer HINT [page 28] to decide initial value.)
- “ENVI Question” window appears and click “Yes” box to continue.
- Thresh(AST~B1B9.img) is added in the “ROI name” box of the “#2 ROI Tool” window and ROI is displayed in red color on #2 Band 1 display.








- Click “Tools” on menu bar of the #2 Band 1 display.
- Select “Link” and then select and click “Link Displays” to compare #1 and #2 display.
- “Link Displays” window appears.
- Confirm “Yes” in the “Display #1” box and “Yes” in the “Display #2” box
- If “No”, click arrow box next to “No” to change “No” to “Yes”.
- After confirming, click “OK” box.

**- Check cloud areas in display #1 are covered by red ROI in display #2 correctly.**

If not correct,
- Select “Thresh(AST~B1B9.img)” in the “ROI Name” box of #2 ROI Tool window.
- Click “Delete ROI” box to delete the entry of the “Thresh(AST~ B1B9.img)”
- Click “Options” on the “#2 ROI Tool” menu bar.
- Select and click “Band Threshold to ROI”.
- “Band Threshold to ROI Input Band” window appears.
- Select “Band 1 of B1B9.img” in the “Select Input Band” box and click “OK” box.
- “Band Threshold to ROI Parameters” window appears.

In case of too much coverage of ROI
- Enter value more than 100 in the “Min Thresh Value” box and click “OK” box.

In case of too little coverage of ROI
- Enter value less than 100 in the “Min Thresh Value” box and click “OK” box.

- “ENVI Question” window appears and click “Yes” box to continue.
- ROI is displayed in red color on #2 Band 1 display and Thresh(AST~ B1B9.img) is added in the “ROI name” box of the “#2 ROI Tool” window.

- Check again cloud areas in display #1 are covered by red ROI in display #2 correctly.

Continue from “If not” above-mentioned to here till getting good results. Trial and error is needed.

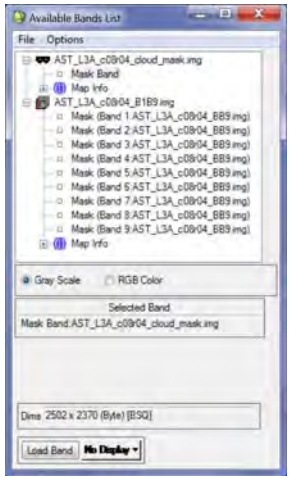
If correct, - Click “Tools” on #2 display menu bar.
- Select and click “Build Mask”.
- “#2 Mask Definition” window appears.
- Click “Options” on menu bar of the “#2 Mask Definition” window
- Select and click “Import ROIs”.
- “Mask Definition Input ROIs” window appears.

- Select “Thresh (AST~ B1B9.img)” in the “ROIs for Mask Definition” box of the “Mask Definition Input ROIs” window.
- Click “OK” box.
- Click “Options” on the “#2 Mask Definition” menu bar.
- Select “Selected Areas Off”.
- Click “Choose” box of the “#2 Mask Definition” window to enter output filename.
- “Output Filename” window appears.
- Choose output file folder and then enter output filename in the “Filename” box.

Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp

(example: AST_L3A_c08r04_cloud_mask.img)

- Click “Open” box in the window.
- Entered output filename appears in the “Enter Output Filename” box of the “#2 Mask Definition” window.
- Click “Apply” box in the window.
- “cloud_mask.img” file is created and appears in the “Available Bands List” window.




- Click “Cancel” box of the “#2 Mask Definition” to close the window.

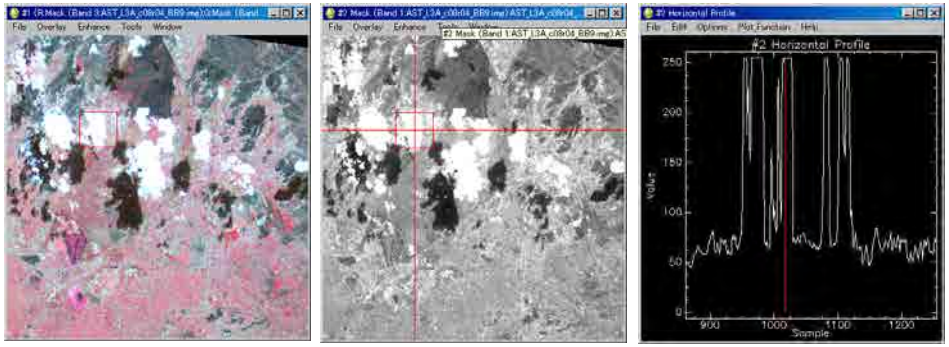




HINT: How to decide initial value of cloud threshold.

- Check the distribution of cloud value between cloud areas and non cloud areas

The figure below shows false color image (left) and Band 1 image (middle) and X profile of Band 1 image on the red horizontal line (right).




On the cloud areas in X Profile, the value of cloud shows more than 100.

In this example image, threshold value “100” of cloud is selected as the initial value.

Function of ”X Profile”: Tools-Profiles-X Profile on the “#2 Band 3 display” menu bar

JOB05-4: Shadow of cloud mask

+ Job content: Build shadow of cloud mask.

+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥analysis_data

+ Input filename: (example: AST_L3A_c08r04_B1B9.img)

+ Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp

+ Output filename: (example: AST_L3A_c08r04_shadow_mask.img)

- Click “File” on main menu bar.
- Select and click “Open Image File”.
- “Enter Data Filenames” window appears.
- Choose and find the input data folder in the window.
- Select and click the input ASTER data file in the window.

Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥analysis_data

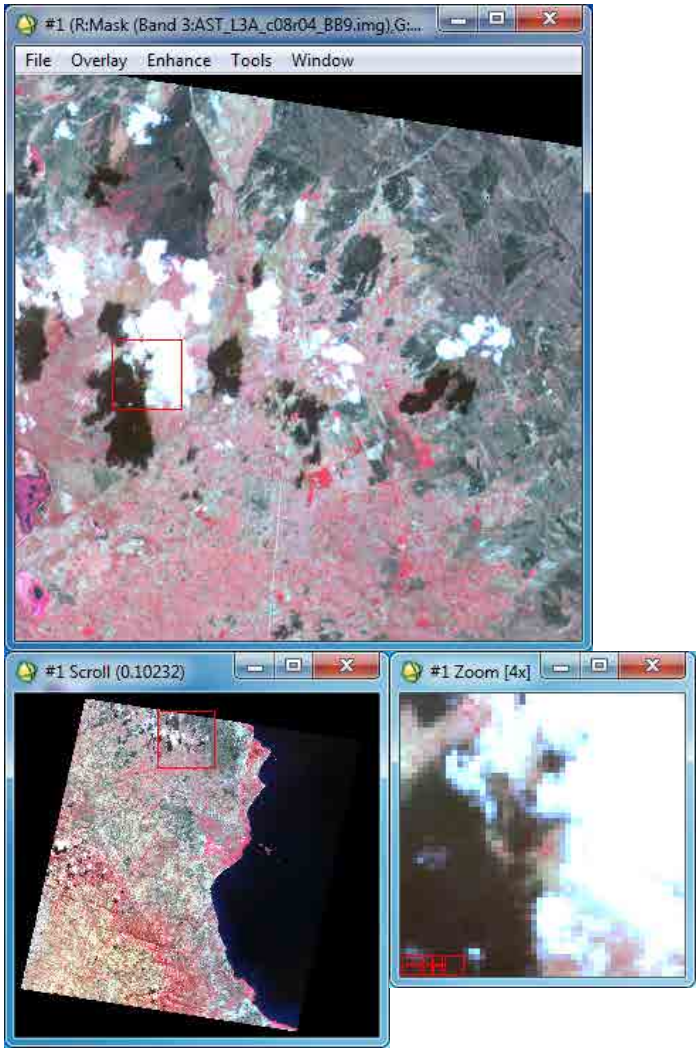
(example: AST_L3A_c08r04_B1B9.img)

- Selected data filename appears in the “File Name” box.
- Click “Open” box in the window.
- Selected ASTER data is read into ENVI and appears in the “Available Bands List” window.
- Click “RGB color” circle shown in lower part of the “Available Bands List” window.
- R/G/B circles and description boxes appear in the lower part of the window.
- When the “R circle” is selected (ticked), click “Band 3”.
- After the click above, the “G circle” is automatically ticked.
- When the “G circle” is selected (ticked), click “Band 2”.
- After the click above, the “B circle” is automatically ticked.
- When the “B circle” is selected (ticked), click “Band 1”.
- After the click above, the “R circle” is automatically ticked again.
- Make sure that Band 3 is shown in the “R box”, Band 2 in the “G box” and Band 1 in the “B box”.
- Click “No Display” box in the bottom of the window.
- Select and click “New Display”.
- Click “Load RGB” box in the bottom of the window.



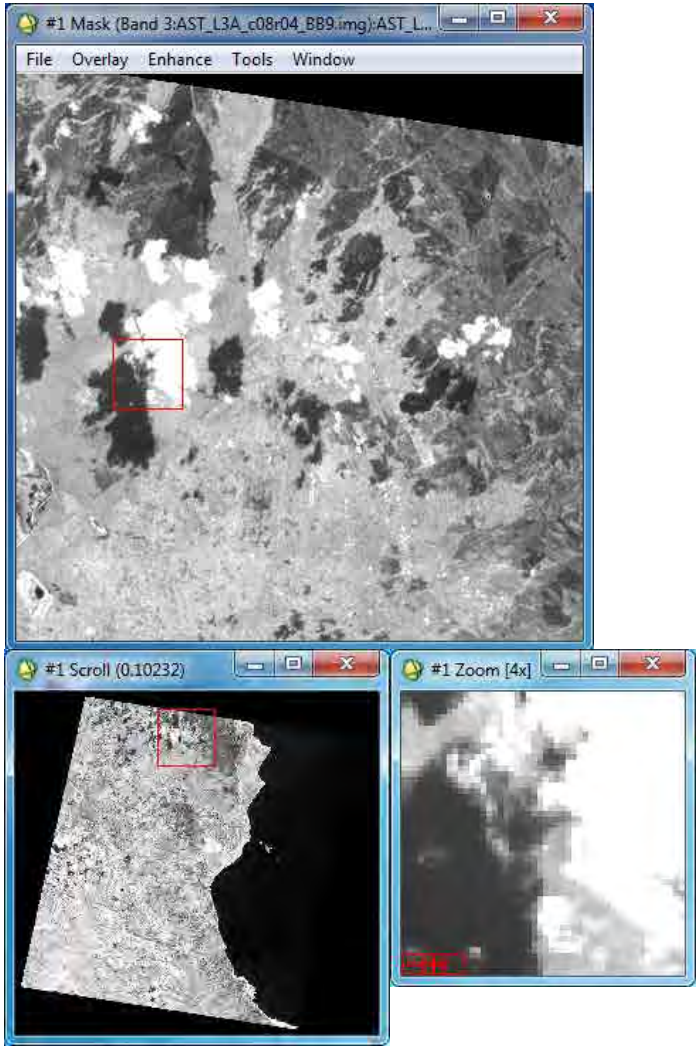


- Three kinds of window “Image / Scroll / Zoom” appear.
- A color composite (false color) image (RGB=B3,B2.B1) of ASTER data is created in the “#1 display”.




- Click “Gray Scale” circle shown in lower part of the “Available Bands List” window.
- After the click above, select “Band 3”.
- Make sure that “Band 3” is shown in the “Selected Band” box.
- Click “Display #1” box in the bottom of the window.

- Select and click “New Display”.
- Click “Load Band” box in the bottom of the window.
- Three kinds of window “Image / Scroll / Zoom” appear.
- Band1 image is created in the “#2 display”.

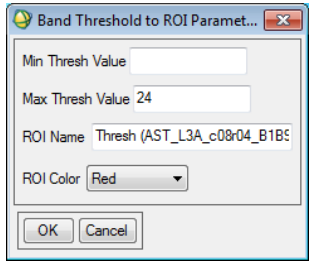



- Click “Overlay” on the “#2 display” menu bar.
- Select and click “Region of Interest”.





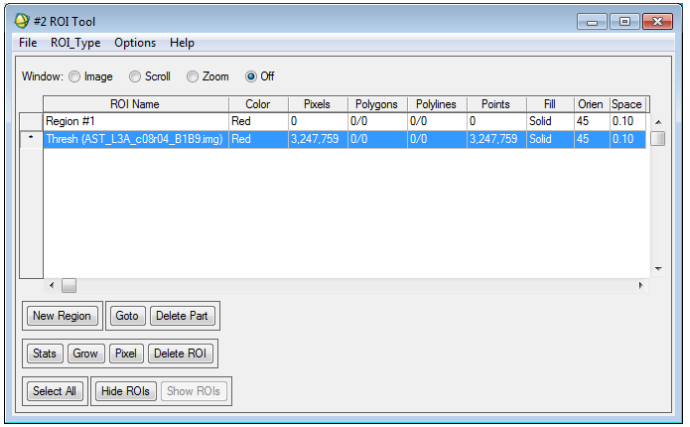
- “#2 ROI Tool” window appears.
- Click “off” circle shown in upper part of the “#2 ROI Tool” window.
- Click “Options” on the “#2 ROI Tool” menu bar.
- Select and click “Band Threshold to ROI”.
- “Band Threshold to ROI Input Band” window appears.
- Select “Band 3 of B1B9.img” in the “Select Input Band” box and click “OK” box.
- “Band Threshold to ROI Parameters” window appears.

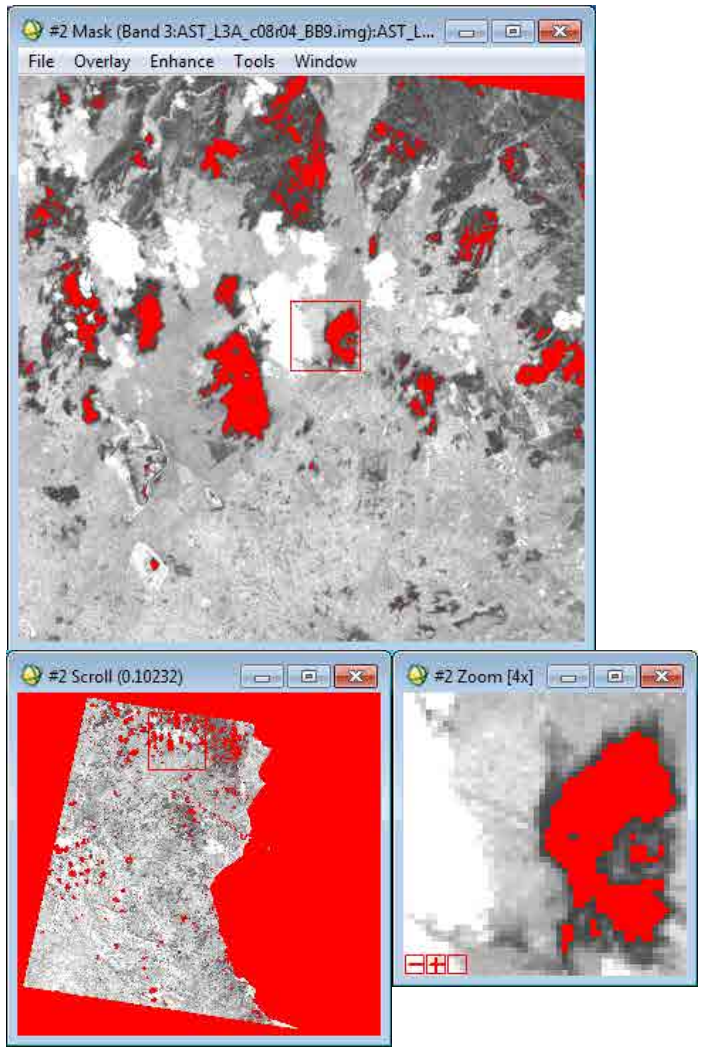



- Enter initial value “24” in the “Max Thresh Value” box and click “OK” box.

(Refer HINT [page 36] to decide initial value.)

- “ENVI Question” window appears and click “Yes” box to continue.
- Thresh(AST~B1B9.img) is added in the “ROI name” box of the “#2 ROI Tool” window and ROI is displayed in red color on #2 Band 3 display.










- Click “Tools” on menu bar of the #2 Band 3 display.
- Select “Link” and then select and click “Link Displays” to compare #1 and #2 display.
- “Link Displays” window appears.
- Confirm “Yes” in the “Display #1” box and “Yes” in the “Display #2” box
- If “No”, click arrow box next to “No” to change “No” to “Yes”.
- After confirming, click “OK” box.

**- Check shadow areas in display #1 are covered by red ROI in display #2 correctly.**

If not correct,
- Select “Thresh(AST~B1B9.img)” in the “ROI Name” box of #2 ROI Tool window.
- Click “Delete ROI” box to delete the entry of the “Thresh(AST~ B1B9.img)”
- Click “Options” on the “#2 ROI Tool” menu bar.
- Select and click “Band Threshold to ROI”.
- “Band Threshold to ROI Input Band” window appears.
- Select “Band 3 of B1B9.img” in the “Select Input Band” box and click “OK” box.
- “Band Threshold to ROI Parameters” window appears.

In case of too much coverage of ROI
- Enter value less than 24 in the “Max Thresh Value” box and click “OK” box.

In case of too little coverage of ROI
- Enter value more than 24 in the “Max Thresh Value” box and click “OK” box.

- “ENVI Question” window appears and click “Yes” box to continue.
- ROI is displayed in red color on #2 Band 3 display and Thresh(AST~ B1B9.img) is added in the “ROI name” box of the “#2 ROI Tool” window.

- Check again shadow areas in display #1 are covered by red ROI in display #2 correctly.

Continue from “If not” above-mentioned to here till getting good results. Trial and error is needed.

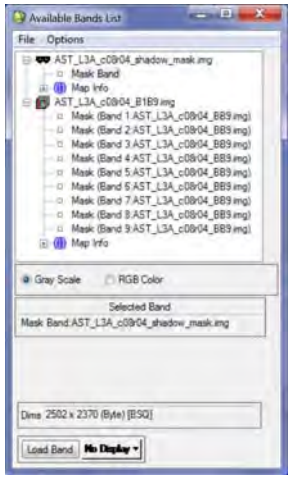
If correct, - Click “Tools” on #2 display menu bar.
- Select and click “Build Mask”.
- “#2 Mask Definition” window appears.
- Click “Options” on menu bar of the “#2 Mask Definition” window
- Select and click “Import ROIs”.
- “Mask Definition Input ROIs” window appears.

- Select “Thresh (AST~ B1B9.img)” in the “ROIs for Mask Definition” box of the “Mask Definition Input ROIs” window.
- Click “OK” box.
- Click “Options” on the “#2 Mask Definition” menu bar.
- Select “Selected Areas Off”.
- Click “Choose” box of the “#2 Mask Definition” window to enter output filename.
- “Output Filename” window appears.
- Choose output file folder and then enter output filename in the “Filename” box.

Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp

(example: AST_L3A_c08r04_shadow_mask.img)

- Click “Open” box in the window.
- Entered output filename appears in the “Enter Output Filename” box of the “#2 Mask Definition” window.
- Click “Apply” box in the window.
- “shadow_mask.img” file is created and appears in the “Available Bands List” window.




- Click “Cancel” box of the “#2 Mask Definition” to close the window.

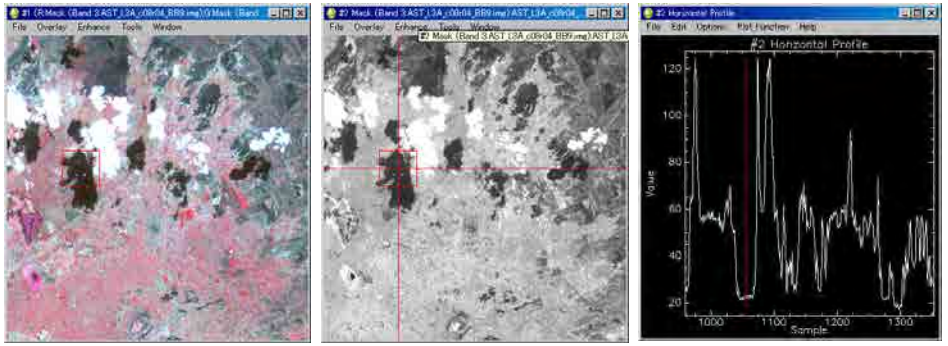




HINT: How to decide initial value of shadow threshold.

- Check the distribution of shadow value between shadow areas and non shadow areas

The figure below shows false color image (left) and Band 3 image (middle) and X profile of Band 3 image on the red horizontal line (right).



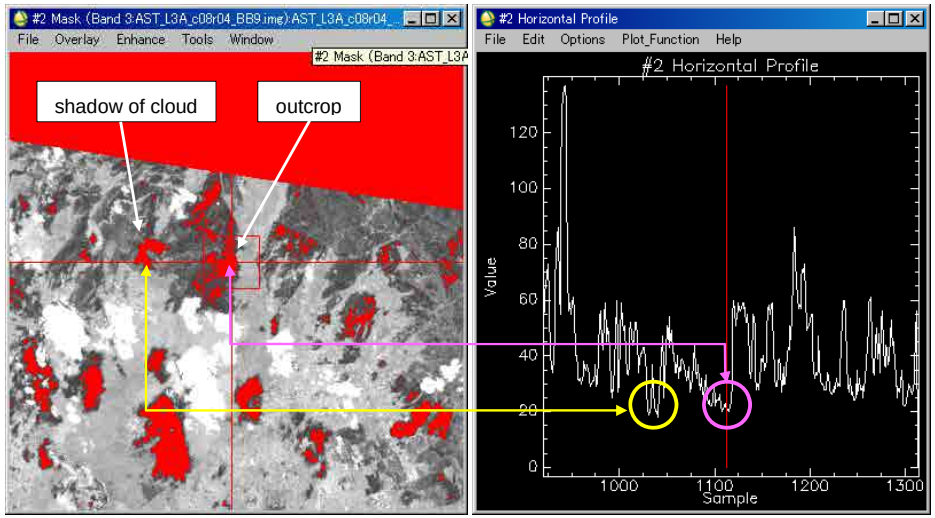

On the shadow areas in X Profile, the value of shadow shows less than 24.

In this example image, threshold value “24” of shadow is selected as the initial value.

Function of “X Profile”: Tools-Profiles-X Profile on the “#2 Band 3 display” menu bar

HINT: How to leave target (outcrop) areas and mask shadow of cloud areas.

The figure below shows ROI (red color) on Band 3 image (left) and X profile of Band 3 image on the red horizontal line (right). This is the result in case of threshold value “24”. In this case, target areas are masked because target areas have almost same reflectance value as shadow of cloud areas. It is difficult to separate them only using threshold value “24”.




To separate each area, the following procedure is used.

- Click “New Region” box on the “#2 ROI Tool” menu bar.
- Click “ROI Type” and select and click “Polygon” and Multi Part: off
- Click “ROI Type” and select and click “Multi Part: off”
- Click “Image” circle shown in upper part of the “#2 ROI Tool” window.
- Move to “ Image” of #2 Band 3 display and enclose shadow of cloud with polygon (figure below).

To create polygon

Trace the border of area to be masked on Image by mouse.

Click left mouse button to put point. Put points as enclosing shadow of cloud. After finishing trace, click right mouse button twice to fix. To cancel, click right mouse button once and small diamond appears then click middle mouse button.

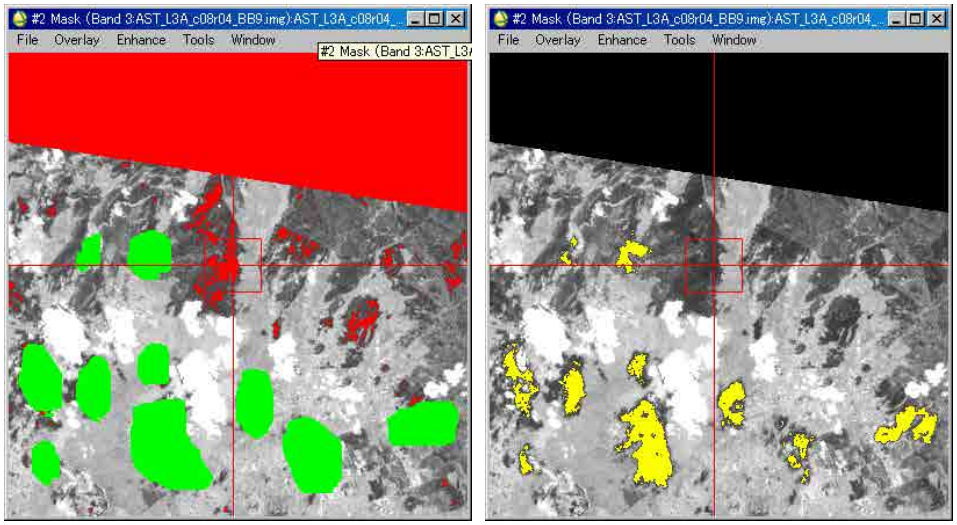
To remove the polygon after fixing, click middle mouse button on the polygon you want to remove.

Repeat this procedure to all areas to be masked.





- After enclosing, move to “#2 ROI Tool” window and click options “#2 ROI Tool” menu bar.
- Select and click “Intersect Regions”
- “ROI Intersection” window appears to select ROIs to be intersected.
- Select ROI by threshold and ROI by manually created polygons in the “Select Region to intersect” box of the window and click “OK” box.
- Intersected ROI is created in the “#2 ROI Tool” window.
- Select ROI by threshold and ROI by manually created polygons in the “#2 ROI Tool” window.
- Click “Delete ROI” box.
- Intersected ROI appears in #2 display.
- Confirm that shadows of cloud areas are masked and target areas are left correctly.




Shadows of cloud enclosed by polygons (left) and intersected ROI (shadow mask) (right)

OPTION: How to create mask manually.

- Click “File” on main menu bar.
- Select and click “Open Image File”.
- “Enter Data Filenames” window appears.
- Choose and find the input data folder in the window.
- Select and click the input ASTER data file in the window.

Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥analysis_data

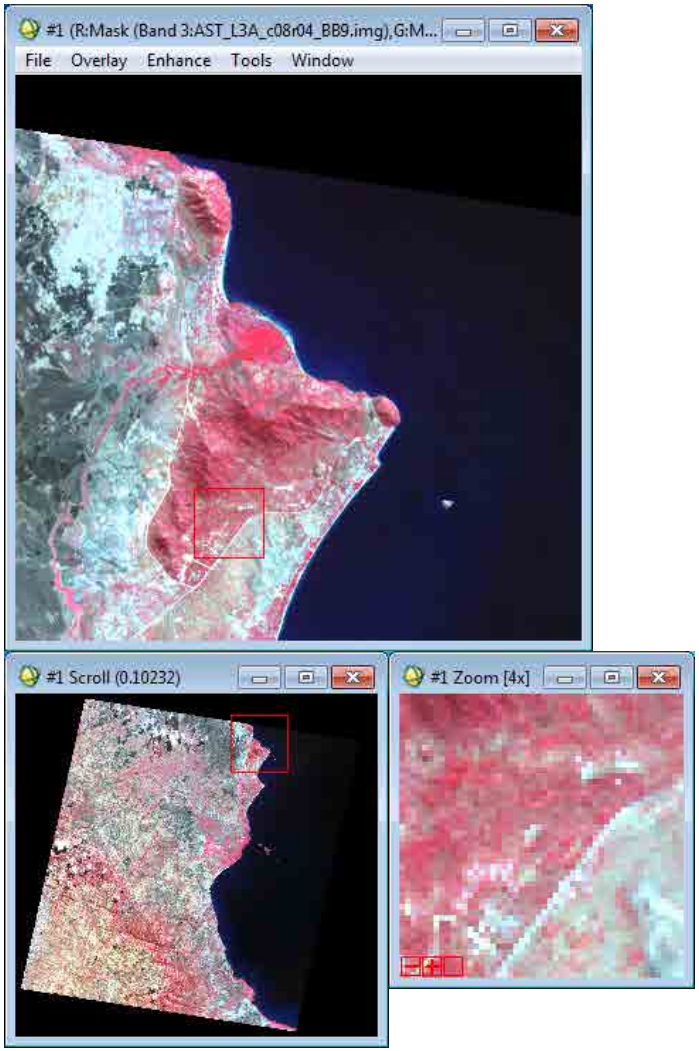
(example: AST_L3A_c08r04_B1B9.img)

- Selected data filename appears in the “File Name” box.
- Click “Open” box in the window.
- Selected ASTER data is read into ENVI and appears in the “Available Bands List” window.
- Click “RGB color” circle shown in lower part of the “Available Bands List” window.
- R/G/B circles and description boxes appear in the lower part of the window.
- When the “R circle” is selected (ticked), click “Band 3”.
- After the click above, the “G circle” is automatically ticked.
- When the “G circle” is selected (ticked), click “Band 2”.
- After the click above, the “B circle” is automatically ticked.
- When the “B circle” is selected (ticked), click “Band 1”.
- After the click above, the “R circle” is automatically ticked again.
- Make sure that Band 3 is shown in the “R box”, Band 2 in the “G box” and Band 1 in the “B box”.
- Click “No Display” box in the bottom of the window.
- Select and click “New Display”.
- Click “Load RGB” box in the bottom of the window.

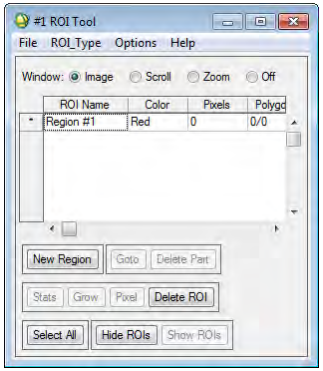




- Three kinds of window “Image / Scroll / Zoom” appear.
- A color composite (false color) image (RGB=B3,B2.B1) of ASTER data is created in the “#1 display”.



- Click “Basic Tools” on #1 display menu bar.
- Select “Region of Interest”, then select and click “ROI Tool”.
- “#1 ROI Tool” window appears.

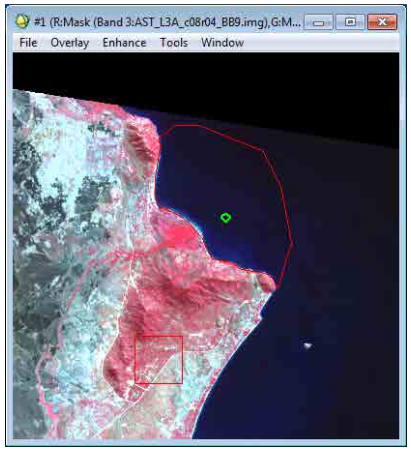



- Click “Image” circle shown in upper part of the “#1 ROI Tool” window.
- Click “ROI Type” on “#1 ROI Tool” menu bar
- Select “Polygon” and “Multi Part: off”.
- Trace the border of area to be masked on Image by mouse.

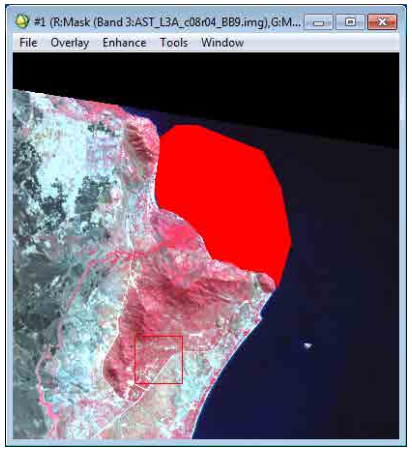
On “Image” window of #1 display, click left mouse button to put point. Put points on the border. After finishing trace, click right mouse button twice to fix. To cancel, click right mouse button once and small diamond appears then click middle mouse button.

To remove the polygon after fixing, click middle mouse button on the polygon you want to remove.

Repeat the trace procedure to all areas to be masked.




Click right mouse button once after putting points.



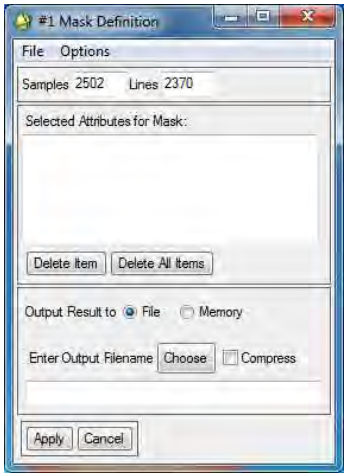

Click right mouse button twice to fix.



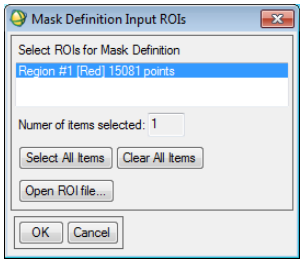


- Click “Basic Tools” on main menu bar.
- Select “Masking” on main menu bar, then select and click “Build Mask”.
- “Mask Definition” window appears.

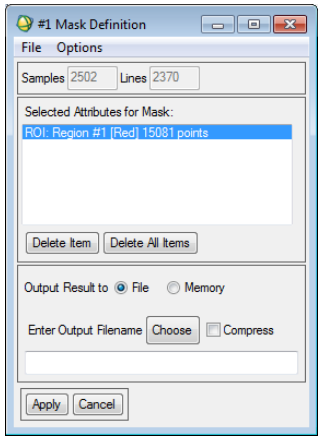

- Select “Display #1” in the “Select Input Display:” box of the “Mask Definition” window.
- Click “OK” box.
- “#1 Mask Definition” window appears.



- Click “Options” on “#1 Mask Definition” menu bar.
- Select and Click “Import ROIs”.
- “Mask Definition Input ROIs” window appears.




- Select “Region #1” in the “ROIs for Mask Definition” box of the “Mask Definition Input ROIs” window.
- Click “OK” box.




- Click “Options” on the “#1 Mask Definition” menu bar.
- Select “Selected Areas Off”.
- Click “Choose” box of the “#1 Mask Definition” window to enter output filename.
- “Output Filename” window appears.
- Choose output file folder and then enter output filename in the “Filename” box.

Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp

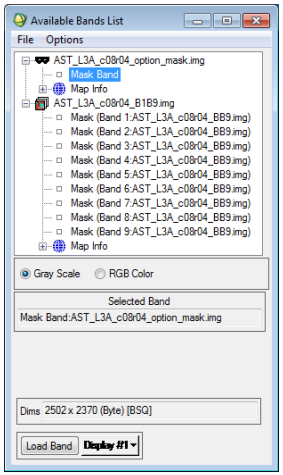
(example: AST_L3A_c08r04_option_mask.img)

- Click “Open” box in the window.
- Entered output filename appears in the “Enter Output Filename” box of the “#1 Mask Definition” window.
- Click “Apply” box in the window.





- “option_mask.img” file is created and appears in the “Available Bands List” window.




- Click “Cancel” box of the “#2 Mask Definition” to close the window.

JOB05-5: Integrate all masks

+ Job content: Integrate NDVI mask, water mask, cloud mask and shadow of cloud mask image.
+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp
+ Input filename: (example: AST_L3A_c08r04_NDVI_mask.img)
+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp
+ Input filename: (example: AST_L3A_c08r04_water_mask.img)
+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp
+ Input filename: (example: AST_L3A_c08r04_cloud_mask.img)
+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp
+ Input filename: (example: AST_L3A_c08r04_shadow_mask.img)

+ Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp
+ Output filename: (example: AST_L3A_c08r04_all_mask.img)

- Click “File” on main menu bar.
- Select and click “Open Image File”.
- “Enter Data Filenames” window appears.
- Choose and find the input data folder in the window.
- Select and click the input ASTER data file in the window.

Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp
(example: AST_L3A_c08r04_NDVI_mask.img)

- Selected data filename appears in the “File Name” box.
- Click “Open” box in the window.
- Selected ASTER data is read into ENVI and appears in the “Available Bands List” window.

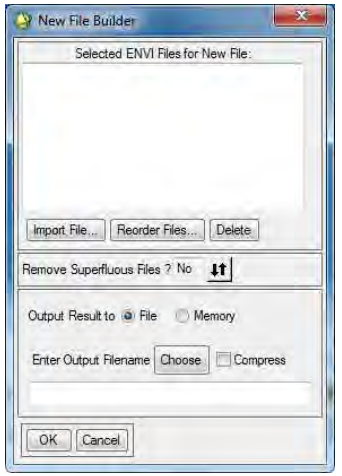
- About input files “AST_L3A_c08r04_water_mask.img” and “AST_L3A_c08r04_cloud_mask.img“ and “AST_L3A_c08r04_shadow_mask.img“ , Repeat the procedure above-mentioned and read those ASTER data if it exists.





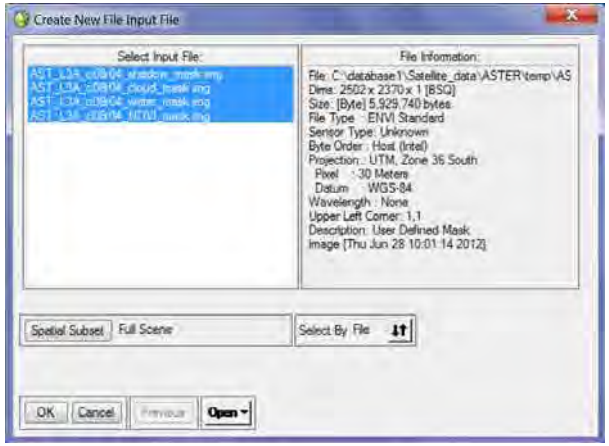
- Four mask files appear in the “Available Bands List” window.


- Click “File” on main menu bar.
- Select “Save File As”, then select and click “ENVI standard”.
- “New File Builder” window appears.




- Click “Import File” box.

- "Create New File Input File" window appears.




- Select following four masks in the "Select Input File" box.

"AST_L3A_c08r04_NDVI_mask.img"

"AST_L3A_c08r04_water_mask.img"

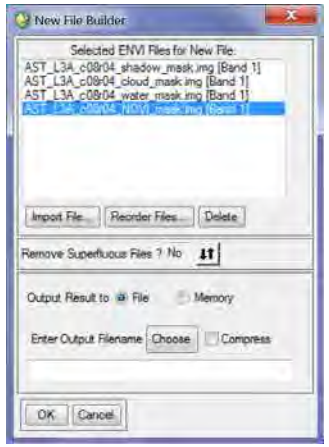
"AST_L3A_c08r04_cloud_mask.img"

"AST_L3A_c08r04_shadow_mask.img"

NOTE: Select and click files with holding down Ctrl key.

- Click "OK" box in the window.

- Make sure that four mask files are shown in the "Selected ENVI File for New File" box of the "New File Builder".








- Click "Choose" box to enter output filename.
- "Output Filename" window appears.
- Choose output file folder and then enter output filename in the "Filename" box.

Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp

Output filename (example: AST_L3A_c08r04_all_mask.img)

- Click "Open" box in the window.
- Entered output filename appears in the "Enter Output Filename" box of the "New File Builder" window.
- Click "OK" box in the window.
- "Create New File" window appears while processing and closes after processing automatically.
- Created all mask data (4 bands) appears in the "Available Bands List" window.

JOB05-6: Build integrated mask

+ Job content: Build integrated mask.

+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp

+ Input filename: (example: AST_L3A_c08r04_all_mask.img)

+ Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp

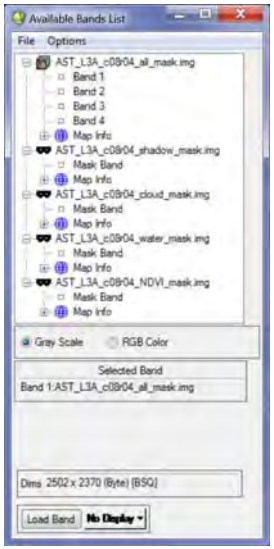
+ Output filename: (example: AST_L3A_c08r04_integrated_mask.img)

- Click “File” on main menu bar.
- Select and click “Open Image File”.
- “Enter Data Filenames” window appears.
- Choose and find the input data folder in the window.
- Select and click the input ASTER data file in the window.

Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp

(example: AST_L3A_c08r04_all_mask.img)

- Selected data filename appears in the “File Name” box.
- Click “Open” box in the window.
- Selected ASTER data is read into ENVI and appears in the “Available Bands List” window.




- Click “Gray Scale” circle shown in lower part of the “Available Bands List” window.
- After the click above, select any band in the “AST_L3A_c08r04_all_mask.img" of the “Available

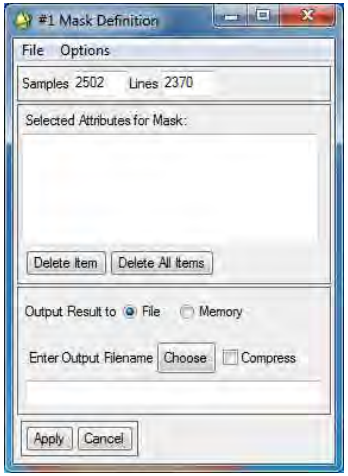




Bands List” window.

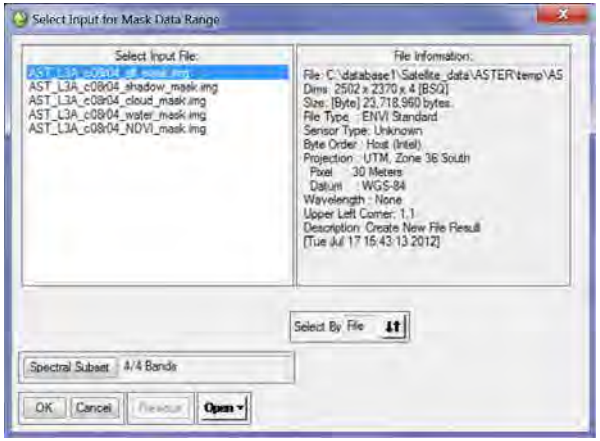
- Click “No Display” box in the bottom of the window.
- Select and click “New Display”.
- Click “Load Band” box in the bottom of the window.
- Three kinds of window “Image / Scroll / Zoom” appear.
- A gray Band image of the “all_mask.img” is created in the “#1 display”.
- Click “Basic Tools” on main menu bar.
- Select “Masking” on main menu bar, then select and click “Build Mask”.
- “Mask Definition” window appears.


- Select “Display #1” in the “Select Input Display:” box of the “Mask Definition” window.
- Click “OK” box.
- “#1 Mask Definition” window appears.




- Click “Options” on “#1 Mask Definition” menu bar.
- Select “Import Data Range”.

- "Select Input for Mask Data Range" window appears.




- Select "AST_L3A_c08r04_all_mask.img" in the "Select Input File:" box.
- Click "OK" box.
- "Input for Data Range Mask" window appears.


- Enter value "0.5" in the "Data Min Value" box.
- Click "Mask pixel if ALL band match range" circle.
- Click "OK" box.
- Click "Options" on "#1 Mask Definition" menu bar.
- Select and Click "Selected Areas on".
- Click "Choose" box to enter output filename.
- "Output Filename" window appears.
- Choose output file folder and then enter output filename in the "Filename" box.

Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp

Output filename (example: AST_L3A_c08r04_integrated_mask.img)





- Click "Open" box in the window.
- Entered output filename appears in the "Enter Output Filename" box of the "#1 Mask Definition" window.
- Click "Apply" box in the window.
- "Build Binary Mask" window appears while processing and closes after processing automatically.
- Integrated mask band appears in the "Available Bands List" window.


- Click "Cancel" box in the "#1 Mask Definition".

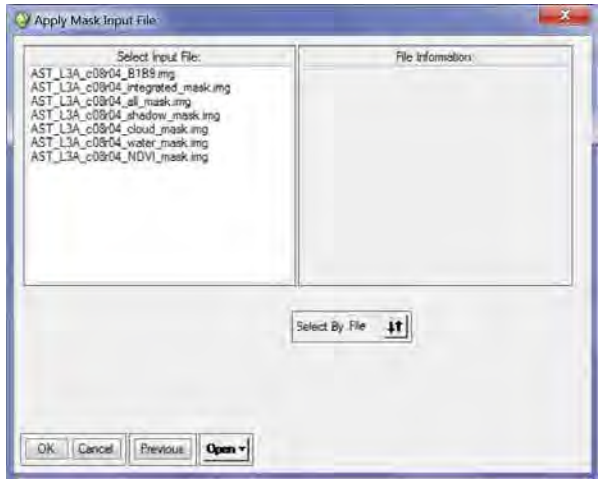
JOB05-7: Apply integrated mask to ASTER data

+ Job content: Apply integrated_mask to B1B9 image to eliminate bad pixels for analysis.
+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥analysis_data
+ Input filename: (example: AST_L3A_c08r04_B1B9.img)
+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥temp
+ Input filename: (example: AST_L3A_c08r04_integrated_mask.img)

+ Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥masked_data
+ Output filename: (example: AST_L3A_c08r04_masked_B1B9.img)

- Click “Basic Tools” on main menu bar.
- Select “Masking”, then select and click “Apply Mask”.

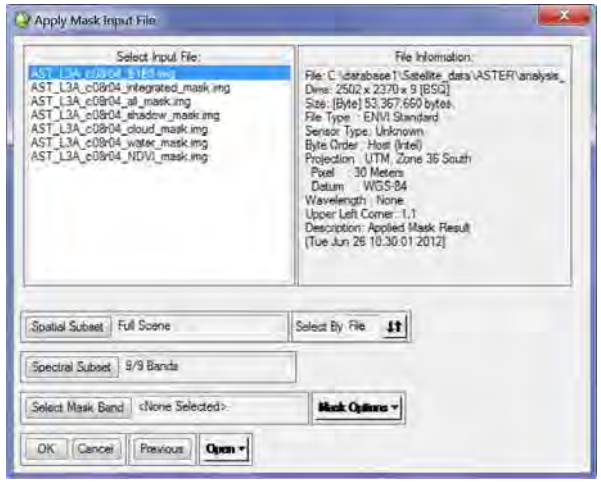
“Apply Mask Input File” window appears.



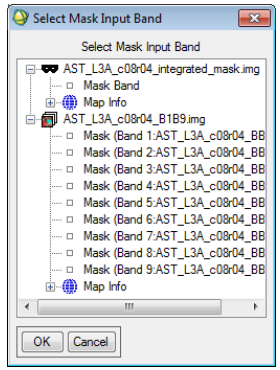





- Select “AST_L3A_c08r04_B1B9.img” in the “Select Input File:” box.

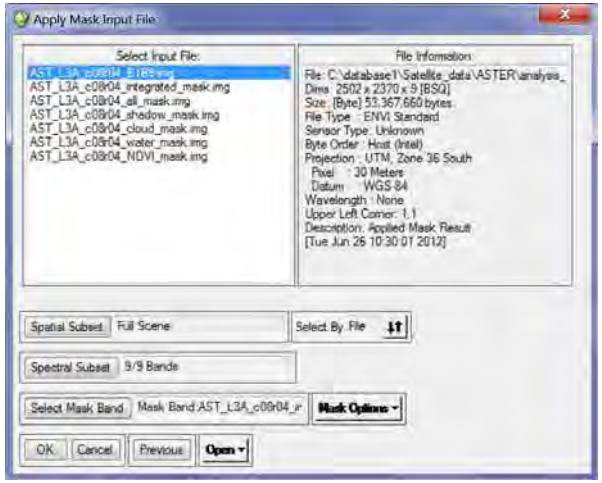



- Click “Select Mask Band” box.
- “Select Mask Input Band” window appears.

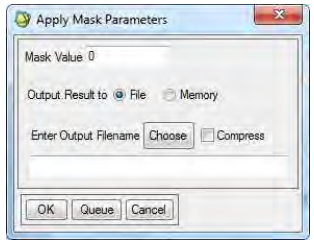



- Select Mask Band of the “AST_L3A_c08r04_integrated_mask.img” in the “Select Mask Input Band” box.
- Click “OK” box.

- Make sure that “AST_L3A_c08r04_B1B9.img” is selected in the “Select Input File:” box and Mask Band of the “AST_L3A_c08r04_integrated_mask.img” is shown in the “Select Mask Input Band” box.




- Click “OK” box in the “Apply Mask Input File” window.
- “Apply Mask Parameters” window appears.




- Click “Choose” box to enter output filename.
- “Output Filename” window appears.
- Choose output file folder and then enter output filename in the “Filename” box.

Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥masked_data

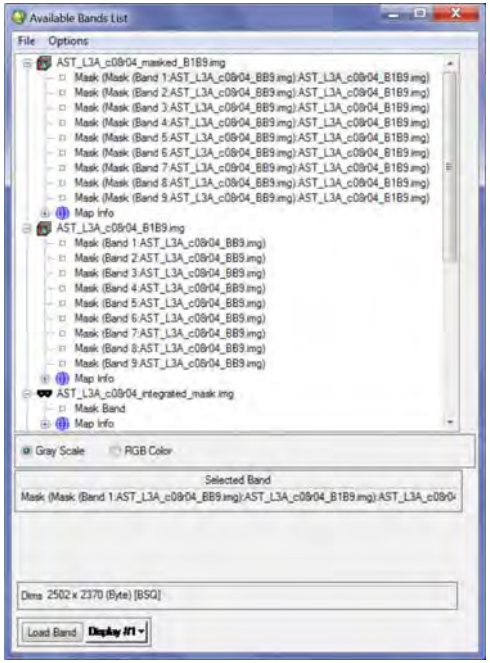
Output filename (example: AST_L3A_c08r04_masked_B1B9.img)

- Click “Open” box in the window.
- Entered output filename appears in the “Enter Output Filename” box of the “#1 Mask Definition” window.
- Click “OK” box in the window.
- “Apply Mask” window appears while processing and closes after processing automatically.





- Masked B1B9 data appears in the “Available Bands List” window.



JOB06-1

+ Job content: Create a color composite image (RGB=B3,B2,B1) of ASTER masked data

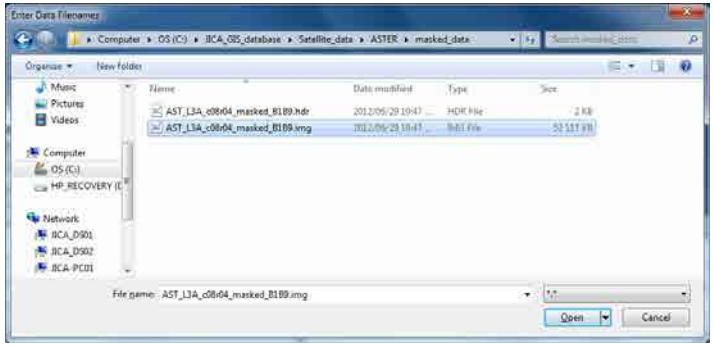
+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥masked_data

+ Input filename: (example: AST_L3A_c08r04_masked_B1B9.img)

- Click “File” on main menu bar.

- Select and click “Open Image File”.

- “Enter Data Filenames” window appears.




- Choose and find the input data folder in the window.

- Select and click the input ASTER data file in the window.

Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥masked_data

(example: AST_L3A_c08r04_masked_B1B9.img)

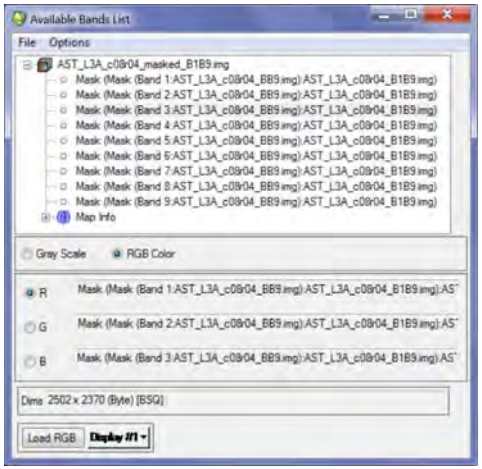
- Selected data filename appears in the “File Name” box.

- Click “Open” box in the window.





- Selected ASTER data is read into ENVI and appears in the “Available Bands List” window.




- Click “RGB color” circle shown in lower part of the “Available Bands List” window.

- R/G/B circles and description boxes appear in the lower part of the window.

- When the “R circle” is selected (ticked), click “Mask (Mask (Band 3:AST_L3A…”.

- After the click above, the “G circle” is automatically ticked.

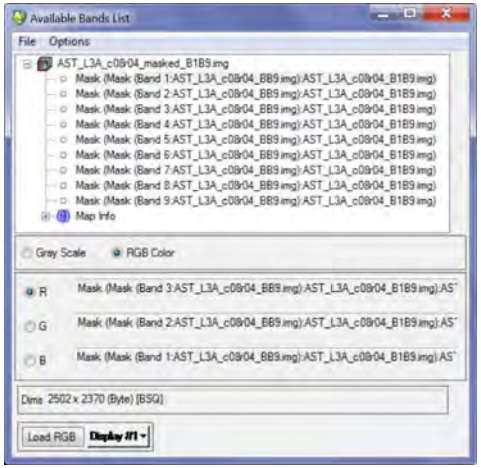
- When the “G circle” is selected (ticked), click “Mask (Mask (Band 2:AST_L3A…”.

- After the click above, the “B circle” is automatically ticked.

- When the “B circle” is selected (ticked), click “Mask (Mask (Band 1:AST_L3A…”.

- After the click above, the “R circle” is automatically ticked again.

- Make sure that Band3 is shown in the “R box”, Band2 in the “G box” and Band1 in the “B box”.

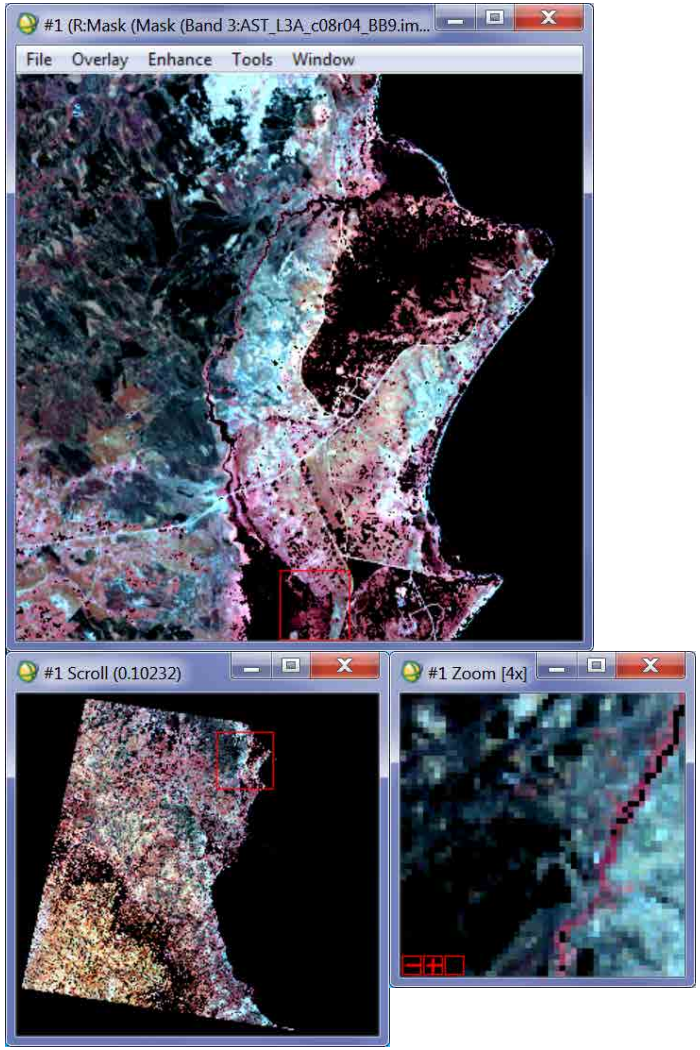



- Click “No Display” box in the bottom of the window.
- Select and click “New Display”.
- Click “Load RGB” box in the bottom of the window.





- Three kinds of window “Image / Scroll / Zoom” appear.
- A color composite (false color) image (RGB=B3,B2,B1) of ASTER masked data is created.



JOB06-2

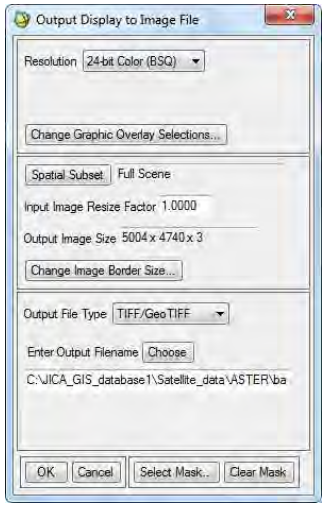
+ Job content: Save the color composite image (RGB=B3,B2,B1) of ASTER masked data

+ Output file folder

: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥band_comp¥B3_B2_B1

+ Output filename: (example: AST_L3A_c08r04_B3_2_1.tif)

- Click “File” on display menu bar.
- Select “Save Image As” and then select and click “Image File…”.
- “Output Display to Image File” window appears.

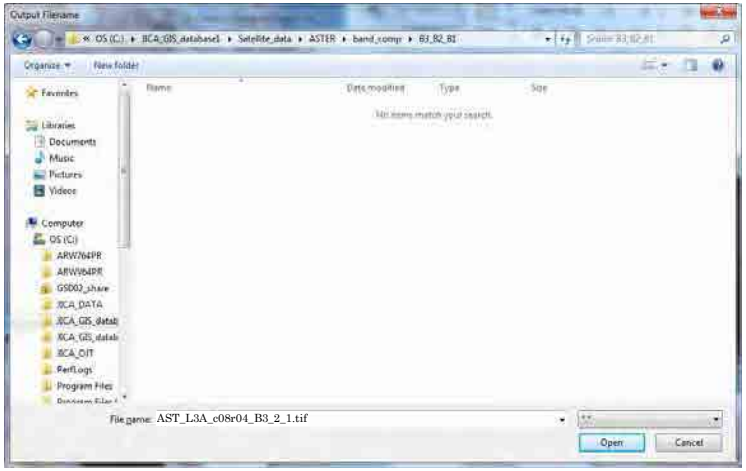



- Select “TIFF/GeoTIFF” in the “Output File Type” box.
- Click “Choose” box to enter output filename.





- “Output Filename” window appears.




- Choose output file folder and then enter output filename in the “Filename” box.

Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥band_comp¥B3_B2_B1

Output filename (example: AST_L3A_c08r04_B3_2_1.tif)

- Click “Open” box in the window.
- Entered output filename appears in the “Enter Output Filename” box of the “Output Display to Image File” window.
- Click “OK” box in the window.
- “AST_L3A_B3_2_1.tif” file is saved in the “¥ASTER¥band_comp¥B3_B2_B1” folder.

JOB07

+ Job content: Calculate the inter-band ratios of ASTER masked data

Calculation ratio of Band7/Band6 and Band3/Band4 and Band2/Band1

+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥masked_data

+ Input filename: (example: AST_L3A_c08r04_masked_B1B9.img)

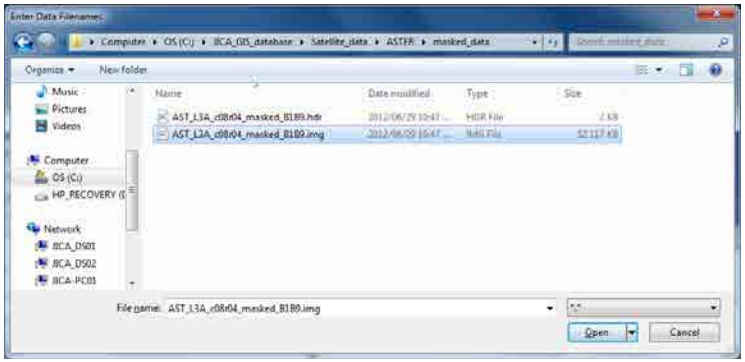
+ Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥band_ratio¥B7d6_B3d4_B2d1

+ Output filename: (example: AST_L3A_c08r04_7d6.img)

+ Output filename: (example: AST_L3A_c08r04_3d4.img)

+ Output filename: (example: AST_L3A_c08r04_2d1.img)

- Click “File” on main menu bar.
- Select and click “Open Image File”.
- “Enter Data Filenames” window appears.




- Choose and find the input data folder in the window.
- Select and click the input ASTER data file in the window.

Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥masked_data

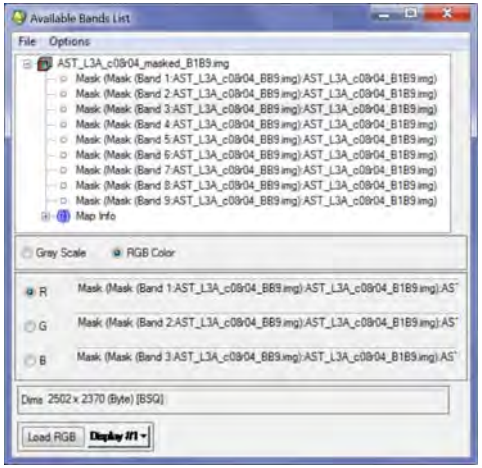
(example: AST_L3A_c08r04_masked_B1B9.img)

- Selected data filename appears in the “File Name” box.
- Click “Open” box in the window.

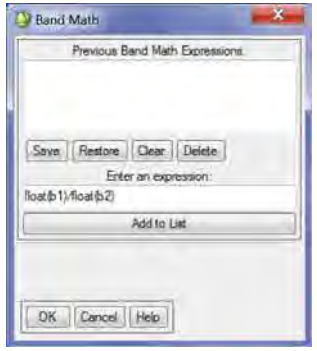




- Selected ASTER data is read into ENVI and appears in the “Available Bands List” window.

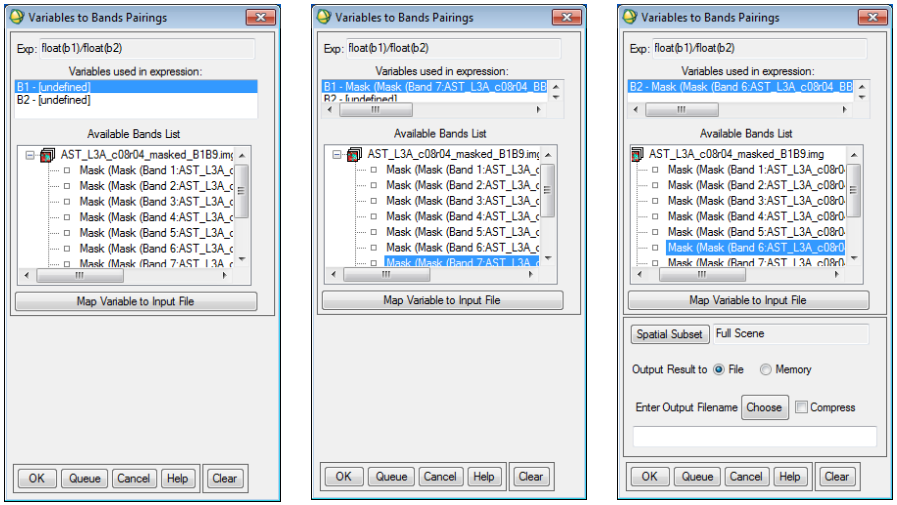



- Click “Basic Tools” on main menu bar.
- Select and click “Band Math”.
- “Band Math” window appears.




- Enter formula “float(b1)/float(b2)” in the “Enter an expression:” box of the “Band Math” window.
- Click “Add to List” box in the “Band Math” window to enter the formula in the “Previous Band Math Expressions:” box.
- Click “OK” box in the “Band Math” window.

- "Variables to Bands Pairings" window appears.
- Select "B1" in "Variables used in expression:" box and then select "Mask (Mask (Band 7:AST_L3A…"
- Select "B2" in "Variables used in expression:" box and then select "Mask (Mask (Band 6:AST_L3A…"
- Make sure that "B1" is followed by Band 7 and "B2" is followed by Band 6 in the "Variables used in expression:" box.




- Click "Choose" box to enter output filename.
- "Output Filename" window appears.
- Choose output file folder and then enter output filename in the "Filename" box.

Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥band_ratio¥B7d6_B3d4_B2d1

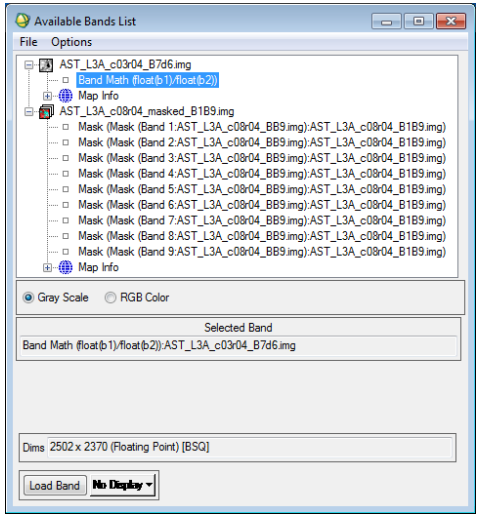
Output filename (example: AST_L3A_c03r04_B7d6.img)

- Click "Open" box in the window.
- Entered output filename appears in the "Enter Output Filename" box of the "Variables to Bands Pairings" window.
- Click "OK" box in the window.
- "Band Math" window appears while processing and closes after processing automatically.





- "B7d6.img" file is created and appears in the "Available Bands List".




- Click "Basic Tools" on main menu bar.
- Select and click "Band Math".
- "Band Math" window appears.
- Click formula "float(b1)/float(b2)" in the "Previous Band Math Expressions:" box.
- Formula "float(b1)/float(b2)" appears in the "Enter an expression:" box of the "Band Math" window.
- Click "OK" box in the "Band Math" window.
- "Variables to Bands Pairings" window appears.
- Select "B1" in "Variables used in expression:" box and then select "Mask (Mask (Band 3:AST_L3A…"
- Select "B2" in "Variables used in expression:" box and then select "Mask (Mask (Band 4:AST_L3A…"
- Make sure that "B1" is followed by Band 3 and "B2" is followed by Band 4 in the "Variables used in expression:" box.
- Click "Choose" box to enter output filename.
- "Output Filename" window appears.
- Choose output file folder and then enter output filename in the "Filename" box.

Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥band_ratio¥B7d6_B3d4_B2d1

Output filename (example: AST_L3A_c03r04_B3d4.img)

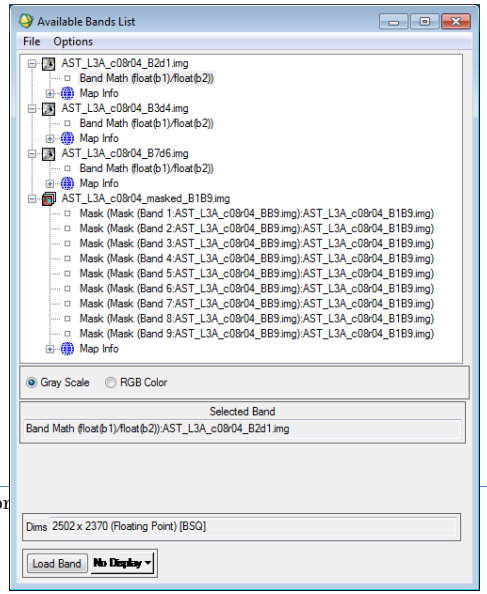
- Click "Open" box in the window.
- Entered output filename appears in the "Enter Output Filename" box of the "Variables to Bands Pairings" window.
- Click "OK" box in the window.

- “Band Math” window appears while processing and closes after processing automatically.
- “B3d4.img” file is created and appears in the “Available Bands List”.
- Click “Basic Tools” on main menu bar.
- Select and click “Band Math”.
- “Band Math” window appears.
- Click formula “float(b1)/float(b2)” in the “Previous Band Math Expressions:” box.
- Formula “float(b1)/float(b2)” appears in the “Enter an expression:” box of the “Band Math” window.
- Click “OK” box in the “Band Math” window.
- “Variables to Bands Pairings” window appears.
- Select “B1” in “Variables used in expression:” box and then select “Mask (Mask (Band 2:AST_L3A…”
- Select “B2” in “Variables used in expression:” box and then select “Mask (Mask (Band 1:AST_L3A…”
- Make sure that “B1” is followed by Band 2 and “B2” is followed by Band 1 in the “Variables used in expression:” box.
- Click “Choose” box to enter output filename.
- “Output Filename” window appears.
- Choose output file folder and then enter output filename in the “Filename” box.

Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥band_ratio¥B7d6_B3d4_B2d1

Output filename (example: AST_L3A_c03r04_B2d1.img)

- Click “Open” box in the window.
- Entered output filename appears in the “Enter Output Filename” box of the “Variables to Bands Pairings” window.
- Click “OK” box in the window.
- “Band Math” window appears while processing and closes after processing automatically.
- “B2d1.img” file is created and appears in the “Available Bands List”.








NOTE: How to save an expression: formula.

Open “Band Math” window. Enter formula in the “Enter an expression:” box and click “Add to List” box to enter formula in the “Previous Band Math Expressions:”. Click “Save” box in the window.

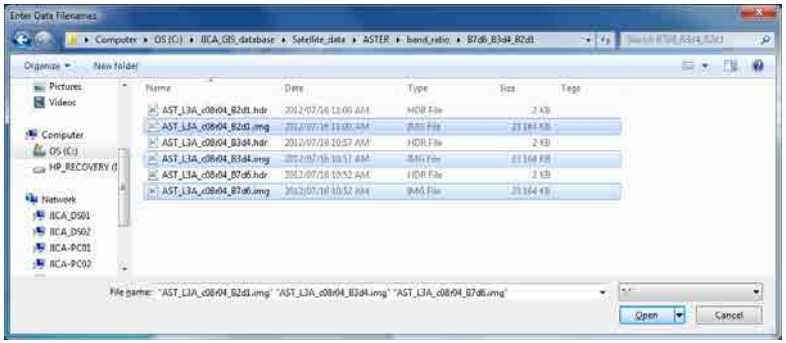
“Save Expressions to File” window appears. After clicking “Choose” box, select proper folder and enter filename "band_ratio.exp" in the “Output Filename” window. Click “OK” box in the window to save.

To restore formula, click “Restore” box in the “Band Math” window. After selecting the folder and the file saved formula, click “Open” box in the “Enter Expressions Filename” window.

JOB08-1

+ Job content: Create a band ratio image (RGB=B7/B6,B3/B4,B2/B1) of ASTER data
+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥band_ratio¥B7d6_B3d4_B2d1
+ Input filename: (example: AST_L3A_c08r04_7d6.img)
+ Input filename: (example: AST_L3A_c08r04_3d4.img)
+ Input filename: (example: AST_L3A_c08r04_2d1.img)

- Click “File” on main menu bar.
- Select and click “Open Image File”.
- “Enter Data Filenames” window appears.




- Choose and find the input data folder in the window.
- Select and click the three input ASTER data files in the window.

Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥band_ratio¥B7d6_B3d4_B2d1

(example: AST_L3A_c08r04_7d6.img, AST_L3A_c08r04_3d4.img, AST_L3A_c08r04_2d1.img)

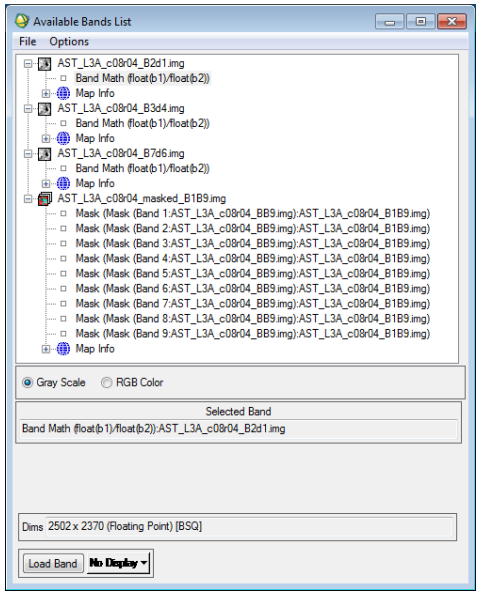
NOTE: Select and click files with holding down Ctrl key.

- Selected data filename appears in the “File Name” box.
- Click “Open” box in the window.



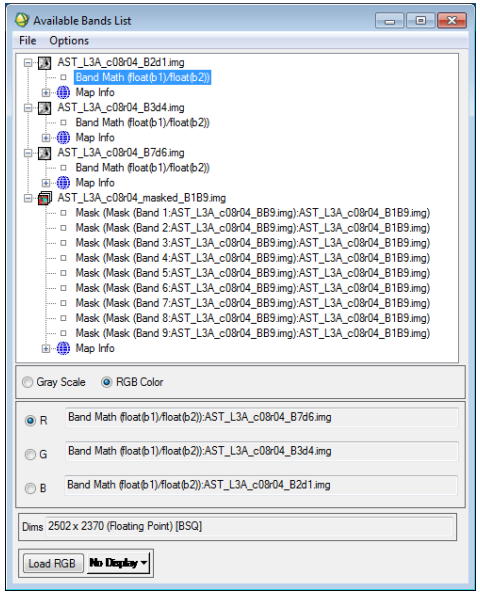


- Selected ASTER data is read into ENVI and appears in the “Available Bands List” window.




- Click “RGB color” circle shown in lower part of the “Available Bands List” window.
- R/G/B circles and description boxes appear in the lower part of the window.
- When the “R circle” is selected (ticked), click “Band Math” of the “AST_L3A_c08r04_7d6.img”.
- After the click above, the “G circle” is automatically ticked.
- When the “G circle” is selected (ticked), click “Band Math” of the “AST_L3A_c08r04_3d4.img”.
- After the click above, the “B circle” is automatically ticked.
- When the “B circle” is selected (ticked), click “Band Math” of the “AST_L3A_c08r04_2d1.img”.
- After the click above, the “R circle” is automatically ticked again.

- Make sure that Band7/Band6 is shown in the “R box”, Band3/Band4 in the “G box” and Band2/Band1 in the “B box”.

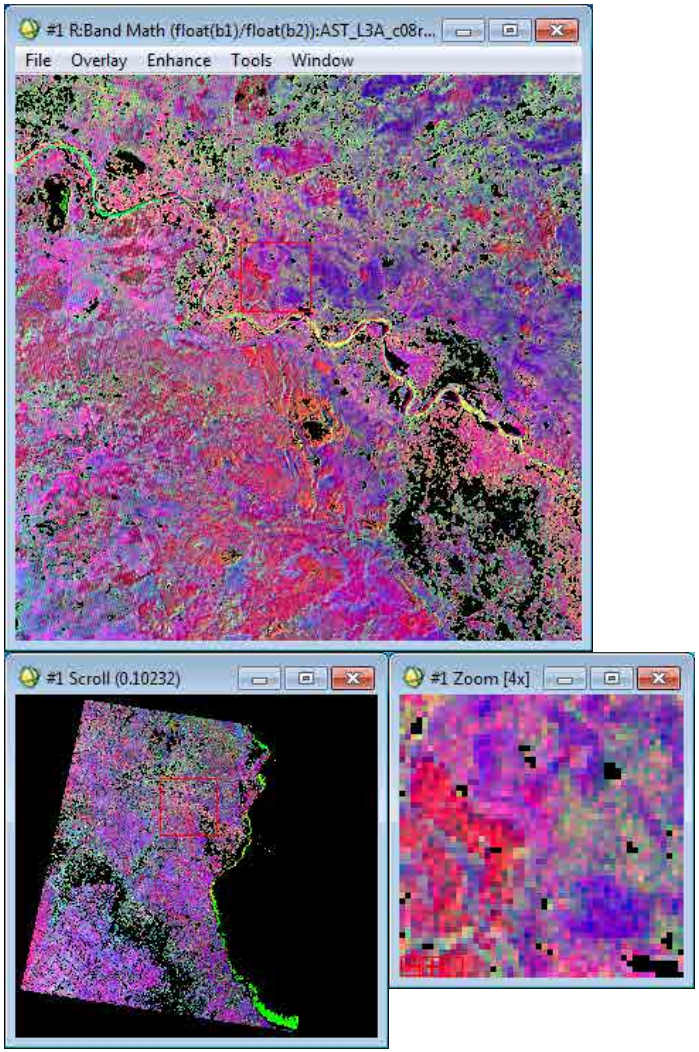



- Click “No Display” box in the bottom of the window.
- Select and click “New Display”.
- Click “Load RGB” box in the bottom of the window.





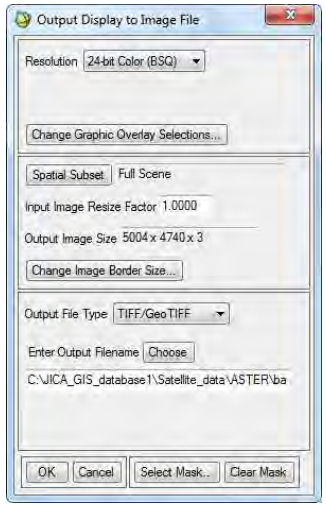
- Three kinds of window “Image / Scroll / Zoom” appear.
- A band ratio image (RGB=B7/B6,B3/B4,B2/B1) of ASTER data is created.



JOB08-2

+ Job content: Save the band ratio image (RGB=B7/B6,B3/B4,B2/B1) of ASTER data
+ Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥band_ratio¥B7d6_B3d4_B2d1
+ Output filename: (example: AST_L3A_c08r04_B7d6_3d4_2d1.tif)

- Click “File” on display menu bar.
- Select “Save Image As” and then select and click “Image File…”.
- “Output Display to Image File” window appears.

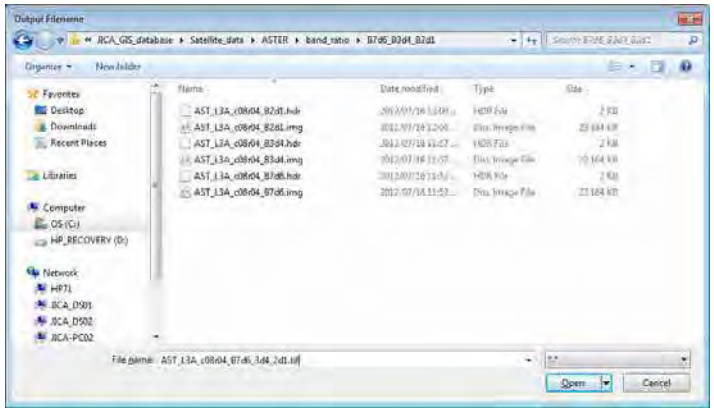



- Select “TIFF/GeoTIFF” in the “Output File Type” box.
- Click “Choose” box to enter output filename.





- “Output Filename” window appears.




- Choose output file folder and then enter output filename in the “Filename” box.

Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥band_ratio¥B7d6_B3d4_B2d1

Output filename (example: AST_L3A_c08r04_B7d6_3d4_2d1.tif)

- Click “Open” box in the window.
- Entered output filename appears in the “Enter Output Filename” box of the “Output Display to Image File” window.
- Click “OK” box in the window.
- “AST_L3A_B7d6_3d4_2d1.tif” file is saved in the “¥ASTER¥band_ratio¥B7d6_B3d4_B2d1” holder.

JOB09-1

+ Job content: Create a color composite image (RGB=B10,B12,B14) of ASTER TIR data

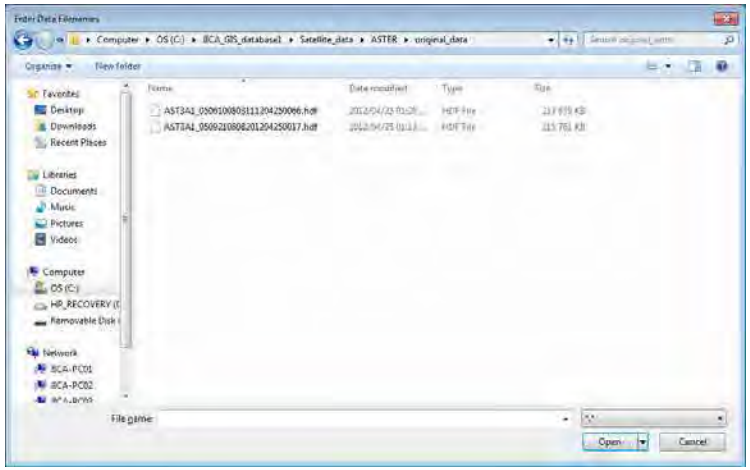
+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥original_data

+ Input filename: (example: AST3A1_0506100803111204250066.hdf)

- Click “File” on main menu bar.

- Select and click “Open Image File”.

- “Enter Data Filenames” window appears.




- Choose and find the input data folder in the window.

- Select and click the input ASTER data file in the window.

Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥original_data

(example: AST3A1_0506100803111204250066.hdf)

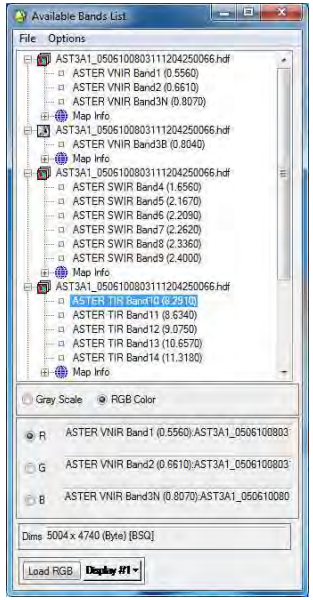
- Selected data filename appears in the “File Name” box.

- Click “Open” box in the window.





- Selected ASTER data is read into ENVI and appears in the “Available Bands List” window.




- Click “RGB color” circle shown in lower part of the “Available Bands List” window.

- R/G/B circles and description boxes appear in the lower part of the window.

- When the “R circle” is selected (ticked), click “ASTER TIR Band10”.

- After the click above, the “G circle” is automatically ticked.

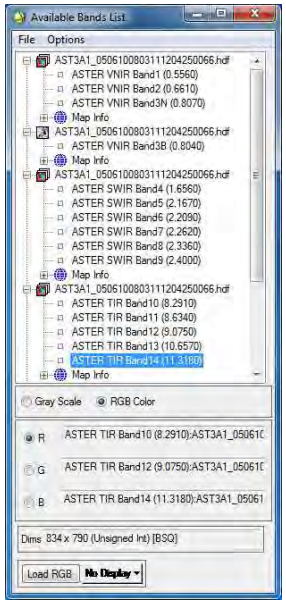
- When the “G circle” is selected (ticked), click “ASTER TIR Band12”.

- After the click above, the “B circle” is automatically ticked.

- When the “B circle” is selected (ticked), click “ASTER TIR Band14”.

- After the click above, the “R circle” is automatically ticked again.

- Make sure that Band10 is shown in the “R box”, Band12 in the “G box” and Band14 in the “B box”.

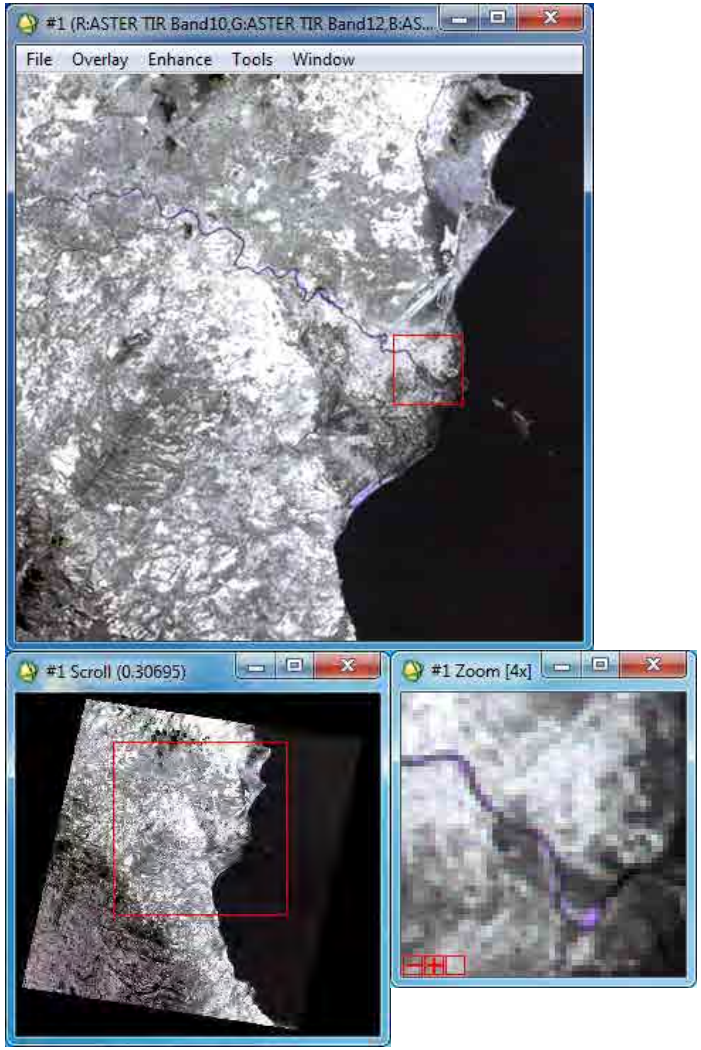



- Click “No Display” box in the bottom of the window.
- Select and click “New Display”.
- Click “Load RGB” box in the bottom of the window.





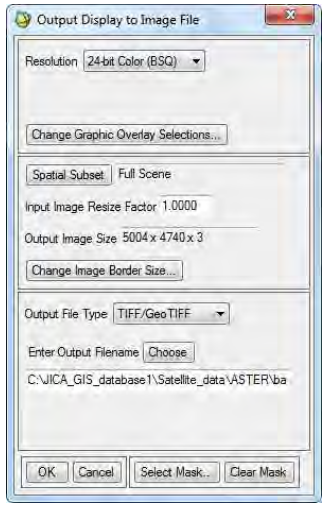
- Three kinds of window “Image / Scroll / Zoom” appear.
- A color composite image (RGB=B10,B12,B14) of ASTER TIR data is created.



JOB09-2

+ Job content: Save the color composite image (RGB=B10,B12,B14) of ASTER TIR data
+ Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥band_comp¥B10_B12_B14
+ Output filename: (example: AST_L3A_c08r04_B10_12_14.tif)

- Click “File” on display menu bar.
- Select “Save Image As” and then select and click “Image File…”.
- “Output Display to Image File” window appears.

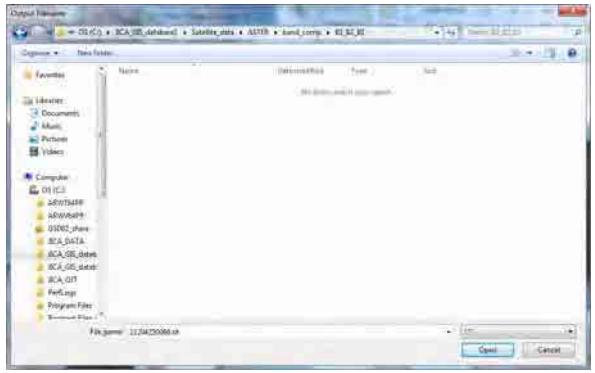



- Select “TIFF/GeoTIFF” in the “Output File Type” box.
- Click “Choose” box to enter output filename.





- “Output Filename” window appears.



- Choose output file folder and then enter output filename in the “Filename” box.

Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥band_comp¥B10_B12_B14
Output filename (example: AST_L3A_c08r04_B10_12_14.tif)

NOTE: To create filename, refer the list of GRANULE ID of ASTER data.

In this case, input filename and output filename are as follows.

+ Input filename: (example: AST3A1_0506100803111204250066.hdf)
+ Output filename: (example: AST_L3A_c08r04_B10_12_14.tif)

How to create filename

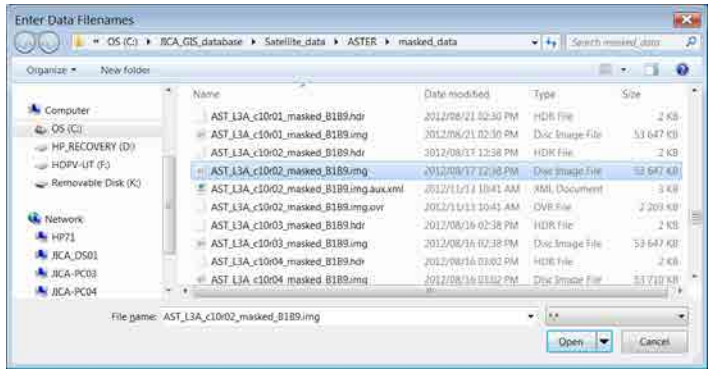
- Find filename “AST3A1_0506100803111204250066” in the list of GRANULE ID of ASTER data.
- See column and row correspond to “AST3A1_0506100803111204250066”
- Confirm the column is 8 and the row is 4.
- Create filename “AST_L3A_c08r04”.
- Append “_B10_12_14.tif”.
- Filename “AST_L3A_c08r04_B10_12_14.tif” is created.

- Click “Open” box in the window.
- Entered output filename appears in the “Enter Output Filename” box of the “Output Display to Image File” window.
- Click “OK” box in the window.
- “AST_L3A_c08r04_B10_12_14.tif” file is saved in the “¥ASTER¥band_comp¥B10_B12_B14” folder.

JOB10-1

+ Job content: Carry out principal component analysis
+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥masked_data
+ Input filename: (example: AST_L3A_c10r02_masked_B1B9.img)
+ Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥PCA
+ Output filename: (example: AST_L3A_c10r02_masked_B1B9_PCA.img)

- Click “File” on main menu bar.
- Select and click “Open Image File”.
- “Enter Data Filenames” window appears.




- Choose and find the input data folder in the window.
- Select and click the input ASTER data file in the window.

Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥masked_data

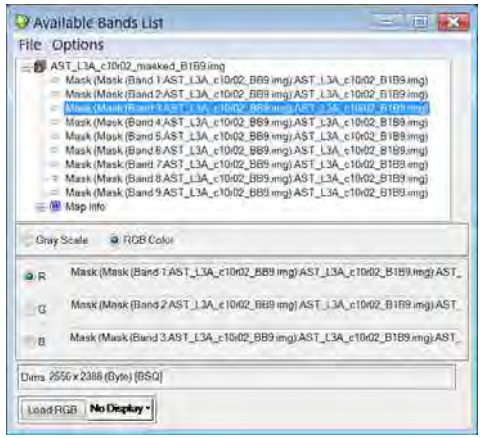
(example: AST_L3A_c10r02_masked_B1B9.img)

- Selected data filename appears in the “File Name” box.
- Click “Open” box in the window.



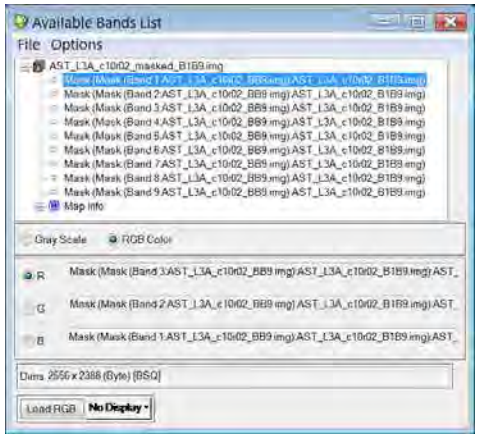


- Selected ASTER data is read into ENVI and appears in the “Available Bands List” window.




- Click “RGB color” circle shown in lower part of the “Available Bands List” window.
- R/G/B circles and description boxes appear in the lower part of the window.
- When the “R circle” is selected (ticked), click “Mask (Mask (Band 3:AST_L3A…”.
- After the click above, the “G circle” is automatically ticked.
- When the “G circle” is selected (ticked), click “Mask (Mask (Band 2:AST_L3A…”.
- After the click above, the “B circle” is automatically ticked.
- When the “B circle” is selected (ticked), click “Mask (Mask (Band 1:AST_L3A…”.
- After the click above, the “R circle” is automatically ticked again.

- Make sure that Band3 is shown in the “R box”, Band2 in the “G box” and Band1 in the “B box”.

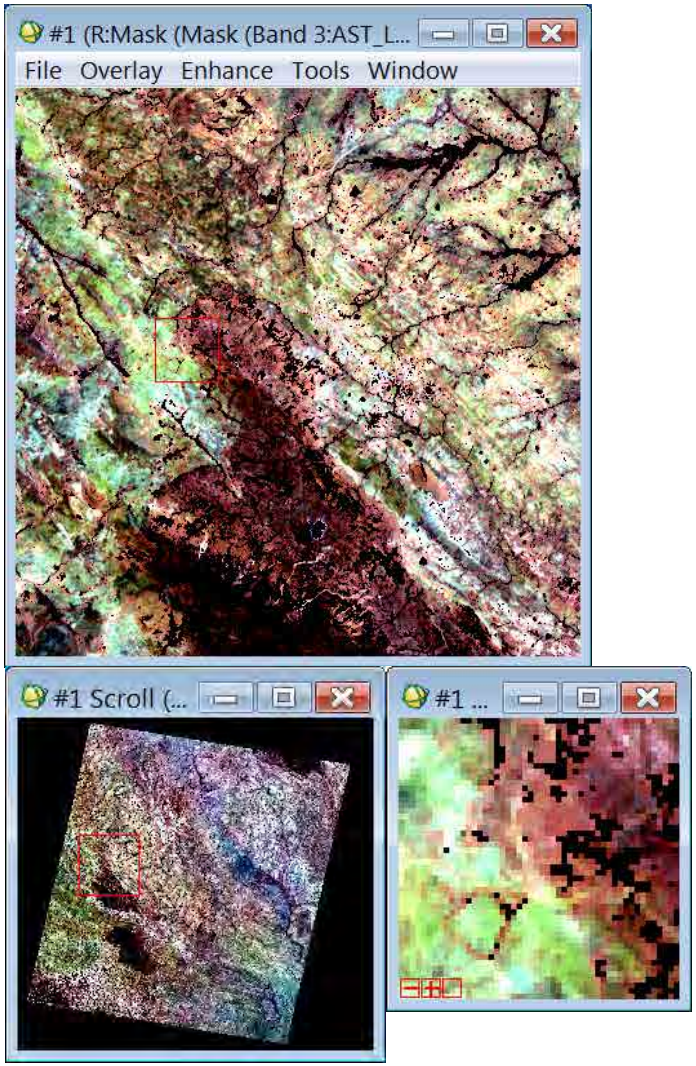



- Click “No Display” box in the bottom of the window.
- Select and click “New Display”.
- Click “Load RGB” box in the bottom of the window.

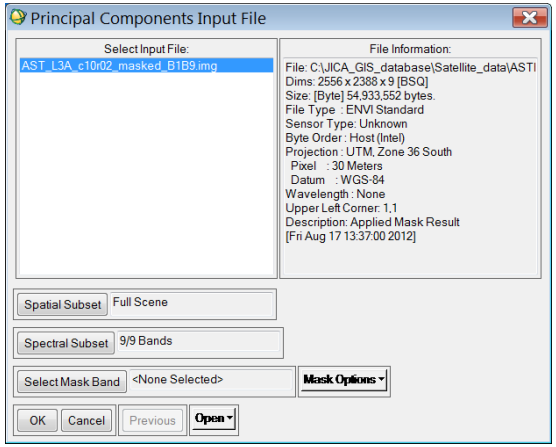




- Three kinds of window “Image / Scroll / Zoom” appear.
- A color composite (false color) image (RGB=B3,B2,B1) of ASTER masked data is created.



- Click “Transform” on display menu bar.
- Select “Principal Components”, then select “Forward PC Rotation” and then select and click "Compute New Statistics and Rotation".
- “Principal Components Input File” window appears.
- Select “AST_L3A_c10r02_masked_B1B9.img” in the “Select Input File” box.

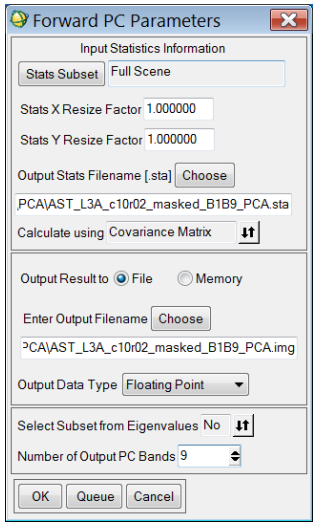



- Click “OK” box.





- “Forward PC Parameters” window appears.




- Click "Choose" box of Output Stats Filename [sta] in the upper part of the window.
- Choose output file folder and then enter output filename in the “Filename” box.

Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥PCA

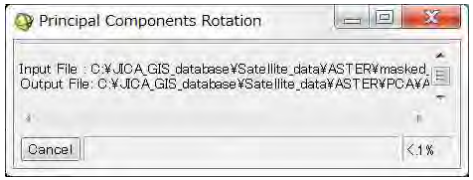
Output filename (example: AST_L3A_c10r02_masked_B1B9_PCA.sta)

- Click "Choose" box of Enter Output Filename in the lower part of the window.
- Choose output file folder and then enter output filename in the “Filename” box.

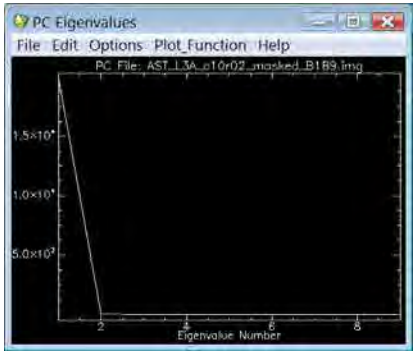
Output file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥PCA

Output filename (example: AST_L3A_c10r02_masked_B1B9_PCA.img)

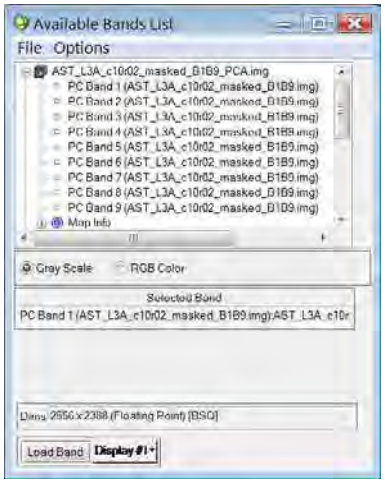
- Click “OK” box.
- Calculation of PCA starts and "Principal Component Rotation" window appears and disappears after finishing calculation.



- "PC Eigenvalues" window appears.




- Calculated PC Band image appears in the "Available Bands List" window.



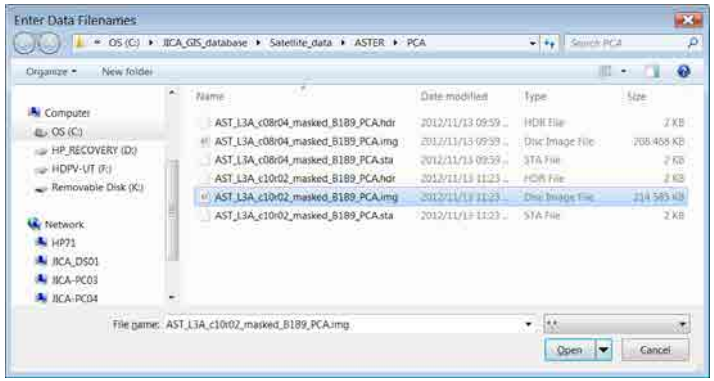





JOB10-2

+ Job content: Create a color composite image of ASTER PCA data
+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥PCA
+ Input filename: (example: AST_L3A_c10r02_masked_B1B9_PCA.img)

- Click "File" on main menu bar.
- Select and click "Open Image File".
- "Enter Data Filenames" window appears.



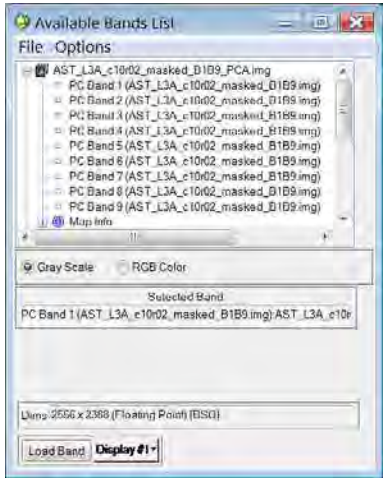

- Choose and find the input data folder in the window.
- Select and click the input ASTER data file in the window.

Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥PCA

(example: AST_L3A_c10r02_masked_B1B9_PCA.img)

- Selected data filename appears in the "File Name" box.
- Click "Open" box in the window.

- Selected ASTER data is read into ENVI and appears in the “Available Bands List” window.

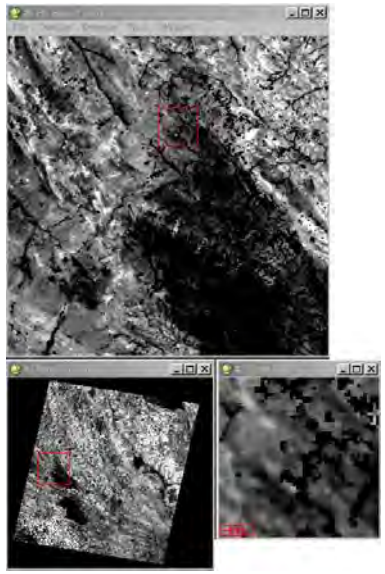



- Click “Gray Scale” circle shown in lower part of the “Available Bands List” window.
- After the click above, select PC Band1 of “AST_L3A_c10r02_masked_B1B9_PCA.img” in the “Available Bands List” window..
- Make sure that “Band 1” is shown in the “Selected Band” box.
- Click “No Display” box in the bottom of the window.
- Select and click “New Display”.
- Click “Load Band” box in the bottom of the window to display PC Band1 image on Display #1.



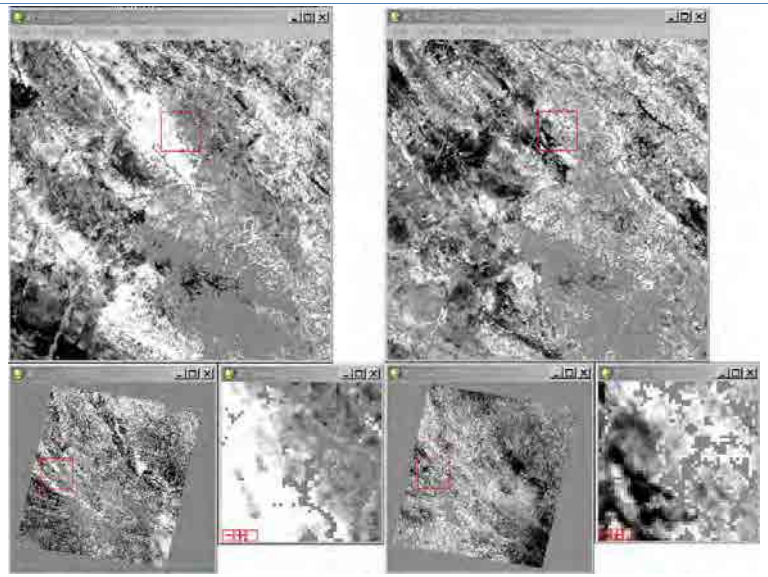


- Three kinds of window “Image / Scroll / Zoom” appear.
- PC Band1 image is created in the “#1 display”.

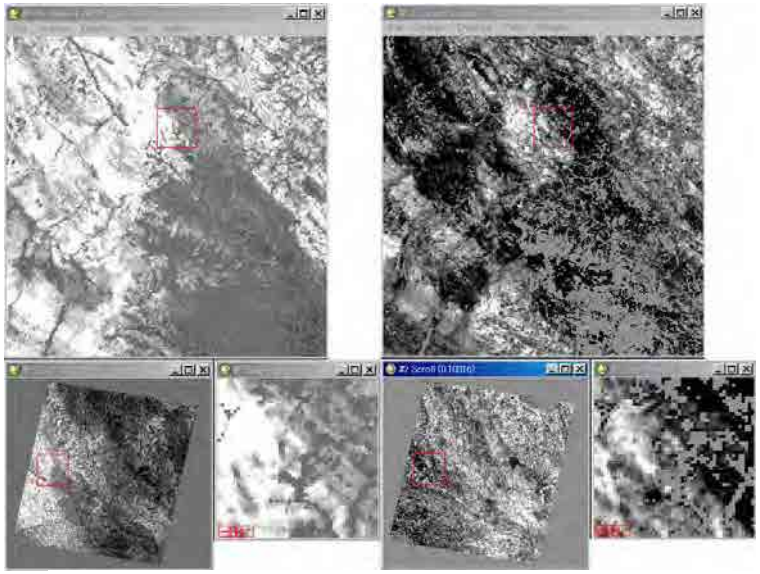


PC Band1 image

By using same manner, display images from PC Band2 to PC Band9



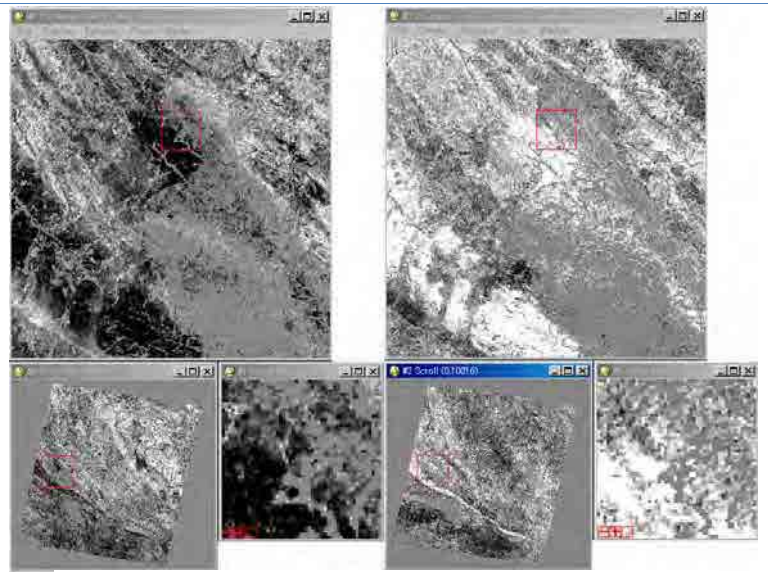
PC Band2 image PC Band3 image



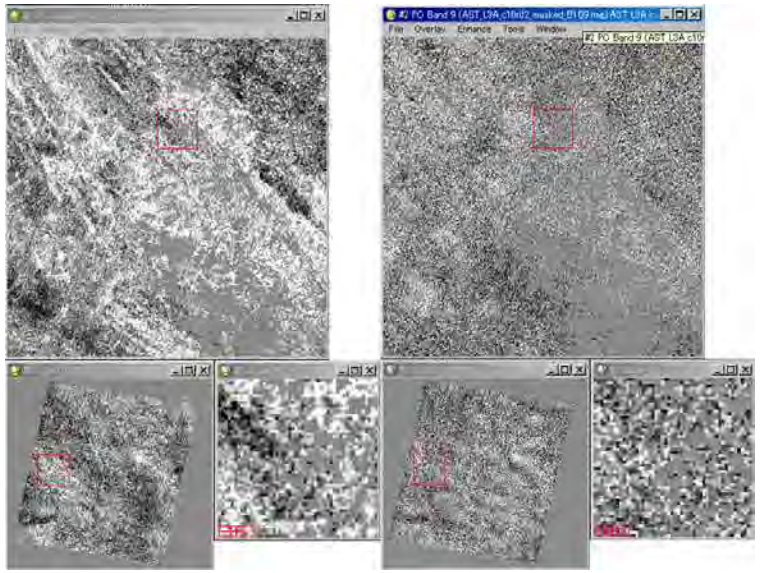
PC Band4 image PC Band5 image







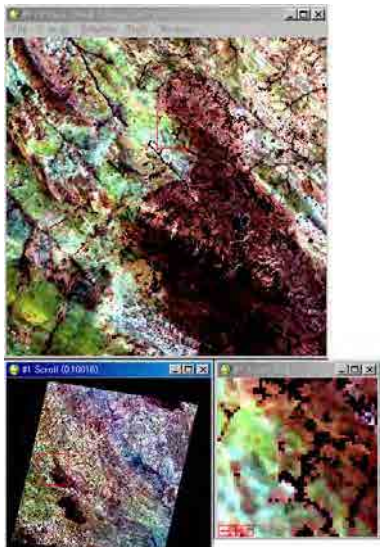
PC Band6 image PC Band7 image



PC Band8 image PC Band9 image

To compare 9 PC Bands with the false color image of the masked data, read "AST_L3A_c10r02_masked_B1B9.img" file in "C:¥JICA_GIS_database¥Satellite_data¥ASTER¥masked_data" folder and display the false color image as follows.

Though there are many images on the desktop, don't miss the operation.



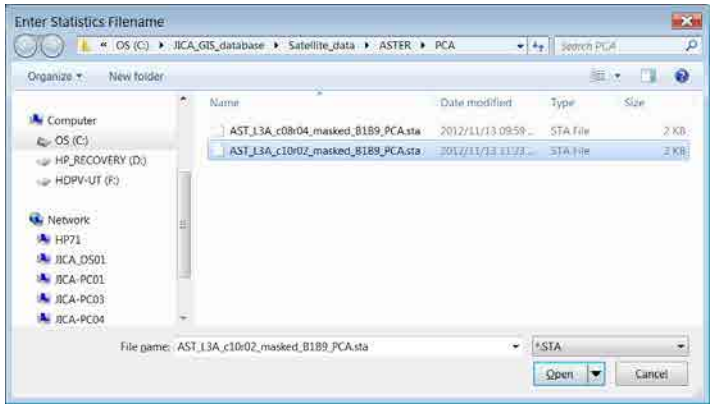
False color image of the masked data





How to view statistics

- Click "Basic Tools" on main menu bar.
- Select "Statistics" and then select and click "View Statistic File".
- "Enter Statistics Filename" window appears.

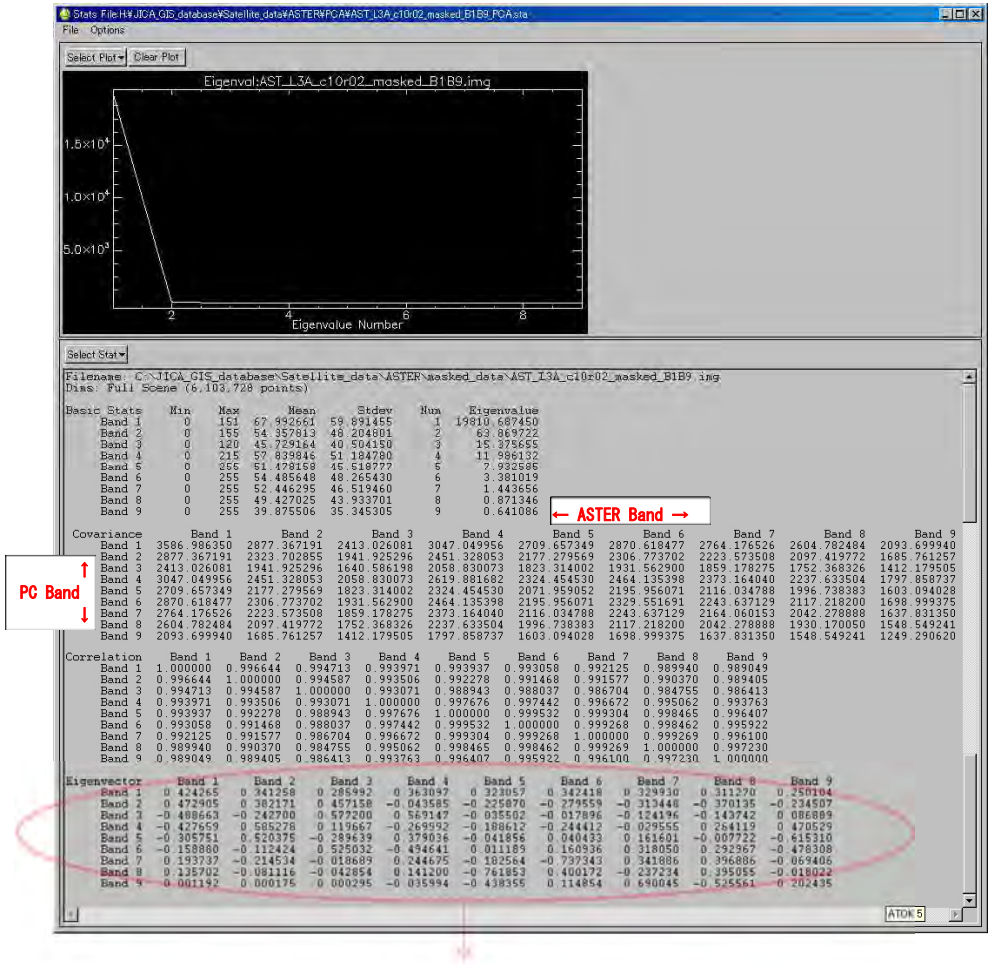



- Select and click the input statistics file in the window.

Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ASTER¥PCA

(example: AST_L3A_c10r02_masked_B1B9_PCA.sta)

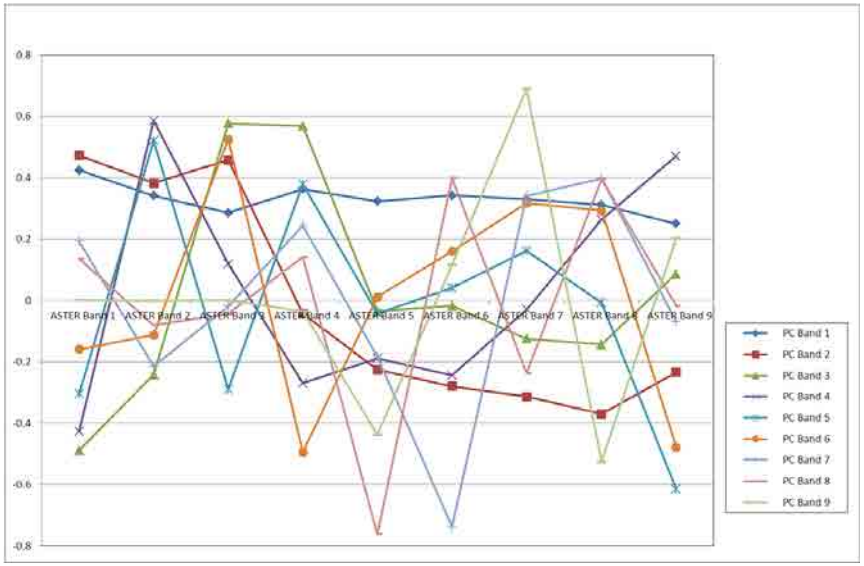
- Selected data filename appears in the "File Name" box.
- Click "Open" box in the window.
- The statistics plot appears in "Stats File" window.




Attention!








This graph is made from eigenvector data of PC band in the list of "Stats File" window.

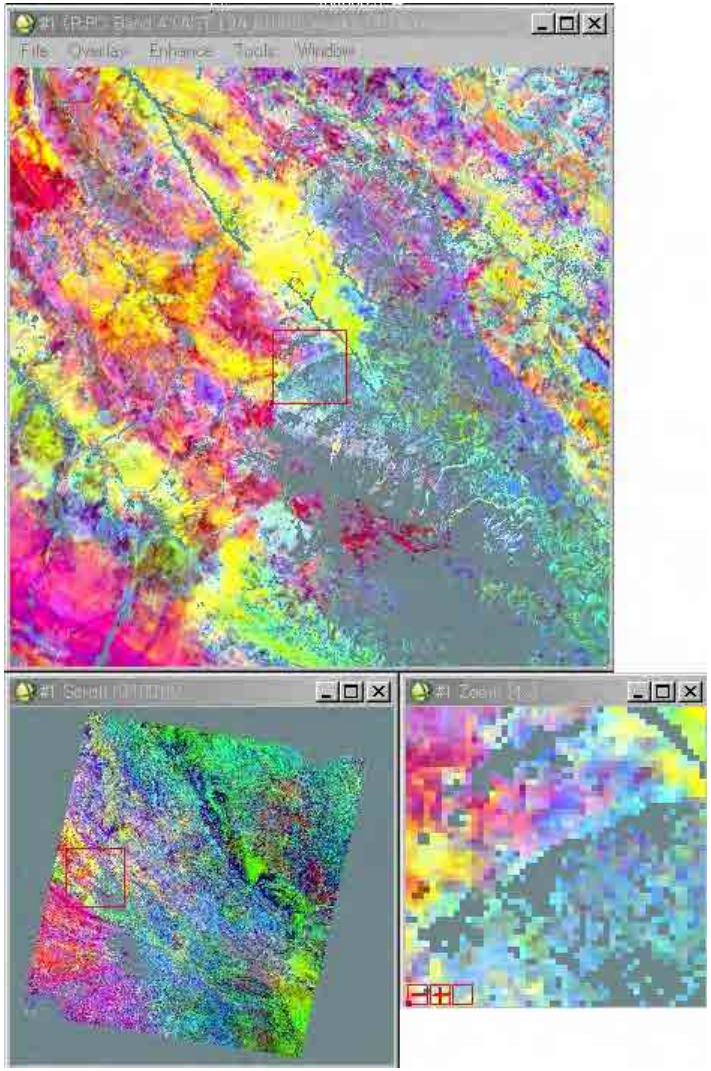
Pay attention to each eigenvector of PC band. How much does each ASTER band contribute to each eigenvector of PC band? Consider what the image of each PC band shows geologically in comparison with geological maps or geological information. Create meaning of PC band image and select effective PC bands for creation of band composite image finally to do geological classification and detection of target geology.

In this case, As PC Band1 eigenvector consists of almost same contribution value of each ASTER band, PC Band1 shows albedo. PC Band1 is out of selection.
Generally, noise on the image increases in larger number of PC Band. Noisy PC Band8 and PC Band9 are out of selection.

In this case, the rest of PC bands (PC Band2, 3, 4, 5, 6, 7) are selected for creation of PC band composite image.
In the graph, eigenvector component of PC band2 shows positive value in VNIR range and negative value in SWIR range. Eigenvector component of PC band4 shows negative value in the middle of bands.
By trial and error, create PC band composite images and select the best image to express geological characters of the survey area.

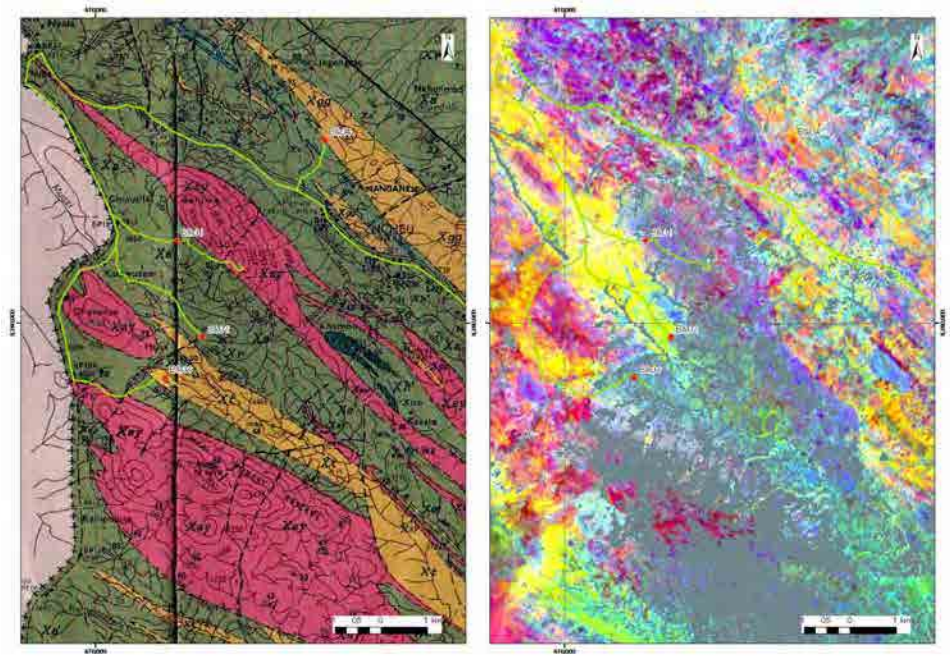
In this case, PC Band2, Band3, Band4 are selected for creation of PC band composite image.

- A color band composite image (RGB=PC Band4,Band2,Band3) of ASTER PCA data is created.







Comparison of the geological map and the PC band composite image (RGB=PC Band4,Band2,Band3)

The distribution of redish color on the PC band composite image corresponds to reddish color on the geological map. The distribution of yellow color and water blue color on the PC band composite image correspond to greenish and yellowish color on the geological map respectively.
Grey color on the PC band composite image shows no analyzed area because of the vegetation.

On the geological map, reddish color, greenish and yellowish color show Xsy(Perthite-gneiss grading into perthosite), Xs'(Banded gneiss) and Xt(Plagioclase-granulite) respectively.

PALSAR data analysis

Data directory: C:¥JICA_GIS_database¥Satellite_data¥PALSAR

PALSAR L1.5 data

・GeoTIFF format, orthorectified, 62 scenes all over Malawi

Data filename: PASL150yymmddhhmmssyymmdd####.tif

[yymmddhhmmss:observation time, yymmdd:processing date, ####: temporary number for products]

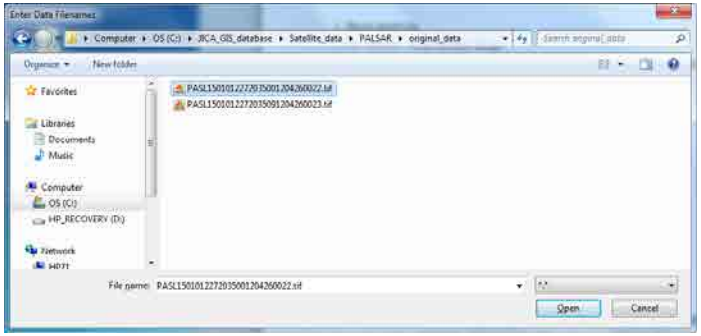
One suit of PALSAR data (example)

PASL150101227203509120426022.tif (use for mosaic)
PASL150101227203509120426022.hh
PASL150101227203509120426022.hh.param
PASL150101227203509120426022.meta
PASL150101227203509120426022.tif.param
PASL150101227203509120426022B.jpg

1. Basic Analysis

+ Job content: Make mosaic image.
+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥PALSAR¥original_data
+ Input filename: (example: PASL150101227203500120426022.tif)
+ Input filename: (example: PASL150101227203509120426023.tif)

- Click “File” on main menu bar.
- Select and click “Open Image File”.
- “Enter Data Filenames” window appears.








- Select and click the input “PASL150*.tif” files to be used for mosaic image.

Input file folder: C:¥JICA_GIS_database¥Satellite_data¥PALSAR¥original_data

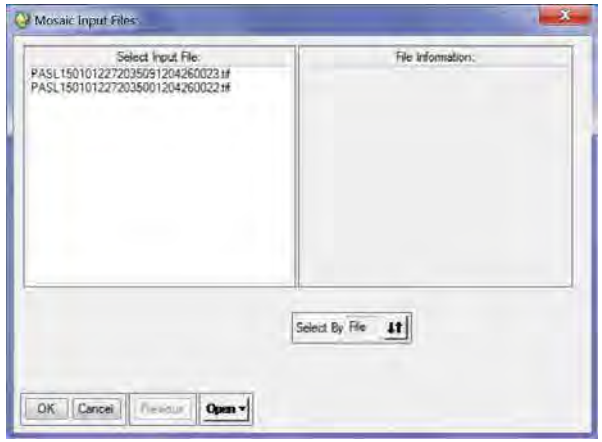
(example: PASL150101227203500120426022.tif)

(example: PASL150101227203509120426023.tif)

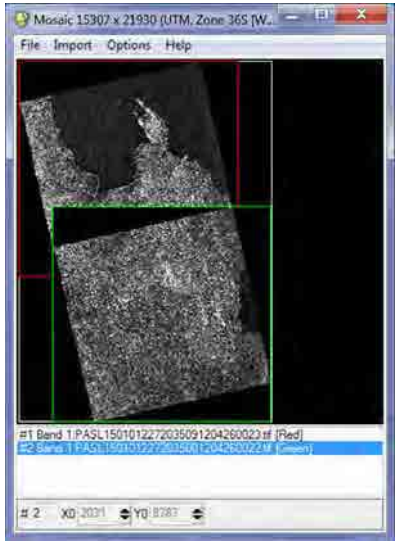
- Selected data filename appears in the “File Name” box.
- Click “Open” box in the window.
- Selected ASTER data is read into ENVI and appears in the “Available Bands List” window.


- Click “Map” on main menu bar.
- Select and Click “Mosaicking” and then select and click “Georeferenced”.
- “Map Base Mosaic” window appears.

- Click “Import” on the “Map Based Mosaic” menu bar and then select and click “Import Files”.
- “Mosaic Input Files” window appears.




- Select all “PASL*.tif” files to be used for mosaic in the “Select Input File:” window
- Click “OK” box.
- “Mosaic # x #” window appears with filename list below.

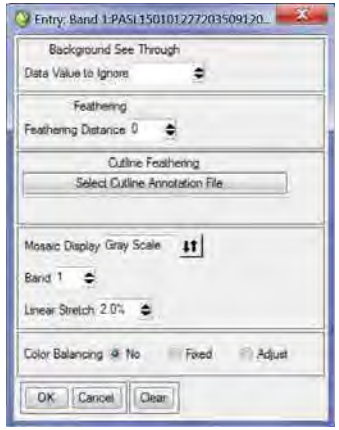


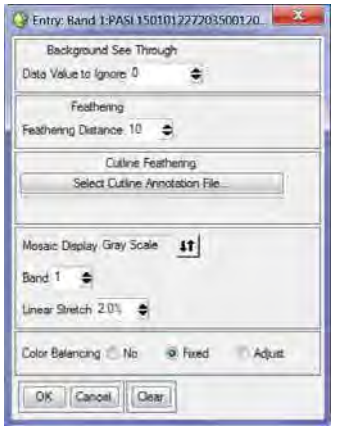





Select one of the imported files in filename list below, then click right mouse button on the filename and select “Edit Entry” in the pop-up menu.

- “Entry: Band1…” window appears.




- Enter “0” in the “Data Value to Ignore” box and “10” in the “Feathering Distance” box.
- Click "Fixed" circle for one image, click "Adjust" circle for the other images in the “Color Balancing”.
- Click “OK” box.

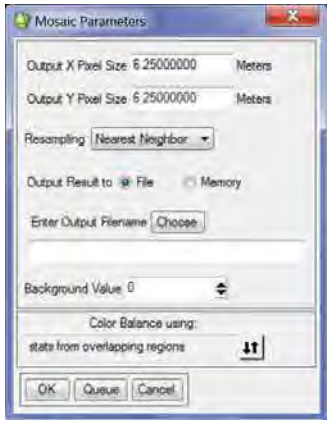
NOTE: Select Fixed image with little water area to get good result of Color Balancing

- Do parameters setting in the “Entry:” window to each image.

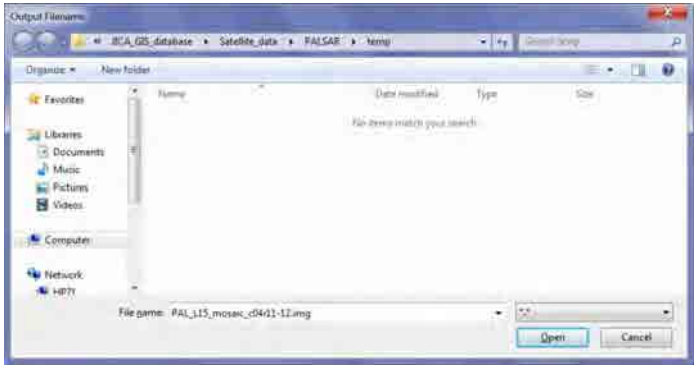
NOTE: Rearrange each image order in filename list with using “Lower Image” or “Raise Image” command to lower image with much cloud or raise image with little cloud

- Click “File” on the “Mosaic # x #” menu bar.
- Select and click “Apply”.

- "Mosaic Parameters" window appears.




- Click "Choose" box of the "Mosaic Parameters" window to enter output filename.
- "Output Filename" window appears.



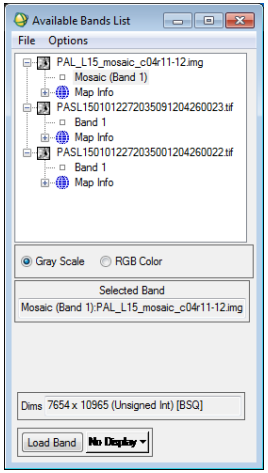

- Choose output file folder and then enter output filename in the "Filename" box.
Output file folder: C:¥JICA_GIS_database¥Satellite_data¥PALSAR¥temp
(example: PAL_L15_mosaic_c04r11-12.img)
- Click "Open" box in the window.
- Entered output filename appears in the "Enter Output Filename" box of the "Mosaic Parameters" window.
- Click "OK" box in the window.

NOTE: Take much time for processing

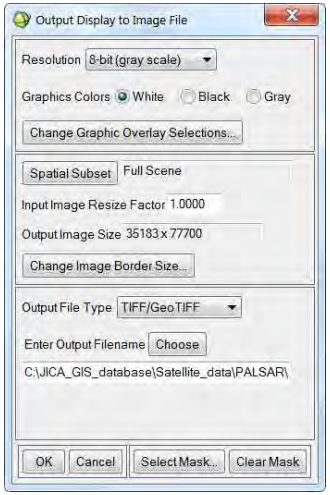




- PALSAR mosaic image is created and appears in the "Available Bands List" window.

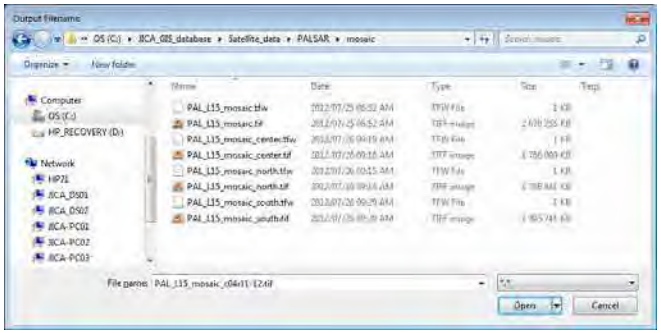



- Select Mosaic (Band1) of "PAL_L15_mosaic_c04r11-12.img" in the "Available Bands List" window.
- Click "Load Band" to display PALSAR mosaic image on the "Display #1".
- Click "File" on the "Display #1" menu bar.
- Select "Save Image As" and then select and click "Image File…".
- "Output Display to Image File" window appears.




- Select "TIFF/GeoTIFF" in the "Output File Type" box.

- Click “Choose” box to enter output filename.
- “Output Filename” window appears.




- Choose output file folder and then enter output filename in the “Filename” box.
Output file folder: C:¥JICA_GIS_database¥Satellite_data¥PALSAR¥mosaic
Output filename (example: PAL_L15_mosaic_c04r11-12.tif)

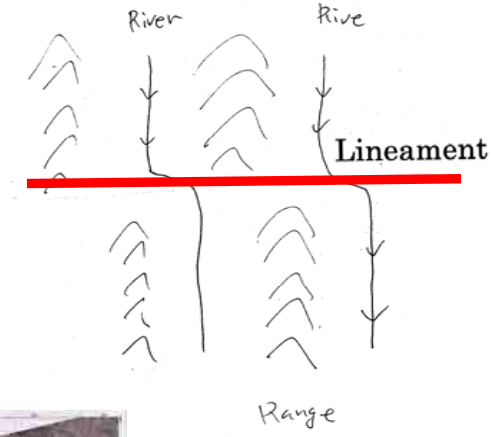
- Click “Open” box in the window.
- Entered output filename appears in the “Enter Output Filename” box of the “Output Display to Image File” window.
- Click “OK” box in the window.
- “PAL_L15_mosaic_c04r11-12.tif” file is saved in the
“C:¥JICA_GIS_database¥Satellite_data¥PALSAR¥mosaic” folder.

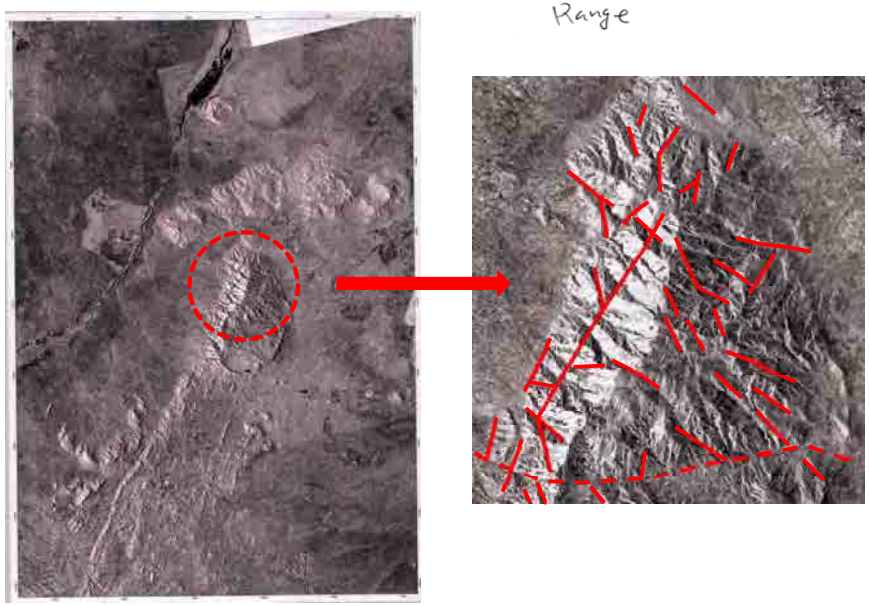




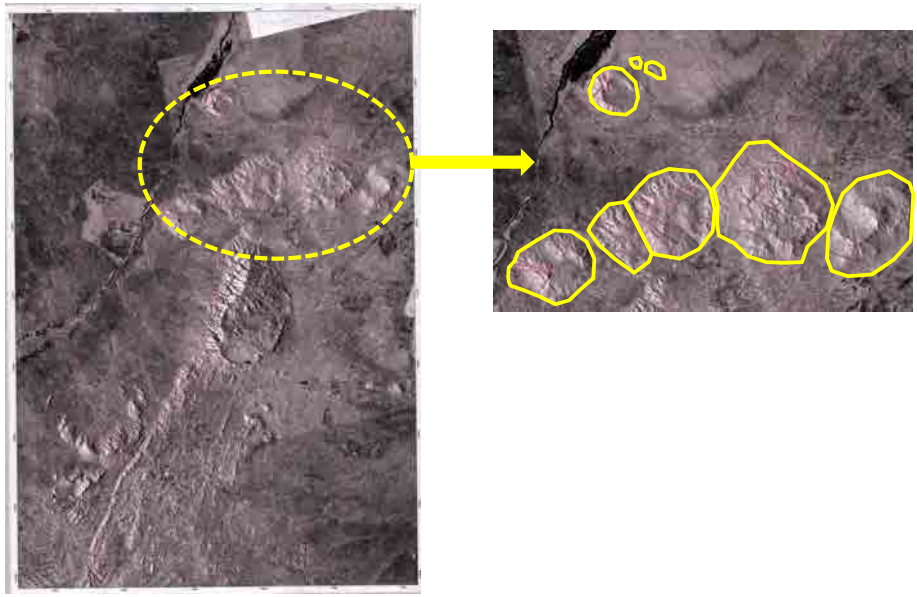
Extraction of Lineament by using PALSAR Image

A **lineament** is a linear feature in a landscape which is an expression of an underlying geological structure such as a fault. Generally a lineament represents a fault-aligned valley, a series of fault or fold-aligned hills, a straight coastline or a combination of these features. Fracture zones, shear zones and igneous intrusions such as dykes can also give rise to lineaments.
Lineaments are often apparent in geological or topographic maps and can appear obvious on aerial or satellite photographs.



Extraction of Chilwa Alkaline rocks which have round shape by using PALSAR Image



By using ArcMap 10, Extraction of lineaments and Chilwa Alkaline rocks is implemented.

(1) Execute ArcMap 10.
(2) Select “File-Add Data-AddData” on main menu.
(3) Select and add proper “PALSAR image” for extraction of lineaments on new layer.
(4) Create new shape file by using “Catalog”.
(5) Select as follows. Feature Type: polyline, Description: WGS_1984_UTM_Zone_36S
(6) Draw lineaments based on PALSAR image.





G-DEM Data Analysis

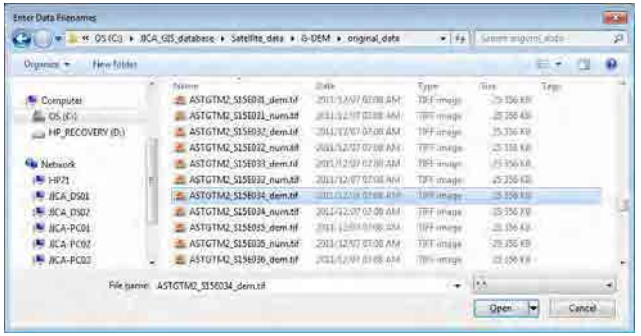
Data directory: C:¥JICA_GIS_database¥Satellite_data¥G-DEM

G-DEM data
・GeoTIFF format, signed 16 bits, 27 scenes all over Malawi
・Global DEM for all the land area covered by ASTER
・Enhanced accuracy due to the use of multiple ASTER images over the same area
Data filename: ASTGTM2_S##E###_dem.hdf
[S##: latitude of lower left, E###: longitude of lower left]

One suit of ASTER data including header data (example)
ASTGTM2_S15E034_dem.tif
ASTGTM2_S15E034_num.tif

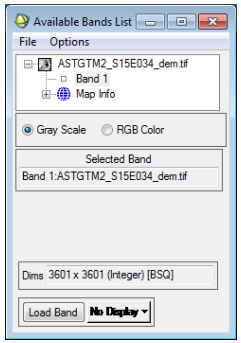
1. Basic Analysis
+ Job content: Create shaded relief map from G-DEM data.
+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥G-DEM¥original_data
+ Input filename: (example: ASTGTM2_S15E034_dem.tif)

- Click “File” on main menu bar.
- Select and click “Open Image File”.
- “Enter Data Filenames” window appears.




- Select and click the input “ASTGTM2_S15E034_dem.tif” file.
Input file folder: C:¥JICA_GIS_database¥Satellite_data¥ G-DEM¥original_data
(example: ASTGTM2_S15E034_dem.tif)

- Selected data filename appears in the “File Name” box.
- Click “Open” box in the window.
- Selected G-DEM data is read into ENVI and appears in the “Available Bands List” window.



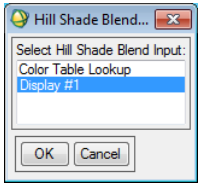

- Click “Gray Scale” circle shown in lower part of the “Available Bands List” window.
- After the click above, select band1 of “ASTGTM2_S15E034_dem.tif” in the “Available Bands List” window..
- Make sure that “Band 1” is shown in the “Selected Band” box.
- Click “No Display” box in the bottom of the window.
- Select and click “New Display”.
- Click “Load Band” box in the bottom of the window to display G-DEM image on Display #1.



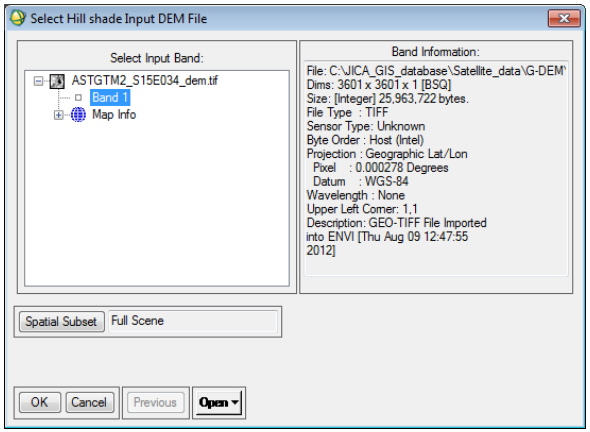


- Three kinds of window “Image / Scroll / Zoom” appear.
- A G-DEM image is created in the “#1 display”.

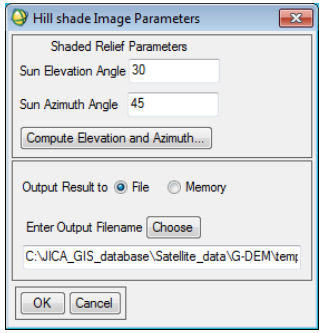
- Click “Topographic” on main menu bar.
- Select and click “Create Hill Shade Image”.
- “Hill Shade Blend Input” window appears.




- Select “Display #1” in the window.
- Click “OK” box.
- “Select Hill shade Input DEM File” window appears.




- Select Band1 of “ASTGTM2_S15E034_dem.tif” in the window.
- Click “OK” box.
- “Hill shade Image Parameters” window appears.



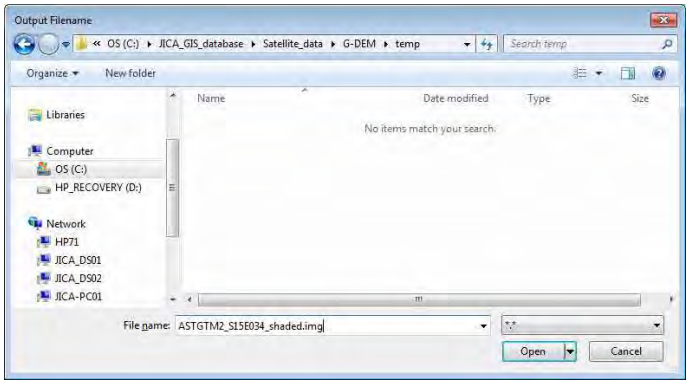

- Enter "30" in “Sun Elevation Angle” box and "45" in “Sun Azimuth Angle” box.

NOTE: If you want to make image high contrast, input small value as Sun Elevation Angle





- Click “Choose” box of the “Hill shade Image Parameters” window to enter output filename.
- “Output Filename” window appears.

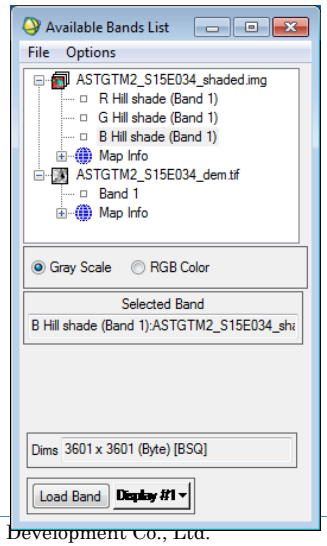



- Choose output file folder and then enter output filename in the “Filename” box.

Output file folder: C:¥JICA_JIS_database¥Satellite_data¥G-DEM¥temp

(example: ASTGTM2_S15E034_shaded.img)

- Click “Open” box in the window.
- Entered output filename appears in the “Enter Output Filename” box of the “Hill shade Image Parameters” window.
- Click “OK” box in the window.
- Shaded relief image is created and appears in the “Available Bands List” window.



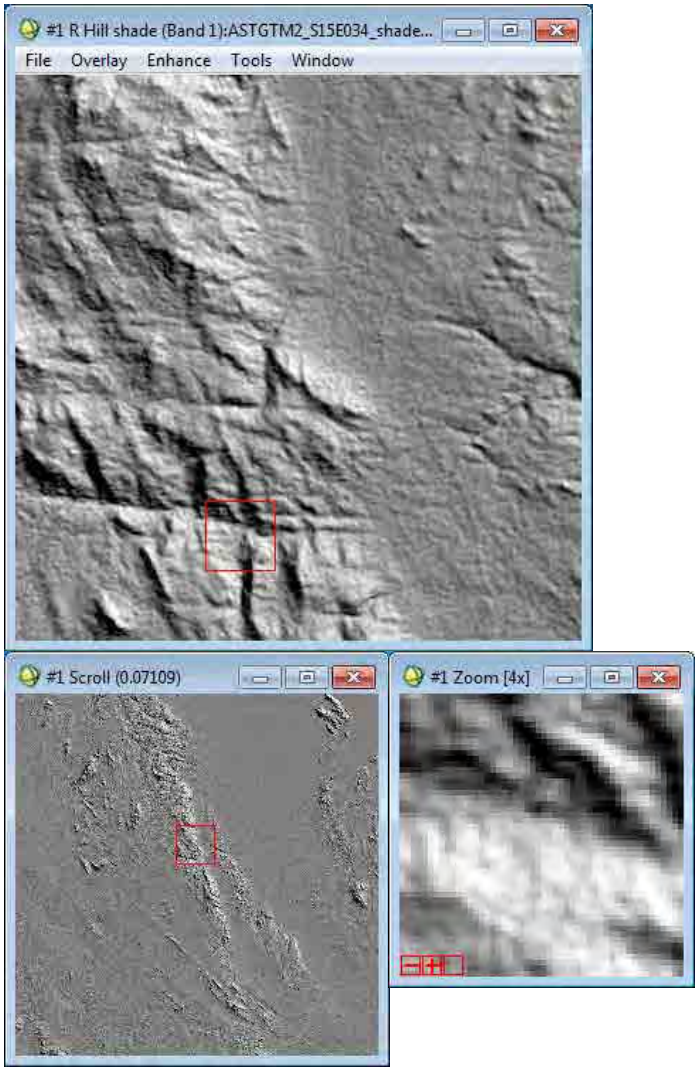
To save shaded relief image as GeoTIFF file

- Click “Gray Scale” circle shown in lower part of the “Available Bands List” window.
- After the click above, select R Hill shade (Band1) of “ASTGTM2_S15E034_shaded.img” in the “Available Bands List” window.
- Make sure that “R Hill shade” is shown in the “Selected Band” box.
- Click “No Display” box in the bottom of the window.
- Select and click “New Display”.
- Click “Load Band” box in the bottom of the window.

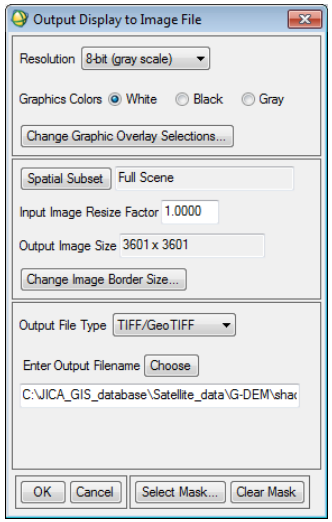




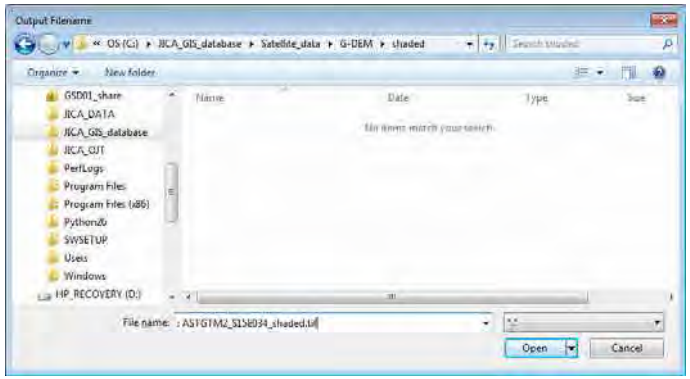
- Three kinds of window “Image / Scroll / Zoom” appear.
- A shaded relief image is created in the “#1 display”.



- Click “File” on the “Display #1” menu bar.
- Select “Save Image As” and then select and click “Image File…”.
- “Output Display to Image File” window appears.




- Select “TIFF/GeoTIFF” in the “Output File Type” box.
- Click “Choose” box to enter output filename.
- “Output Filename” window appears.




- Choose output file folder and then enter output filename in the “Filename” box.

Output file folder: C:¥JICA_GIS_database¥Satellite_data¥G-DEM¥shaded

Output filename (example: GDM_S15E034_shaded.tif)

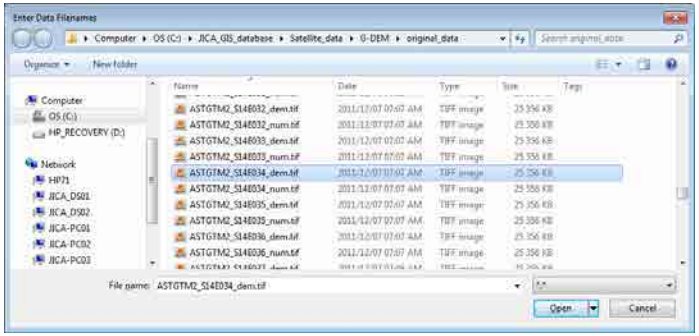




- Click “Open” box in the window.
- Entered output filename appears in the “Enter Output Filename” box of the “Output Display to Image File” window.
- Click “OK” box in the window.
- “GDM_S15E034_shaded.tif” file is saved in the “C:¥JICA_GIS_database¥Satellite_data¥G-DEM¥shaded” folder.

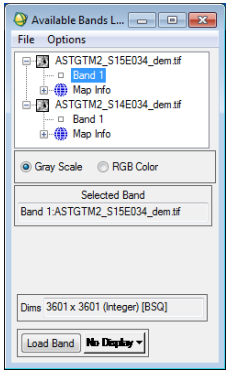
+ Job content: Make mosaic image.
+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥G-DEM¥original_data
+ Input filename: (example: ASTGTM2_S14E034_dem.tif)
+ Input filename: (example: ASTGTM2_S15E034_dem.tif)

- Click “File” on main menu bar.
- Select and click “Open Image File”.
- “Enter Data Filenames” window appears.




- Select and click the input “ASTGTM2_*_dem.tif” files to be used for mosaic image.
Input file folder: C:¥JICA_GIS_database¥Satellite_data¥G-DEM¥original_data
(example: ASTGTM2_S14E034_dem.tif)
(example: ASTGTM2_S15E034_dem.tif)

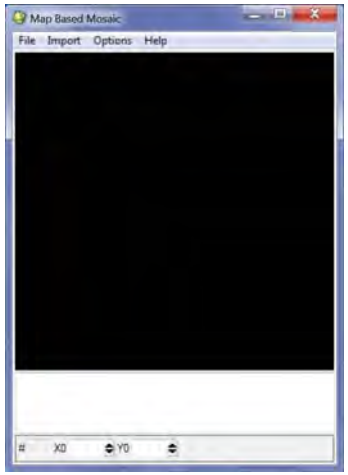
- Click “Open” box in the window.
- Selected G-DEM data is read into ENVI and appears in the “Available Bands List” window.
Repeat same step to a file for mosaic or select all files at once.



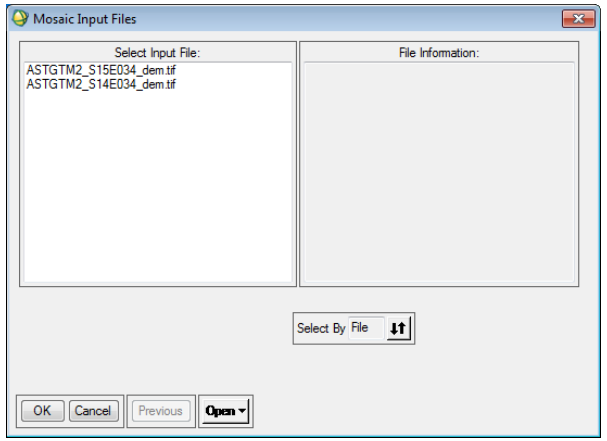





- Click “Map” on main menu bar.
- Select and Click “Mosaicking” and then select and click “Georeferenced”.
- “Map Base Mosaic” window appears.

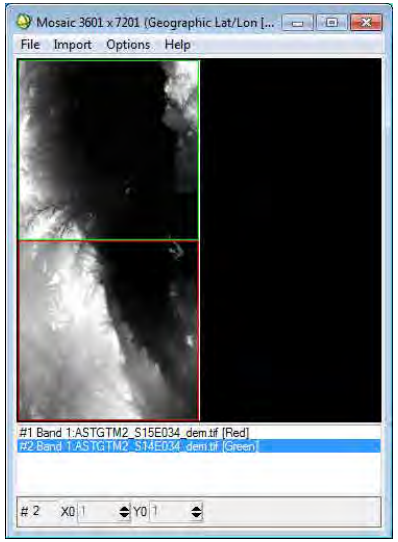



- Click “Import” on the “Map Based Mosaic” menu bar and then select and click “Import Files”.
- “Mosaic Input Files” window appears.



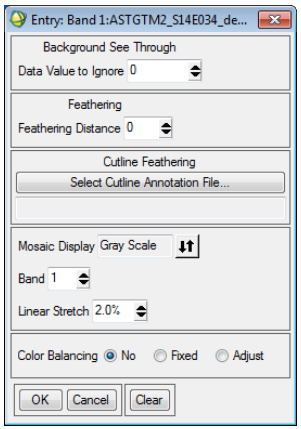

- Select all “ASTGTM2_*_dem.tif” files to be used for mosaic in the “Select Input File:” window
- Click “OK” box.

- "Mosaic # x #" window appears with filename list below.




Select one of the imported files in filename list below, then click right mouse button on the filename and select "Edit Entry" in the pop-up menu.

- "Entry: Band1:ASTGTM2…" window appears.

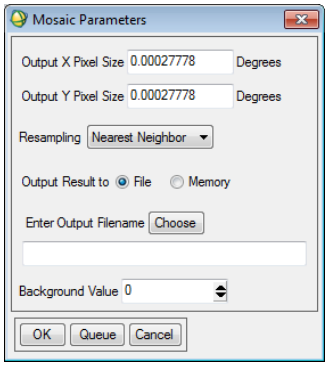



- Enter "0" in the "Data Value to Ignore" box and "0" in the "Feathering Distance" box.
- Click "No" circle in the "Color Balancing".
- Click "OK" box.

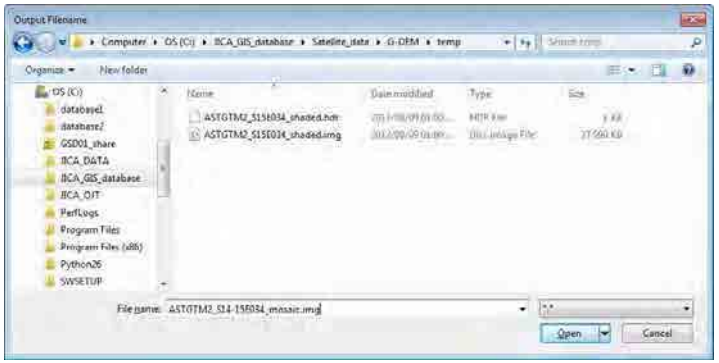




- Do parameters setting in the "Entry:" window to each image.
- Click "File" on the "Mosaic # x #" menu bar.
- Select and click "Apply".
- "Mosaic Parameters" window appears.




- Click "Choose" box of the "Mosaic Parameters" window to enter output filename.
- "Output Filename" window appears.




- Choose output file folder and then enter output filename in the "Filename" box.

Output file folder: C:¥JICA_GIS_database¥Satellite_data¥G-DEM¥temp

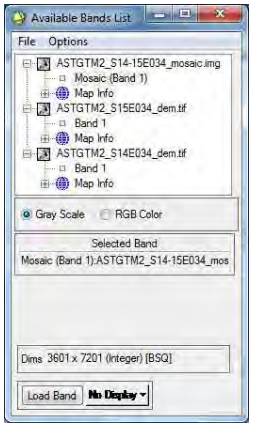
(example: ASTGTM2_mosaic_S14-15E034.img)

- Click "Open" box in the window.
- Entered output filename appears in the "Enter Output Filename" box of the "Mosaic Parameters" window.

- Click “OK” box in the window.

NOTE: Take much time for processing

- G-DEM mosaic image is created and appears in the “Available Bands List” window.



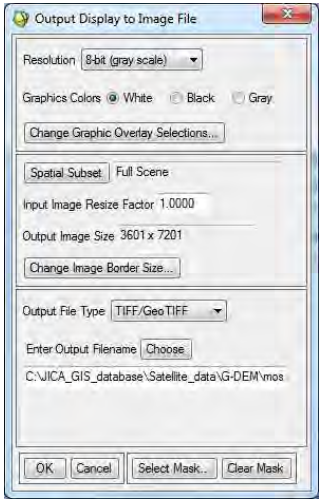

- Click “Gray Scale” circle shown in lower part of the “Available Bands List” window.
- After the click above, select Mosaic (Band1) of “ASTGTM2_mosaic_S14-15E034.img” in the “Available Bands List” window.
- Make sure that “Mosaic (Band1)” is shown in the “Selected Band” box.
- Click “No Display” box in the bottom of the window.
- Select and click “New Display”.
- Click “Load Band” box in the bottom of the window.



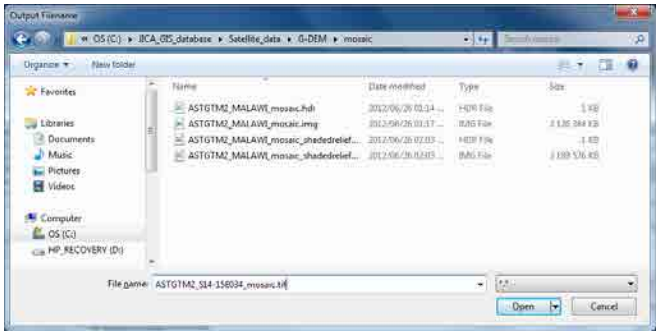


- Three kinds of window “Image / Scroll / Zoom” appear.
- A mosaic image is created in the “#1 display”.

- Click “File” on the “Display #1” menu bar.
- Select “Save Image As” and then select and click “Image File…”.
- “Output Display to Image File” window appears.




- Select “TIFF/GeoTIFF” in the “Output File Type” box.
- Click “Choose” box to enter output filename.
- “Output Filename” window appears.




- Choose output file folder and then enter output filename in the “Filename” box.

Output folder: C:¥JICA_GIS_database¥Satellite_data¥G-DEM¥mosaic

Output filename (example: GDM_mosaic_S14-15E034.tif)

- Click “Open” box in the window.

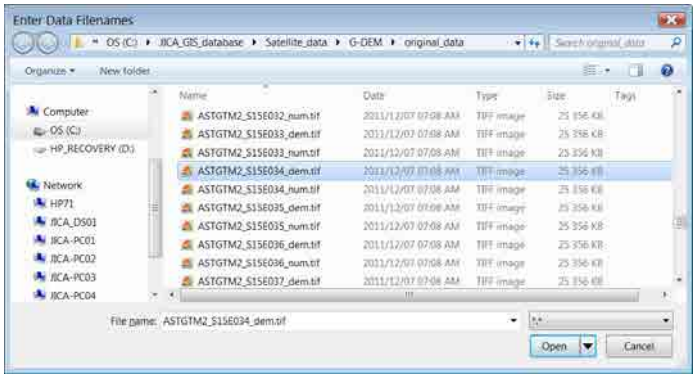




- Entered output filename appears in the “Enter Output Filename” box of the “Output Display to Image File” window.
- Click “OK” box in the window.
- “GDM_mosaic_S14-15E034.tif” file is saved in the “C:¥JICA_GIS_database¥Satellite_data¥G-DEM¥mosaic” folder.

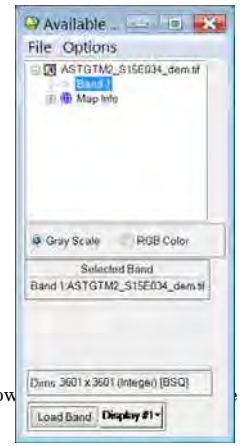
+ Job content: Create contour map from G-DEM data.
+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥G-DEM¥original_data
+ Input filename: (example: ASTGTM2_S15E034_dem.tif)

- Click “File” on main menu bar.
- Select and click “Open Image File”.
- “Enter Data Filenames” window appears.




- Select and click the input “ASTGTM2_*_dem.tif” files to be used for mosaic image.
Input file folder: C:¥JICA_GIS_database¥Satellite_data¥G-DEM¥original_data
(example: ASTGTM2_S15E034_dem.tif)

- Click “Open” box in the window.
- Selected G-DEM data is read into ENVI and appears in the “Available Bands List” window.

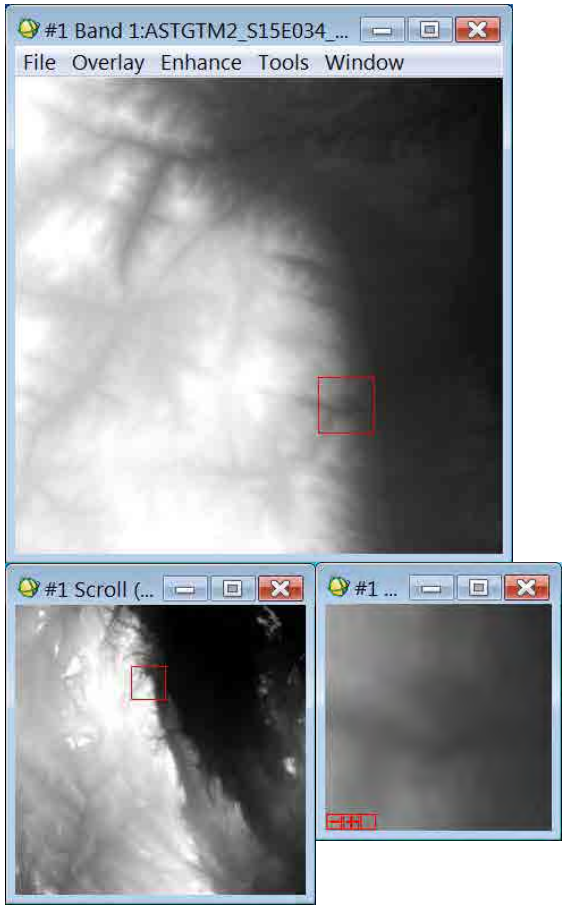



- Click “Gray Scale” circle shown in low Bands List” window.

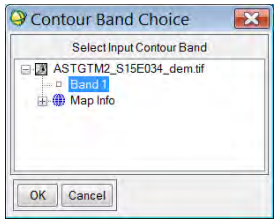




- After the click above, select band1 of “ASTGTM2_S15E034_dem.tif” in the “Available Bands List” window..
- Make sure that “Band 1” is shown in the “Selected Band” box.
- Click “No Display” box in the bottom of the window.
- Select and click “New Display”.
- Click “Load Band” box in the bottom of the window to display G-DEM image on Display #1.



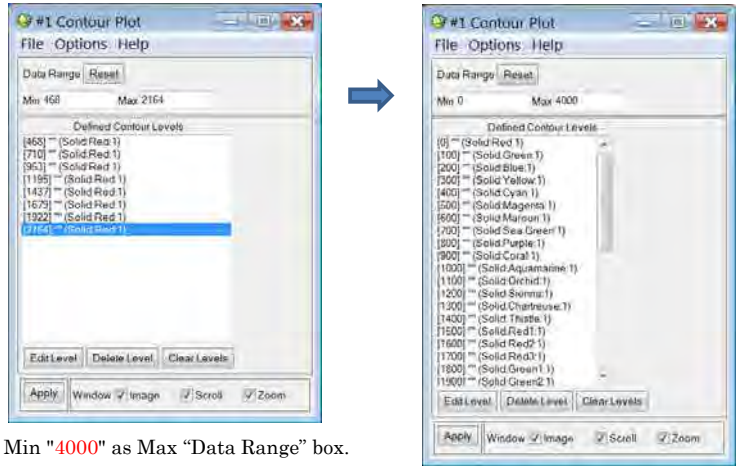
- Click “Overlay” “Display #1” menu bar.
- Select and click “Contour Lines”.
- “Contour Band Choice” window appears.




- Select Band1 of "ASTGTM2_S15E034_dem.tif" in the window.
- Click “OK” box.

To create contour of 100 m interval

- “#1 Contour Plot” window appears.



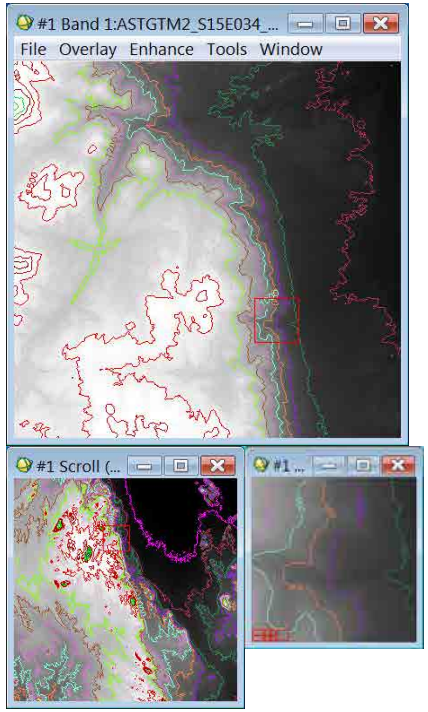

- Enter "0" as Min "4000" as Max “Data Range” box.
- Click “Options” on “#1 Contour Plot” menu bar.
- Select “Set Number of Default Levels”.
- “Set Number of Default Levels” window appears.


- Enter "41" in “Number of Default Levels” box of “Set Number of Default Levels” window.



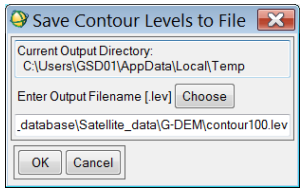


- Click “OK” box.
- Click “Options” on “#1 Contour Plot” menu bar.
- Select “Apply Default Levels (Multi Color)” so that contour line colors change.
- Click “Options” again and select “Label Contours with Level Value” to post elevation labels.
- Click “Apply,” so that contours are overlaid on #1 Display.

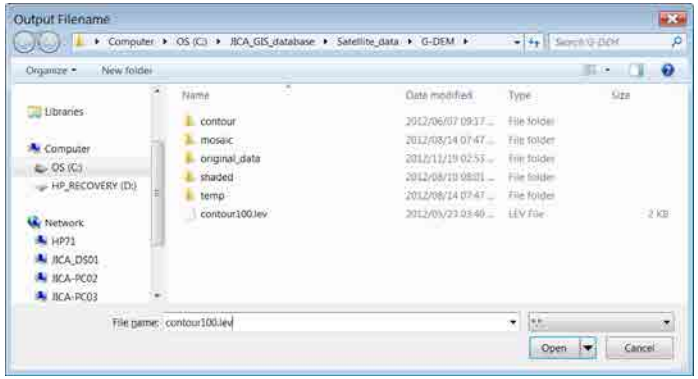



To save levels

- Select “File” on “#1 Contour Plot” menu bar.
- Select and click “Save Levels”.
- “Save Contour Levels to File” window appears.



- Click “Choose” box to enter output filename.
- “Output Filename” window appears.




- Choose output file folder and then enter output filename in the “Filename” box.

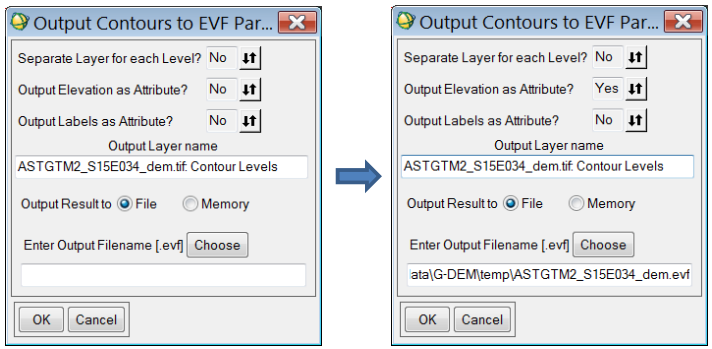
Output file folder: C:¥JICA_JIS_database¥Satellite_data¥G-DEM

(example: contour100.lev)

- Click “Open” box in the window.
- Entered output filename appears in the “Enter Output Filename” box of the “Save Contour Levels to File” window.
- Click “OK” box in the window to save “contour100.lev” file.

To export contours to shapefile

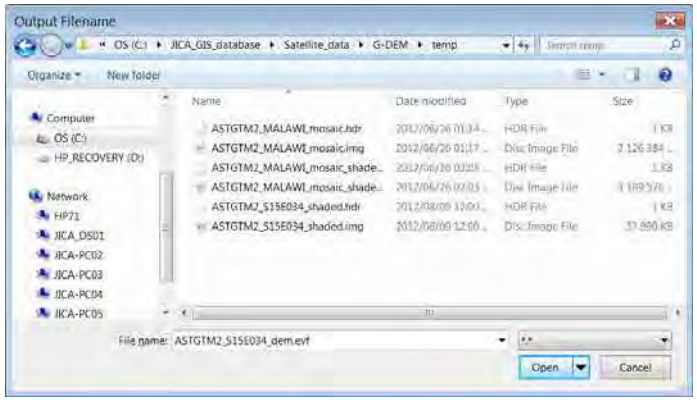
- Select “File” on “#1 Contour Plot” menu bar.
- Select and click “Output Contours to EVFs”.
- “Output Contours to EVFs Parameters” window appears.








- Select "No" in “Separate Layer for each Level?” box.
- Select "Yes" in “Output Elevation as Attribute?” box and "No" in “Output Labels as Attribute?” box.
- Click “Choose” box.
- “Output Filename” window appears.

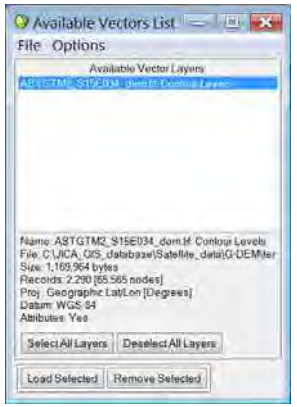



- Choose output file folder and then enter output filename in the “Filename” box.

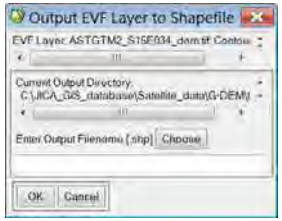
Output file folder: C:¥JICA_JIS_database¥Satellite_data¥G-DEM¥temp

(example: ASTGTM2_S15E034_dem.evf)

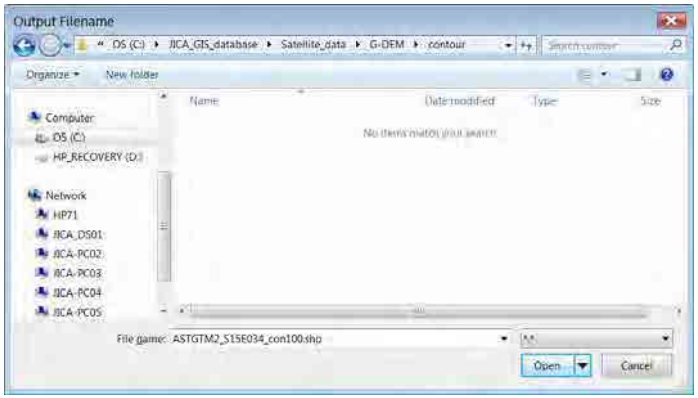
- Click “Open” box in the window.
- Entered output filename appears in the “Enter Output Filename” box of the “Output Contours to FVFs” window.
- Click “OK” box in the window to save “ASTGTM2_S15E034_dem.evf” file.
- “Available Vectors List” window appears.



- Select “ASTGTM2_S15E034_dem.tif: Contour Levels” in “Available Vector Layers” box of the window.
- Select “File” on “Available Vectors List” menu bar.
- Select and click “Export Layers to Shapefile”
- “Output EVF Layer to Shapefile” window appears.




- Click “Choose” box.
- “Output Filename” window appears.

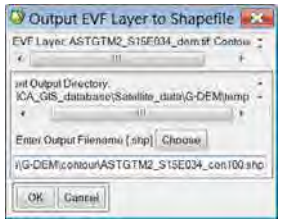



- Choose output file folder and then enter output filename in the “Filename” box.

Output file folder: C:¥JICA_JIS_database¥Satellite_data¥G-DEM¥contour

(example: ASTGTM2_S15E034_con100.shp)

- Click “Open” box in the window.
- Entered output filename appears in the “Enter Output Filename” box of the “Output EVF Layer to Shapefile” window.





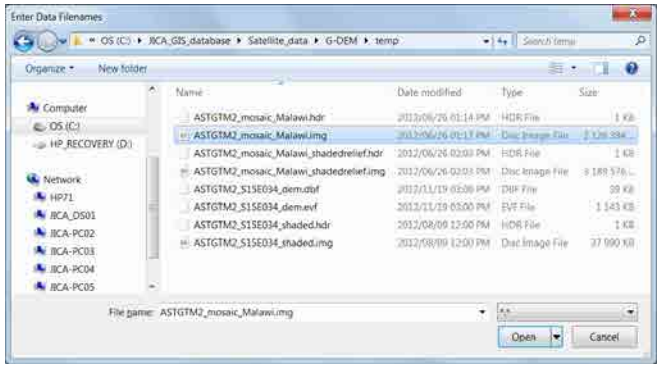



- Click “OK” box in the window to save “ASTGTM2_S15E034_con100.shp” file.

The mosaic map of whole Malawi is created in same manner.

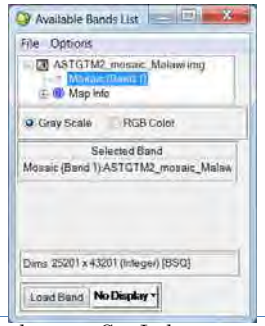
+ Job content: Create 3D map from G-DEM data.
+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥G-DEM¥temp
+ Input filename: (example: ASTGTM2_mosaic_Malawi.img)
+ Input file folder: C:¥JICA_GIS_database¥Satellite_data¥LANDSAT¥temp
+ Input filename: (example: LANDSAT_mosaic_Malawi.img
+ Output file folder: C:¥JICA_GIS_database¥Satellite_data¥LANDSAT¥3D
+ Output filename: (example: LANDSAT_3D_Malawi.tif

- Click “File” on main menu bar.
- Select and click “Open Image File”.
- “Enter Data Filenames” window appears.




- Select and click the input “ASTGTM2_mosaic_Malawi.img” file.
Input file folder: C:¥JICA_JIS_database¥Satellite_data¥G-DEM¥temp
(example: ASTGTM2_mosaic_Malawi.img)

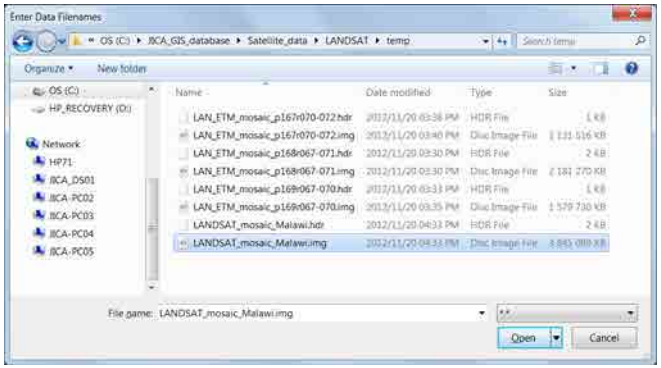
- Click “Open” box in the window.
- Selected G-DEM data is read into ENVI and appears in the “Available Bands List” window.








- Click “File” on main menu bar.
- Select and click “Open Image File”.
- “Enter Data Filenames” window appears.

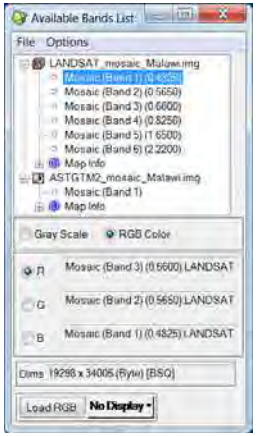



- Select and click the input “LANDSAT_mosaic_Malawi.img” file.
Input file folder: C:¥JICA_JIS_database¥Satellite_data¥LANDSAT¥temp
(example: LANDSAT_mosaic_Malawi.img)

- Click “Open” box in the window.
- Selected G-DEM data is read into ENVI and appears in the “Available Bands List” window.


- Click “RGB color” circle shown in lower part of the “Available Bands List” window.
- R/G/B circles and description boxes appear in the lower part of the window.

- When the “R circle” is selected (ticked), click “Mosaic (Band3)”.
- After the click above, the “G circle” is automatically ticked.
- When the “G circle” is selected (ticked), click “Mosaic (Band2)”.
- After the click above, the “B circle” is automatically ticked.
- When the “B circle” is selected (ticked), click “Mosaic (Band1)”.
- After the click above, the “R circle” is automatically ticked again.
- Make sure that Band3N is shown in the “R box”, Band2 in the “G box” and Band1 in the “B box”.



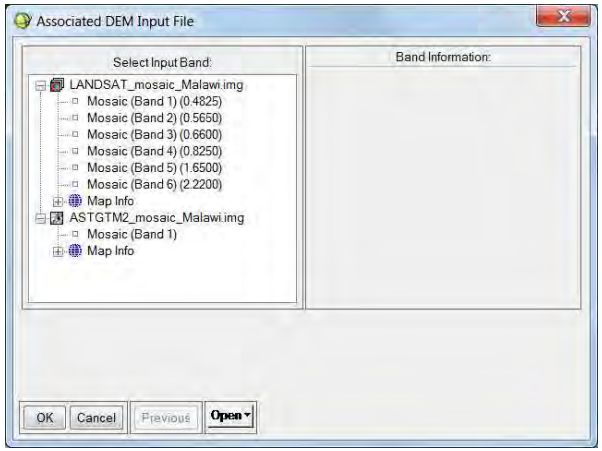

- Click “No Display” box in the bottom of the window.
- Select and click “New Display”.
- Click “Load RGB” box in the bottom of the window.



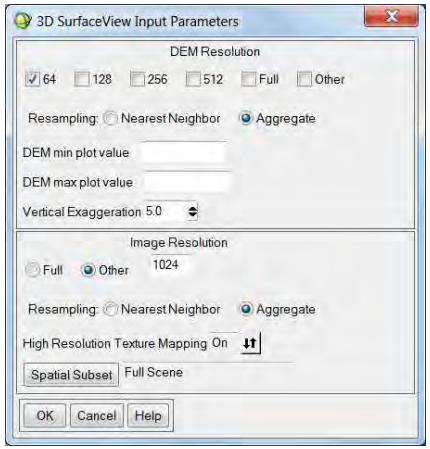


- Three kinds of window “Image / Scroll / Zoom” appear.
- A color composite (true color) image (RGB=B3,B2,B1) of LANDSAT data is created.

- Click “Topographic” on main menu bar.
- Select and click “3D Surface View”.
- “Associated DEM Input File” window appears.



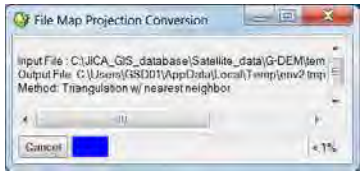

- Select Mosaic (Band1) of "ASTGTM2_mosaic_Malawi.img" in “Select Input Band:” box of “Associate DEM Input File” window”
- Click “OK” box.
- “3D SurfaceView Input Parameters” window appears.





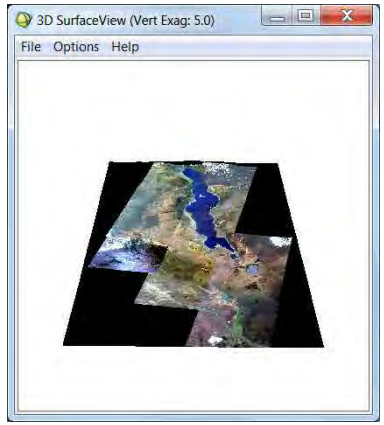



- Use default as parameter in the window.
- Click “OK” box.
- Processing begins and windows appear as follows.



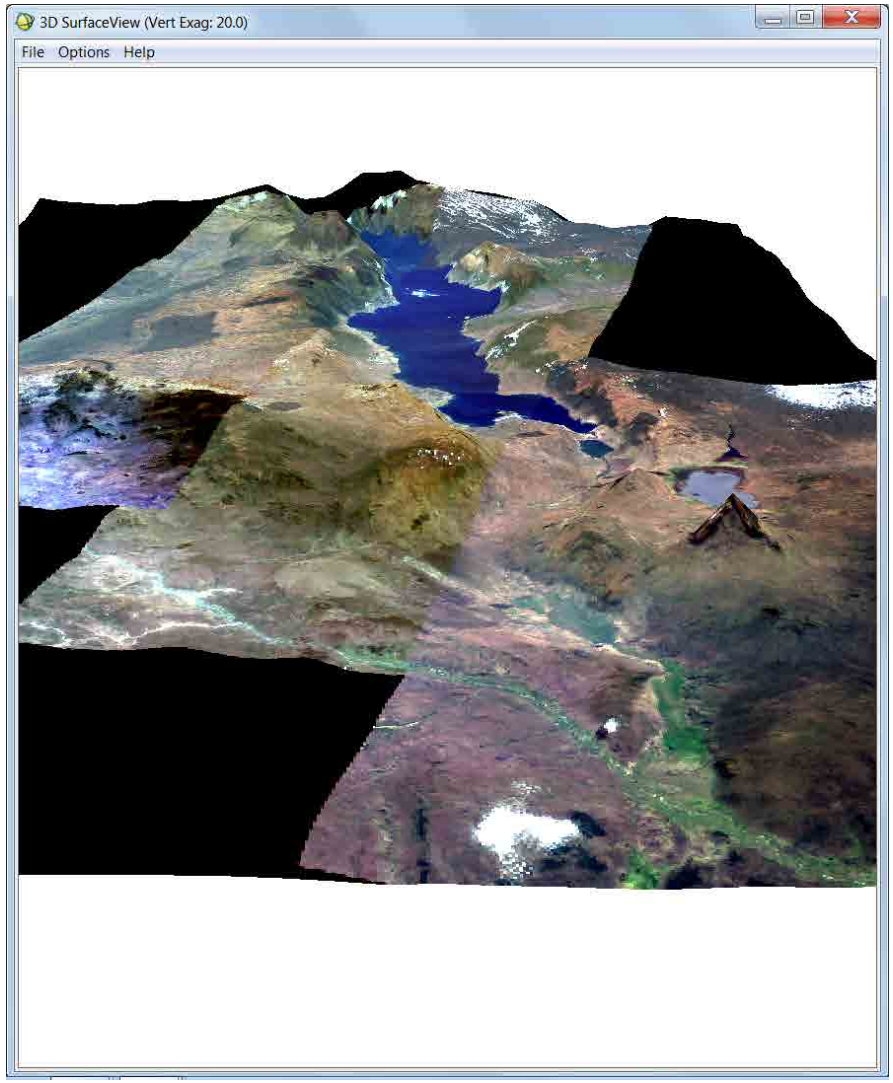


- After finishing processing, “3D SurfaceView” window appears.




- Select “Options” on “3D SurfaceView” menu bar.
- Select and click “Surface Controles”.
- “3D Surface View Controls” window appears.


- Enter “20” in “Vertical Exaggeration” box of “3D Surface View Controls” window.
- Changes are reflected to the 3D image directly.
- Change parameters properly, if needed.




On the window, to

Enlarge and Reduce: Moving mouse to right or left direction with holding down mouse right key.

Turn and Incline: Moving mouse to any directions with holding down mouse left key.

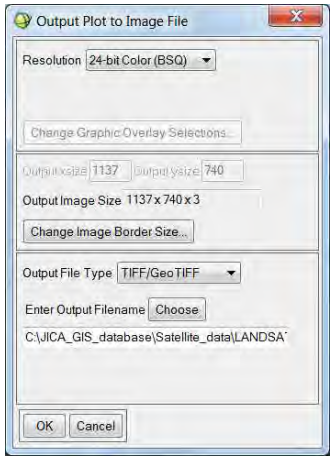
Move image in the window: Moving mouse to any directions with holding down mouse wheel.



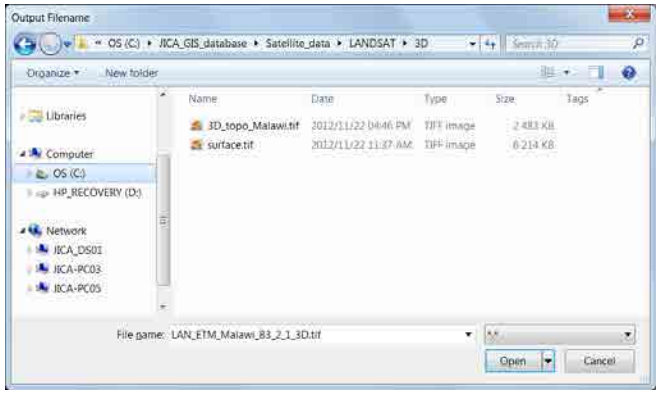


To save 3D map

- Select “File” on the “3D Surface View” menu bar.
- Select click “Save Surface As” and select and click “Image File…”.
- “Output Plot to Image File” window appears.




- Select “TIFF/GeoTIFF” in the “Output File Type” box.
- Click “Choose” box to enter output filename.
- “Output Filename” window appears.




- Choose output file folder and then enter output filename in the “Filename” box.

Output file folder: C:¥JICA_GIS_database¥Satellite_data¥LANDSAT¥3D

Output filename (example: LAN_ETM_Malawi_B3_2_1_3D.tif)

- Click “Open” box in the window.

- Entered output filename appears in the “Enter Output Filename” box of the “Output Display to Image File” window.
- Click “OK” box in the window.
- “LAN_ETM_Malawi_B3_2_1_3D.tif” file is saved in the C:¥JICA_GIS_database¥Satellite_data¥LANDSAT¥3D” holder.





LANDSAT data analysis

Data directory: C:¥JICA_GIS_database¥Satellite_data¥LANDSAT

LANDSAT data (USGS processed data)
・GeoTIFF format, orthorectified, 12 images all over Malawi
Data filename: p###r###_7dtyyyymmdd_z##_##.tif
[p###:path, r###:row, z##_##:UTMzone, band]
Header filename: p###r###_7xyyyymmdd.met (meta file)

one suit of LANDSAT data (example)
p168r069_7dk20000831_z36_10.tif
p168r069_7dk20000831_z36_20.tif
p168r069_7dk20000831_z36_30.tif
p168r069_7dk20000831_z36_40.tif
p168r069_7dk20000831_z36_50.tif
p168r069_7dk20000831_z36_61.tif
p168r069_7dk20000831_z36_62.tif
p168r069_7dk20000831_z36_70.tif
p168r069_7dk20000831_z36_80.tif
p168r069_7x20000831.met

1. Pre-Processing
・Integrate the 6 bands (1,2,3,4,5,7) and create data of 6 bands.
(1) Main menu: File-Open External File-Landsat-GeoTIFF with Metadata
(2) “Enter Landsat MetaData Filenames ”window: Select "p168r069_7x20000831.met"-open
Data directory: C:¥JICA_GIS_database¥Satellite_data¥LANDSAT¥original_data
(3) Main menu: File-Save File As-ENVI standard
(4) “New File Builder” window: Click “Import File”: “Create New File Input File” window: Select the third "p168r069_7x20000831.met"-ok
(5) “New File Builder” window: Click “Choose”: “Output Filename” window: Select folder “C:¥JICA_JIS_database¥Satellite_data¥LANDSAT¥temp” and enter filename "p168r069_BB6.img"-open-ok

・Build mask of areas where no data exists in all 6 bands (create data only in the areas where data exist).
(1) “Available Bands List” window: Select any band in "p168r069_BB6.img" and click “Load Band” to

display LANDSAT image on Display #1
(2) Main menu: Basic Tools-Masking-Build Mask
(3) “Mask Definition” window: Select “Display #1”-ok
(4) “#1 Mask Definition” window: Options-Import Data Range
(5) “Select Input for Mask Data Range” widow: Select "p168r069_BB6.img"-ok
(6) “Input for Data Range Mask” window: Data Max Value "0.5" and select “Mask pixel if ANY band match range”-ok
(7) “#1 Mask Definition” window: Options: Click “Selected Areas off"
(8) “#1 Mask Definition” window: Click “Choose”: “Output Filename” window: Select folder
“C:¥JICA_JIS_database¥Satellite_data¥LANDSAT¥temp” and enter filename
"p168r069_BB6_mask.img"-open-apply
(9) “#1 Mask Definition” window: Click “Cancel”

・Apply “BB6_mask” to “BB6_image” to eliminate bad pixels for analysis
(1) Main menu: Basic Tools-Masking-Apply Mask
(2) “Apply Mask Input File” window: Select “p168r069_BB6.img”
(3) Click “Select Mask Band”
(4) “Select Mask Input Band” window: Select Mask Band of “p168r069_BB6_mask.img”-ok
(5) “Apply Mask Input File” window: ok
(6) “Apply Mask Parameters” window: Click “Choose”: “Output Filename” window: Select folder
“C:¥JICA_JIS_database¥Satellite_data¥LANDSAT¥analysis_data” and enter filename
“p168r069_B1B6.img”-open-ok

2. Basic Analysis
・Calculate the normalized difference vegetation index (NDVI)
Method 1
(1) Main menu: Transform-NDVI
(2) “NDVI Calculation Input File” window: Select "p168r069_B1B6"-ok
(3) “NDVI Calculation Parameters” window: Input File Type: “Landsat TM”
(4) Click “Choose”: “Output Filename” window: Select folder
“C:¥JICA_JIS_database¥Satellite_data¥LANDSAT¥temp” and enter filename
"p168r069_NDVI.img"-open-ok

Method 2
Formula for LANDSAT
NDVI = (Infrared - Red) / (Infrared + Red) = (Band4 - Band3) / (Band4 + Band3)





(1) Main menu: Basic Tools-Band Math
(2) “Band Math” window: Enter an expression "(float(b1)-float(b2))/(float(b1)+float(b2))"-ok
(3) “Variables to Bands Pairings” window: Select “B1-[undefined]” in “Variable used in expression:” and select Band4 of "p168r069_B1B6.img" in “Available Band List”-ok
Select “B2-[undefined]” in “Variable used in expression:” and select Band3 of "p168r069_B1B6.img" in “Available Band List”
(4) Click “Choose”: “Output Filename” window: Select folder
“C:¥JICA_JIS_database¥Satellite_data¥LANDSAT¥temp” and enter filename
"p168r069_NDVI.img"-open-ok
note: Save an expression: “Band Math” window: Click “Add to List” and click “Save”: “Save Expressions to File” window: click “Choose”: Select proper folder and enter filename "NDVI.exp"-ok

・Build vegetation mask using NDVI
(1) “Available Bands List” window: Select NDVI (Band Math) of "p168r069_NDVI.img" and click “Load Band” to display NDVI image on Display #1
(2) Main menu: Basic Tools-Masking-Build Mask
(3) “Mask Definition” window: Select “Display #1”-ok
(4)” #1 Mask Definition” window: Options-Import Data Range
(5) “Select Input for Mask Data Range” window: Select "p168r069_NDVI.img"-ok
(6) “Input for Data Range Mask” window: Data Max Value "0.15"
note: How to decide Threshold (Data Max Value): Find the optimum value by trial and error. It depends on image. See “How to build various masks.docx” for more information.

(7) “#1 Mask Definition” window: Options: Click “Selected Areas on”
(8) Click “Choose”: “Output Filename” window: Select folder
“C:¥JICA_JIS_database¥Satellite_data¥LANDSAT¥temp” and enter filename
"p168r069_NDVI_mask.img"-open-apply
(9) “#1 Mask Definition” window: Click “Cancel”

・Build mask data for water areas, cloud areas and cloud-shadow areas to carry out the masking process.
For water areas
Use Band4 of p168r069_B1B6.img to create mask data for water areas.
(1) “Available Bands List” window: Select Band4 of "p168r069_B1B6.img" and click “Load Band” to display Band4 of “p168r069_B1B6.img” on Display #1
(2) Main menu: Basic Tools-Masking-Build Mask
(3) “Mask Definition” window: Select “Display #1”-ok

(4) “#1 Mask Definition” window: Options-Import Data Range
(5) “Select Input for Mask Data Range” window: Select "p168r069_B1B6.img"-ok
(6) Click “Spectral Subset”: “File Spectral Subset” window: Select Band4-ok: “Select Input for Mask Data Range” window: ok
(7) “Input for Data Range Mask” window: Data Max Value "20"-ok
note: How to decide Threshold (Data Max Value): Find the optimum value by trial and error. It depends on image. See “How to build various masks.docx” for more information.

(8) “#1 Mask Definition” window: Options: Click “Selected Areas off”
(9) “#1 Mask Definition” window: Click “Choose”: “Output Filename” window: Select folder “C:¥JICA_JIS_database¥Satellite_data¥LANDSAT¥temp” and enter filename “p168r069_water_mask.img”-open-apply
(10) “#1 Mask Definition” window: Click “Cancel”

For cloud areas
Use Band7 of p168r069_B1B6.img to create mask data for cloud areas.
(1) “Available Bands List” window: Select Band7 of "p168r069_B1B6.img" and click “Load Band” to display Band7 of “p168r069_B1B6.img” on Display #1
(2) Main menu: Basic Tools-Masking-Build Mask
(3) “Mask Definition” window: Select “Display #1”-ok
(4) “#1 Mask Definition” window: Options-Import Data Range
(5) “Select Input for Mask Data Range” window: Select "p168r069_B1B6.img"-ok
(6) Click “Spectral Subset”: “File Spectral Subset” window: Select Band7-ok: “Select Input for Mask Data Range” window: ok
(7) “Input for Data Range Mask” window: Data Min Value "120"-ok
note: How to decide Threshold (Data Min Value): Find the optimum value by trial and error. It depends on image. See “How to build various masks.docx” for more information.

(8) “#1 Mask Definition” window: Options: Click “Selected Areas off”
(9) “#1 Mask Definition” window: Click “Choose”: “Output Filename” window: Select folder “C:¥JICA_JIS_database¥Satellite_data¥LANDSAT¥temp” and enter filename “p168r069_cloud_mask.img”-open-apply
(10) “#1 Mask Definition” window: Click “Cancel”

For shadow of cloud areas
Use Band4 of p168r069_B1B6.img to create mask data for shadow of cloud areas.
(1) “Available Bands List” window: Select Band4 of "p168r069_B1B6.img" and click “Load Band” to





display Band4 of “p168r069_B1B6.img” on Display #1
(2) Main menu: Basic Tools-Masking-Build Mask
(3) “Mask Definition” window: Select “Display #1”-ok
(4) “#1 Mask Definition” window: Options-Import Data Range
(5) “Select Input for Mask Data Range” window: Select "p168r069_B1B6.img"-ok
(6) Click “Spectral Subset”: “File Spectral Subset” window: Select Band4-ok: “Select Input for Mask Data Range” window: ok
(7) “Input for Data Range Mask” window: Data Max Value "24"-ok
note: How to decide Threshold (Data Max Value): Find the optimum value by trial and error. It depends on image. See “How to build various masks.docx” for more information.

(8) “#1 Mask Definition” window: Options: Click “Selected Areas off”
(9) “#1 Mask Definition” window: Click “Choose”: “Output Filename” window: Select folder “C:¥JICA_JIS_database¥Satellite_data¥LANDSAT¥temp” and enter filename “p168r069_shadow_mask.img”-open-apply
(10) “#1 Mask Definition” window: Click “Cancel”

OPTION
・Create mask manually.
(1) “Available Bands List” window: Select Band3 of "p168r069_shadow_mask.img" and click “Load Band” to display Band3 of “p168r069_shadow_mask.img” on Display #1
(2) Main menu: Basic Tools-Region of Interest-ROI Tool
(3) “#1 ROI Tool” widow: Window: Select “Image”
(4) “#1 ROI Tool” widow: ROI Type: Select “Polygon” and “Multi Part: off”
(5) Trace the border of area to be masked on Image by mouse.
On “Image” window of #1 display, click left mouse button to put point. Put points on the border. After finishing trace, click right mouse button twice to fix. To cancel, click right mouse button once and small diamond appears then click middle mouse button.
To remove the polygon after fixing, click middle mouse button on the polygon you want to remove.
Repeat the trace procedure (5) to all areas to be masked.

(6) Main menu: Basic Tools-Masking-Build Mask
(7) “Mask Definition” window: Select “Display #1”-ok
(8) “#1 Mask Definition” window: Options-Import ROIs
(9) “Mask Definition Input ROIs” window: Select “Region #1” in “Select ROIs for Mask Definition”-ok
(10) “#1 Mask Definition” window: Options-click “Selected Areas off"
(11) “#1 Mask Definition” window: Click “Choose”: “Output Filename” window: Select folder

"C:¥JICA_JIS_database¥Satellite_data¥LANDSAT¥temp" and enter filename
"p168r069_option_mask.img"-open-apply
(12) "#1 Mask Definition" window: Click "Cancel"

・Integrate NDVI mask, water mask, cloud mask and shadow of cloud mask image.
(1) Main menu: File-Save File As -ENVI standard
(2) "New File Builder" window: Click "Import File": "Create New File Input File" window: Select
"p168r069_NDVI_mask.img", "p168r069_water_mask.img",
"p168r069_cloud_mask.img" and "p168r069_shadow_mask.img"-ok
note: Select files with holding down Ctrl key.
(3) "New File Builder" window: Click "Choose": "Output Filename" window: Select folder
"C:¥JICA_JIS_database¥Satellite_data¥LANDSAT¥temp" and enter filename
"p168r069_all_mask.img"-open-ok

・Build integrated mask.
(1) "Available Bands List" window: Select any band in "p168r069_all_mask.img" and click "Load Band" to display LANDSAT image on Display #1
(2) Main menu: Basic Tools-Masking-Build Mask
(3) "Mask Definition" window: Select "Display #1"-ok
(4) "#1 Mask Definition" window: Options-Import Data Range
(5) "Select Input for Mask Data Range" window: Select "p168r069_all_mask.img"-ok
(6) "Input for Data Range Mask" window: Data Min Value "0.5" and select "Mask pixel if ALL band match range"-ok
(7) "#1 Mask Definition" window: Options: Click "Selected Areas on"
(8) "#1 Mask Definition" window: Click "Choose": "Output Filename" window: Select folder
"C:¥JICA_JIS_database¥Satellite_data¥LANDSAT¥temp" and enter filename
"p168r069_integrated_mask.img"-open-apply
(9) "#1 Mask Definition" window: Click "Cancel"

・Apply integrated mask to B1B6 image to eliminate bad pixels for analysis.
(1) Main menu: File-Open Image File:
(2) "Enter Data Filenames" window: Select "p168r069_B1B6.img" and
"p168r069_integrated_mask.img"-open
(3) Main menu: Basic Tools-Masking-Apply Mask
(4) "Apply Mask Input File" window: Select "p168r069_B1B6.img"
(5) Click "Select Mask Band"
(6) "Select Mask Input Band" window: Select Mask Band of





"p168r069_imtegrated_mask.img"-ok
(7) "Apply Mask Input File" window: ok
(8) "Apply Mask Parameters" window: Click "Choose": "Output Filename" window: Select folder
"C:¥JICA_JIS_database¥Satellite_data¥LANDSAT¥masked_data" and enter filename
"p168r069_masked_B1B6.img"-open-ok

・Create various band composite images.
(1) Main menu: File-Open Image File
(2) "Enter Data Filenames" window: Select "p168r069_masked_B1B6.img"-open
(3) "Available Band List" window: Select "RGB Color", Select one band of
"p168r069_masked_B1B6.img" to each color Red, Green and Blue
(4) Click "No Display" then select and click "New Display"
(5) Click "Load RGB"

Band and Color Combination of Band-composite Image for LANDSAT
・Image of true color: R:Band3, G:Band2, B:Band1
・Image of false color: R:Band4, G:Band3, B:Band2
(Vegetation area shows red)
・Image of natural color: R: Band5, G: Band4, B: Band2

To save band composite image as GeoTIFF file
(6) "Display #1" menu: File-Save Image As-Image File
(7) "Output Display to Image File" window: Output File Type: Select TIFF/GeoTIFF
(8) Click "Choose": "Output Filename" window: Select folder (In case of false color image)
"C:¥JICA_JIS_database¥Satellite_data¥LANDSAT¥band_comp¥B4_B3_B2" and enter filename
"LAN_ETM_c02r03_B4_3_2.tif"-open-ok
note: Here change filename, referring List of GRANULE ID of LANDSAT data.

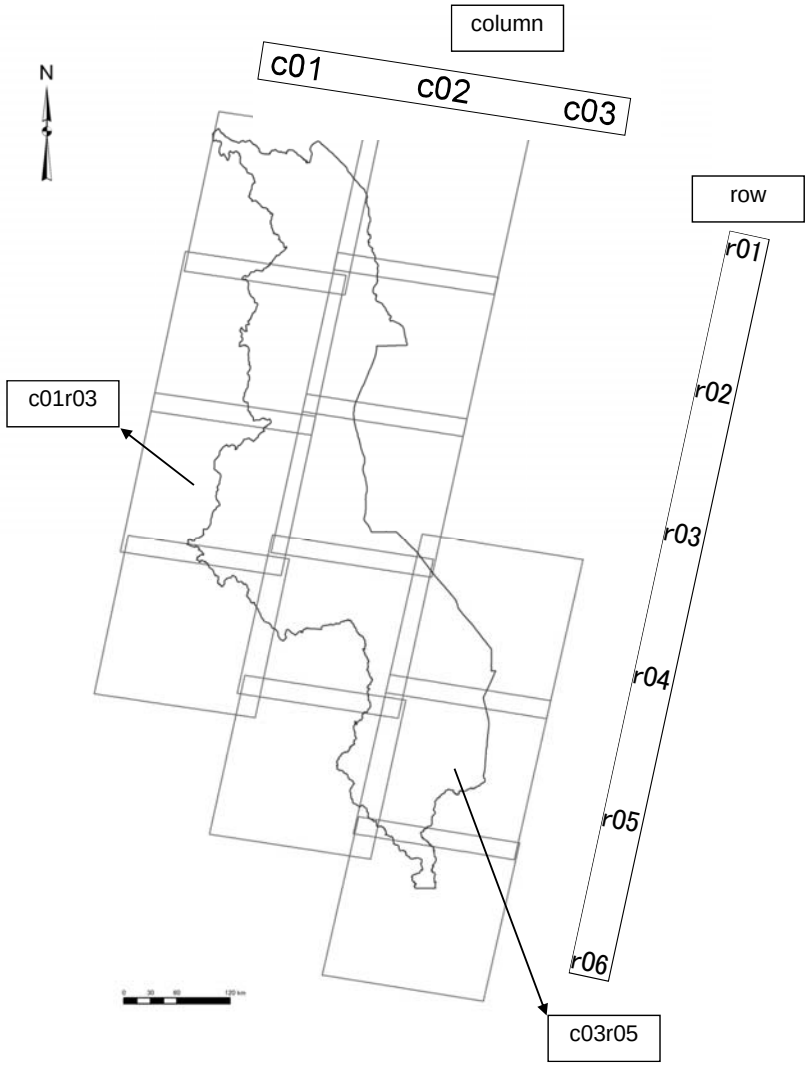
・Create 3D map using DEM data
(1) Main menu: Open Image File:
(2) "Enter Data Filenames" window: Select "p168r069_B1B6.img"-open
(3) "Available Bands List" window: Select "RGB Color", Select Band3 as R, Band2 as G and Band1 as B. Then, click "Load RGB" to display band composite image on #1 display.
(4) Main menu: File-Open Image File:
(5) "Enter Data Filenames" window: Select "GDM_mosaic.tif"
in C:¥JICA_GIS_database¥Satellite_data¥G-DEM¥mosaic folder.
(6) Main menu: Topographic-3D Surface View

(7) “Associate DEM Input File” window: Select Band1 of "GDM_mosaic.tif" in “Select Input Band:”-ok
(8) “3D Surface View Input Parameters” window: Use default-ok
(9) “3D Surface View” window: Options-Surface Controls: “3D Surface View Controls” window: Change display parameters properly.

To save 3D map
(10) “3D Surface View” window: File-Save Surface As-Image File:
(11) “Output Plot to Image File” window: Output File Type: Select TIFF/GeoTIFF
(12) Click “Choose”: “Output Filename” window: Select folder
“C:¥JICA_JIS_database¥Satellite_data¥LANDSAT¥3D” and enter filename
“LAN_ETM_c02r03_B3_2_1_3D.tif”-open-ok

How to Make an Address of Satellite Data Image on Coverage Map

Coverage map for LANDSAT




How to change original filename to new file name using column and row.
EXAMPLE From : p169r067_7dp20010910 To : LAN_ETM_c01r01





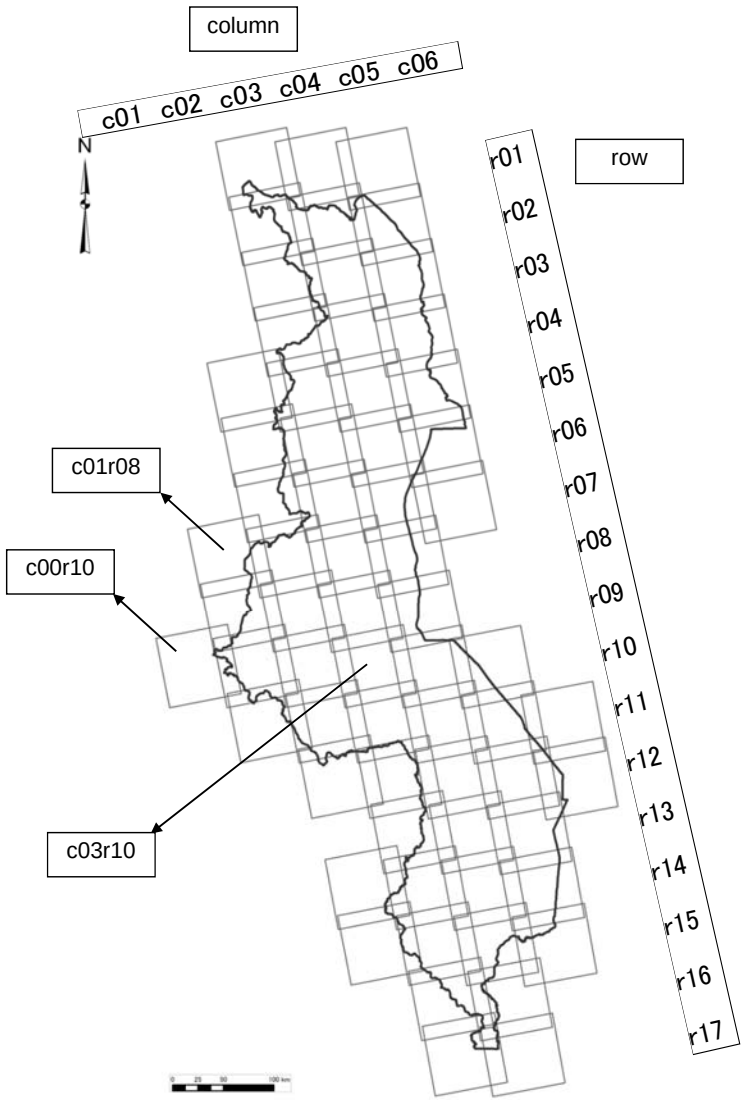
List of GRANULE ID of LANDSAT data

Corresponding index between column & row and Granule ID

| | GRANULE ID (filename) | column | row |
|---|---|---|---|
| 1 | p169r067_7dp20010910_z36_## | 1 | 1 |
| 2 | p169r068_7dp20020508_z36_## | 1 | 2 |
| 3 | p169r069_7dp20020508_z36_## | 1 | 3 |
| 4 | p169r070_7dp20000721_z36_## | 1 | 4 |
| 5 | p168r067_7dp20020618_z36_## | 2 | 1 |
| 6 | p168r068_7dp20000831_z36_## | 2 | 2 |
| 7 | p168r069_7dp20000831_z36_## | 2 | 3 |
| 8 | p168r070_7dp20010717_z36_## | 2 | 4 |
| 9 | p168r071_7dp20010701_z36_## | 2 | 5 |
| 10 | p167r070_7dp20020526_z36_## | 3 | 4 |
| 11 | p167r071_7dp20020526_z36_## | 3 | 5 |
| 12 | p167r072_7dp19990822_z36_## | 3 | 6 |

How to change original filename to new file name using column and row.
EXAMPLE From : p169r067_7dp20010910 To : LAN_ETM_c01r01

Coverage map for PALSAR




How to change original filename to new file name using column and row.
EXAMPLE From : PASL150110216204056l204260061 To : PAL_L15_c01r08



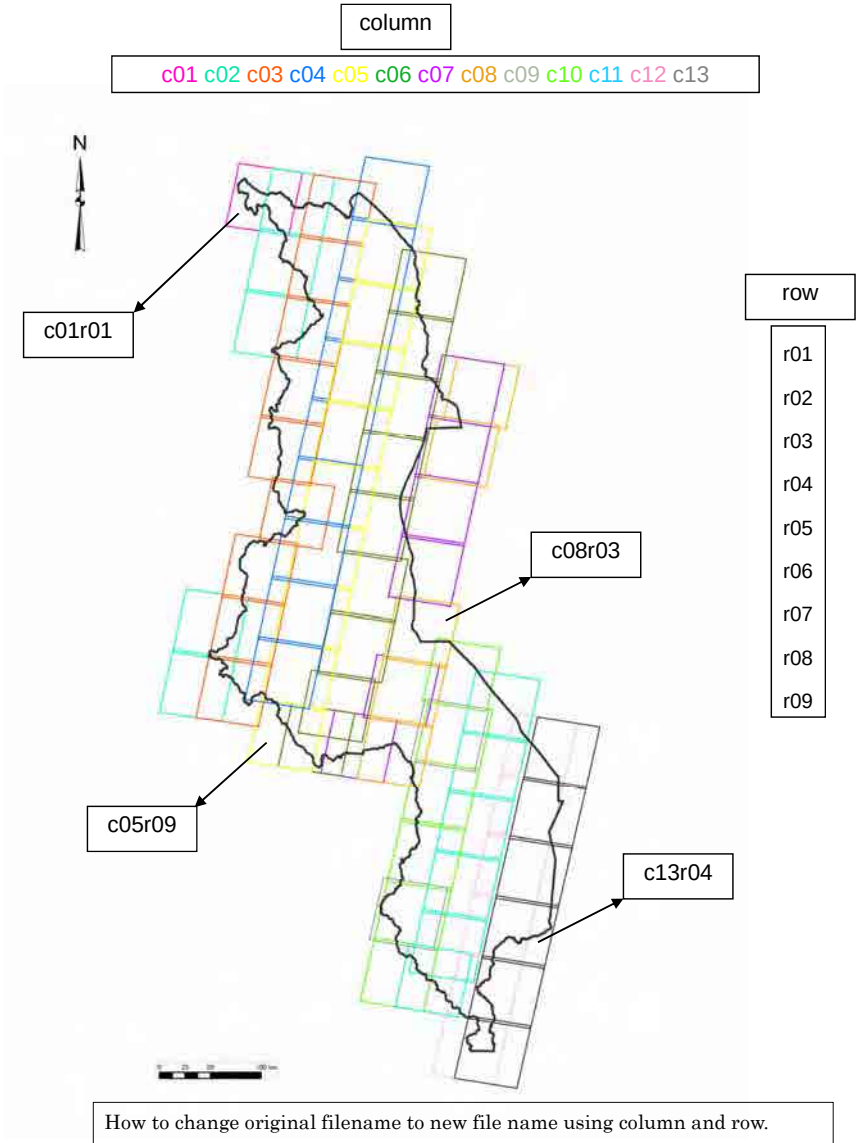


List of GRANULE ID of PALSAR data
Corresponding index between column & row and Granule ID

| | GRANULE ID (filename) | column | raw | Center Latitude | Center Longitude |
|---|---|---|---|---|---|
| 1 | PASL150110118204326l301230189 | 0 | 10 | −13.7057 | 32.5567 |
| 2 | PASL150110216204056l204260061 | 1 | 8 | −12.7226 | 32.8323 |
| 3 | PASL150110216204047l204260060 | 1 | 9 | −13.2184 | 32.9487 |
| 4 | PASL150110216204039l204260059 | 1 | 10 | −13.7141 | 33.0657 |
| 5 | PASL150110216204031l204260058 | 1 | 11 | −14.2074 | 33.1943 |
| 6 | PASL150110130203934l204260057 | 2 | 5 | −11.2378 | 33.0103 |
| 7 | PASL150110130203926l204260056 | 2 | 6 | −11.7313 | 33.1355 |
| 8 | PASL150110130203918l204260055 | 2 | 7 | −12.2272 | 33.2506 |
| 9 | PASL150110130203909l204260054 | 2 | 8 | −12.7231 | 33.3664 |
| 10 | PASL150110130203901l204260053 | 2 | 9 | −13.217 | 33.4914 |
| 11 | PASL150110130203853l204260052 | 2 | 10 | −13.7126 | 33.6084 |
| 12 | PASL150110130203845l204260051 | 2 | 11 | −14.2081 | 33.7262 |
| 13 | PASL150110130203836l204260050 | 2 | 12 | −14.7036 | 33.8446 |
| 14 | PASL150110130203820l204260049 | 2 | 14 | −15.692 | 34.0945 |
| 15 | PASL150110130203812l204260048 | 2 | 15 | −16.1873 | 34.2151 |
| 16 | PASL150110113203819l204260016 | 3 | 1 | −9.2544 | 33.0854 |
| 17 | PASL150110113203811l204260015 | 3 | 2 | −9.7488 | 33.2062 |
| 18 | PASL150110113203803l204260014 | 3 | 3 | −10.245 | 33.319 |
| 19 | PASL150110113203755l204260013 | 3 | 4 | −10.7412 | 33.4324 |
| 20 | PASL150110113203747l204260012 | 3 | 5 | −11.2372 | 33.5464 |
| 21 | PASL150110113203738l204260011 | 3 | 6 | −11.7307 | 33.6716 |
| 22 | PASL150110113203730l204260010 | 3 | 7 | −12.2266 | 33.7868 |
| 23 | PASL150110113203722l204260009 | 3 | 8 | −12.7225 | 33.9026 |
| 24 | PASL150110113203714l204260008 | 3 | 9 | −13.2183 | 34.019 |
| 25 | PASL150110113203705l204260007 | 3 | 10 | −13.7121 | 34.1447 |
| 26 | PASL150110113203657l204260006 | 3 | 11 | −14.2078 | 34.2625 |
| 27 | PASL150110113203649l204260005 | 3 | 12 | −14.7033 | 34.381 |
| 28 | PASL150110113203641l204260004 | 3 | 13 | −15.1963 | 34.511 |
| 29 | PASL150110113203632l204260003 | 3 | 14 | −15.6916 | 34.6309 |
| 30 | PASL150110113203624l204260002 | 3 | 15 | −16.1869 | 34.7515 |
| 31 | PASL150110113203616l204260001 | 3 | 16 | −16.682 | 34.873 |
| 32 | PASL150110113203608l204260000 | 3 | 17 | −17.1745 | 35.006 |
| 33 | PASL150101227203631l204260033 | 4 | 1 | −9.255 | 33.6169 |
| 34 | PASL150101227203623l204260032 | 4 | 2 | −9.749 | 33.7399 |
| 35 | PASL150101227203614l204260031 | 4 | 3 | −10.2453 | 33.8527 |
| 36 | PASL150101227203606l204260030 | 4 | 4 | −10.7415 | 33.9661 |
| 37 | PASL150101227203558l204260029 | 4 | 5 | −11.2354 | 34.0886 |
| 38 | PASL150101227203550l204260028 | 4 | 6 | −11.7315 | 34.2032 |
| 39 | PASL150101227203541l204260027 | 4 | 7 | −12.2274 | 34.3184 |
| 40 | PASL150101227203533l204260026 | 4 | 8 | −12.7232 | 34.4342 |
| 41 | PASL150101227203525l204260025 | 4 | 9 | −13.2166 | 34.5614 |
| 42 | PASL150101227203517l204260024 | 4 | 10 | −13.7124 | 34.6785 |
| 43 | PASL150101227203509l204260023 | 4 | 11 | −14.2079 | 34.7963 |
| 44 | PASL150101227203500l204260022 | 4 | 12 | −14.7035 | 34.9148 |
| 45 | PASL150101227203452l204260021 | 4 | 13 | −15.1966 | 35.0449 |
| 46 | PASL150101227203444l204260020 | 4 | 14 | −15.692 | 35.1648 |
| 47 | PASL150101227203436l204260019 | 4 | 15 | −16.1873 | 35.2855 |
| 48 | PASL150101227203427l204260018 | 4 | 16 | −16.6796 | 35.4177 |
| 49 | PASL150101227203419l204260017 | 4 | 17 | −17.1745 | 35.5399 |
| 50 | PASL150110125203347l204260047 | 5 | 1 | −9.2534 | 34.164 |
| 51 | PASL150110125203339l204260046 | 5 | 2 | −9.7497 | 34.2762 |
| 52 | PASL150110125203331l204260045 | 5 | 3 | −10.2459 | 34.389 |
| 53 | PASL150110125203323l204260044 | 5 | 4 | −10.7421 | 34.5024 |
| 54 | PASL150110125203314l204260043 | 5 | 5 | −11.236 | 34.6248 |
| 55 | PASL150110125203306l204260042 | 5 | 6 | −11.7321 | 34.7394 |
| 56 | PASL150110125203258l301230190 | 5 | 7 | −12.2201 | 34.8834 |
| 57 | PASL150110125203233l204260041 | 5 | 10 | −13.713 | 35.2145 |
| 58 | PASL150110125203225l204260040 | 5 | 11 | −14.2086 | 35.3323 |
| 59 | PASL150110125203217l204260039 | 5 | 12 | −14.7017 | 35.4615 |
| 60 | PASL150110125203209l204260038 | 5 | 13 | −15.1971 | 35.5807 |
| 61 | PASL150110125203200l204260037 | 5 | 14 | −15.6925 | 35.7006 |
| 62 | PASL150110125203152l204260036 | 5 | 15 | −16.1878 | 35.8212 |
| 63 | PASL150110223202937l204260035 | 6 | 11 | −14.2071 | 35.8756 |
| 64 | PASL150110223202929l204260034 | 6 | 12 | −14.7026 | 35.994 |

Coverage map for ASTER

How to make an address of satellite data image is different from PALSAR or LANDSAT, as the location of ASTER images line irregularly.




How to change original filename to new file name using column and row.
EXAMPLE From : AST3A1_0507030808241204250009 To : AST_L3A_c01r01





List of GRANULE ID of ASTER data
Corresponding index between column & row and Granule ID

| | GRANULE ID (filename) | column | row | north west latitude | north west longitude | north east latitude | north east longitude | south east latitude | south east longitude | sowth west latitude | south west longitude |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | AST3A1_0507030808241204250009 | 1 | 1 | −9.22746 | 32.95295 | −9.31032 | 33.51729 | −9.868 | 33.39589 | −9.78492 | 32.83055 |
| 2 | AST3A1_0508040808251204250013 | 2 | 1 | −9.27174 | 33.25409 | −9.35336 | 33.81352 | −9.91113 | 33.69271 | −9.82933 | 33.13228 |
| 3 | AST3A1_0508040808341204250012 | 2 | 2 | −9.80663 | 33.13724 | −9.88841 | 33.69764 | −10.4461 | 33.57656 | −10.3642 | 33.01511 |
| 4 | AST3A1_0508040808431204250014 | 2 | 3 | −10.3415 | 33.02009 | −10.4234 | 33.5815 | −10.9811 | 33.46014 | −10.8989 | 32.89762 |
| 5 | AST3A1_0509050809111204250015 | 2 | 4 | −13.0205 | 32.46896 | −13.1035 | 33.03637 | −13.6608 | 32.9134 | −13.5776 | 32.34459 |
| 6 | AST3A1_0509050809201204250047 | 2 | 5 | −13.555 | 32.34963 | −13.6382 | 32.91838 | −14.1954 | 32.79502 | −14.112 | 32.22482 |
| 7 | AST3A1_0111290813551204250021 | 3 | 1 | −12.0316 | 33.25247 | −12.1123 | 33.81785 | −12.67 | 33.69767 | −12.5892 | 33.13099 |
| 8 | AST3A1_0509210808021204250016 | 3 | 2 | −9.32524 | 33.61972 | −9.40611 | 34.17795 | −9.96392 | 34.05778 | −9.88289 | 33.49854 |
| 9 | AST3A1_0509210808111204250018 | 3 | 3 | −9.86018 | 33.50348 | −9.9412 | 34.06268 | −10.499 | 33.94228 | −10.4178 | 33.38202 |
| 10 | AST3A1_0509210808201204250017 | 3 | 4 | −10.3951 | 33.38697 | −10.4763 | 33.94719 | −11.0339 | 33.82653 | −10.9526 | 33.2652 |
| 11 | AST3A1_0509210808291204250019 | 3 | 5 | −10.9301 | 33.27013 | −11.0114 | 33.83142 | −11.569 | 33.7105 | −11.4875 | 33.14804 |
| 12 | AST3A1_0509210808381204250020 | 3 | 6 | −11.4648 | 33.15302 | −11.5463 | 33.71543 | −12.1039 | 33.59423 | −12.0222 | 33.03058 |
| 13 | AST3A1_0509210808551204250022 | 3 | 7 | −12.5343 | 32.91776 | −12.6161 | 33.48259 | −13.1736 | 33.36078 | −13.0916 | 32.7946 |
| 14 | AST3A1_0509210809041204250023 | 3 | 8 | −13.069 | 32.7996 | −13.1511 | 33.36571 | −13.7084 | 33.24357 | −13.6262 | 32.67605 |
| 15 | AST3A1_0509210809131204250026 | 3 | 9 | −13.6035 | 32.68109 | −13.6857 | 33.24855 | −14.2431 | 33.12605 | −14.1607 | 32.55713 |
| 16 | AST3A1_0511010802021204250025 | 4 | 1 | −9.16618 | 34.08353 | −9.25063 | 34.65599 | −9.8082 | 34.53414 | −9.72349 | 33.96069 |
| 17 | AST3A1_0511010802111204250024 | 4 | 2 | −9.70079 | 33.9657 | −9.78549 | 34.53911 | −10.343 | 34.41693 | −10.2581 | 33.84246 |
| 18 | AST3A1_0511010802191204250028 | 4 | 3 | −10.2353 | 33.84752 | −10.3202 | 34.42194 | −10.8776 | 34.29942 | −10.7924 | 33.72389 |
| 19 | AST3A1_0511010802281204250027 | 4 | 4 | −10.7697 | 33.72893 | −10.8549 | 34.30442 | −11.4123 | 34.18151 | −11.3269 | 33.60484 |
| 20 | AST3A1_0511010802371204250029 | 4 | 5 | −11.3042 | 33.6099 | −11.3896 | 34.18652 | −11.9469 | 34.06329 | −11.8612 | 33.48545 |
| 21 | AST3A1_0610030802221204250039 | 5 | 1 | −9.72218 | 34.11076 | −9.80699 | 34.68423 | −10.3644 | 34.56198 | −10.2794 | 33.98745 |
| 22 | AST3A1_0610030802311204250052 | 5 | 2 | −10.2567 | 33.99248 | −10.3417 | 34.56696 | −10.8991 | 34.44436 | −10.8138 | 33.86877 |
| 23 | AST3A1_0610030802401204250054 | 5 | 3 | −10.7912 | 33.87379 | −10.8765 | 34.44934 | −11.4339 | 34.32631 | −11.3483 | 33.74959 |
| 24 | AST3A1_0610030802491204250053 | 5 | 4 | −11.3256 | 33.75465 | −11.4112 | 34.33132 | −11.9684 | 34.20794 | −11.8826 | 33.63004 |
| 25 | AST3A1_0610030802581204250050 | 5 | 5 | −11.86 | 33.6351 | −11.9459 | 34.21295 | −12.5031 | 34.08917 | −12.4169 | 33.51004 |
| 26 | AST3A1_0610030803071204250055 | 5 | 6 | −12.3943 | 33.51514 | −12.4804 | 34.09422 | −13.0375 | 33.97004 | −12.9511 | 33.38961 |
| 27 | AST3A1_0610030803161204250057 | 5 | 7 | −12.9285 | 33.3947 | −13.0149 | 33.97507 | −13.572 | 33.85046 | −13.4853 | 33.26868 |
| 28 | AST3A1_0610030803241204250042 | 5 | 8 | −13.4626 | 33.27382 | −13.5493 | 33.85554 | −14.1062 | 33.73048 | −14.0192 | 33.14729 |
| 29 | AST3A1_0610030803331204250043 | 5 | 9 | −13.9967 | 33.15243 | −14.0837 | 33.73555 | −14.6406 | 33.61001 | −14.5533 | 33.02536 |
| 30 | AST3A1_0606130803441204250034 | 6 | 1 | −14.0383 | 33.43046 | −14.1233 | 34.00531 | −14.6804 | 33.88056 | −14.595 | 33.3042 |
| 31 | AST3A1_0608230808551204250035 | 6 | 2 | −9.99216 | 34.41845 | −10.0738 | 34.993 | −10.6317 | 34.87436 | −10.55 | 34.29869 |
| 32 | AST3A1_0608230809041204250036 | 6 | 3 | −10.5273 | 34.30357 | −10.609 | 34.8792 | −11.1669 | 34.7604 | −11.085 | 34.1836 |
| 33 | AST3A1_0608230809121204250037 | 6 | 4 | −11.0625 | 34.18846 | −11.1443 | 34.76522 | −11.7021 | 34.64626 | −11.6202 | 34.06826 |
| 34 | AST3A1_0608230809211204250038 | 6 | 5 | −11.5975 | 34.07316 | −11.6793 | 34.65111 | −12.2371 | 34.53197 | −12.1551 | 33.95273 |
| 35 | AST3A1_0608230809301204250040 | 6 | 6 | −12.1325 | 33.95761 | −12.2145 | 34.5368 | −12.7722 | 34.41745 | −12.6901 | 33.83691 |
| 36 | AST3A1_0608230809571204250041 | 6 | 7 | −13.7373 | 33.60941 | −13.8196 | 34.19267 | −14.3772 | 34.07264 | −14.2948 | 33.48784 |
| 37 | AST3A1_0609240809241204250058 | 6 | 8 | −12.6761 | 33.90288 | −12.7582 | 34.48353 | −13.3158 | 34.36403 | −13.2337 | 33.78196 |
| 38 | AST3A1_0609240809331204250059 | 6 | 9 | −13.211 | 33.78689 | −13.2931 | 34.3689 | −13.8508 | 34.24916 | −13.7685 | 33.66567 |
| 39 | AST3A1_0403190803351204250051 | 7 | 1 | −10.9251 | 34.78178 | −11.0064 | 35.34279 | −11.5641 | 35.22184 | −11.4826 | 34.65965 |
| 40 | AST3A1_0403190803441204250056 | 7 | 2 | −11.4599 | 34.66463 | −11.5414 | 35.22677 | −12.099 | 35.10553 | −12.0173 | 34.54216 |
| 41 | AST3A1_0403190803531204250002 | 7 | 3 | −11.9946 | 34.54715 | −12.0763 | 35.11047 | −12.6339 | 34.98893 | −12.552 | 34.42433 |
| 42 | AST3A1_0403190804021204250006 | 7 | 4 | −12.5295 | 34.42931 | −12.6113 | 34.99386 | −13.1688 | 34.872 | −13.0868 | 34.30611 |
| 43 | AST3A1_0502020803191204250004 | 7 | 5 | −13.6007 | 34.20676 | −13.683 | 34.77392 | −14.2404 | 34.6512 | −14.1578 | 34.08257 |
| 44 | AST3A1_0502180803191204250007 | 7 | 6 | −14.0962 | 33.8221 | −14.1798 | 34.39209 | −14.737 | 34.26817 | −14.6532 | 33.69667 |
| 45 | AST3A1_0008310818211204250004 | 8 | 1 | −10.9449 | 34.91555 | −11.0255 | 35.47768 | −11.5835 | 35.35758 | −11.5027 | 34.79426 |
| 46 | AST3A1_0506100802351204250011 | 8 | 2 | −11.4711 | 34.7413 | −11.5527 | 35.30371 | −12.1103 | 35.18245 | −12.0285 | 34.6188 |
| 47 | AST3A1_0506100803021204250010 | 8 | 3 | −13.0752 | 34.38772 | −13.1573 | 34.95385 | −13.7147 | 34.83163 | −13.6324 | 34.2641 |
| 48 | AST3A1_0506100803111204250066 | 8 | 4 | −13.6098 | 34.26912 | −13.6921 | 34.83658 | −14.2494 | 34.71403 | −14.1669 | 34.1451 |
| 49 | AST3A1_0506100803201204250067 | 8 | 5 | −14.1444 | 34.15013 | −14.2269 | 34.719 | −14.7841 | 34.59607 | −14.7014 | 34.02569 |
| 50 | AST3A1_0503150757261204250008 | 9 | 6 | −13.9888 | 34.6451 | −14.0759 | 35.22827 | −14.6327 | 35.10268 | −14.5453 | 34.518 |
| 51 | AST3A1_0503150757521204250005 | 9 | 7 | −15.5905 | 34.27767 | −15.6785 | 34.86539 | −16.2351 | 34.73829 | −16.1468 | 34.14886 |
| 52 | AST3A1_0410220756591204250068 | 10 | 1 | −13.995 | 34.6845 | −14.081 | 35.26442 | −14.638 | 35.13941 | −14.5516 | 34.55797 |
| 53 | AST3A1_0410220757071204250069 | 10 | 2 | −14.5291 | 34.5631 | −14.6154 | 35.14448 | −15.1723 | 35.01899 | −15.0857 | 34.43604 |
| 54 | AST3A1_0410220757161204250071 | 10 | 3 | −15.0631 | 34.44119 | −15.1497 | 35.02408 | −15.7065 | 34.89811 | −15.6196 | 34.31358 |
| 55 | AST3A1_0410220757251204250070 | 10 | 4 | −15.597 | 34.31876 | −15.684 | 34.90322 | −16.2407 | 34.77674 | −16.1534 | 34.19058 |
| 56 | AST3A1_0410220757341204250072 | 10 | 5 | −16.1309 | 34.19578 | −16.2181 | 34.78187 | −16.7747 | 34.65486 | −16.6871 | 34.06701 |
| 57 | AST3A1_0501260757101204250006 | 10 | 6 | −13.452 | 34.74794 | −13.5389 | 35.32955 | −14.0958 | 35.20433 | −14.0087 | 34.62125 |
| 58 | AST3A1_0010020818101204250005 | 11 | 1 | −13.7311 | 35.10846 | −13.8132 | 35.69306 | −14.3707 | 35.57341 | −14.2884 | 34.98727 |
| 59 | AST3A1_0010020818191204250060 | 11 | 2 | −14.266 | 34.99215 | −14.3482 | 35.57823 | −14.9055 | 35.45833 | −14.8231 | 34.87065 |
| 60 | AST3A1_0010020818281204250061 | 11 | 3 | −14.8009 | 34.87552 | −14.8832 | 35.46314 | −15.4405 | 35.34296 | −15.358 | 34.75367 |
| 61 | AST3A1_0010020818371204250063 | 11 | 4 | −15.3356 | 34.75858 | −15.418 | 35.3478 | −15.9753 | 35.22733 | −15.8927 | 34.63638 |
| 62 | AST3A1_0010020818461204250064 | 11 | 5 | −15.8704 | 34.64128 | −15.953 | 35.23215 | −16.5102 | 35.11137 | −16.4274 | 34.5187 |
| 63 | AST3A1_0502110757481204250003 | 11 | 6 | −16.1791 | 34.51944 | −16.2653 | 35.10037 | −16.822 | 34.97366 | −16.7354 | 34.39097 |
| 64 | AST3A1_0311210758481204250048 | 12 | 1 | −14.1112 | 35.46677 | −14.1938 | 36.03548 | −14.751 | 35.91243 | −14.6682 | 35.3422 |
| 65 | AST3A1_0311210758561204250046 | 12 | 2 | −14.6456 | 35.34725 | −14.7284 | 35.91742 | −15.2856 | 35.79399 | −15.2026 | 35.22225 |
| 66 | AST3A1_0311210759051204250002 | 12 | 3 | −15.18 | 35.22732 | −15.2631 | 35.79899 | −15.8202 | 35.67517 | −15.7369 | 35.10185 |
| 67 | AST3A1_0311210759141204250044 | 12 | 4 | −15.7144 | 35.10694 | −15.7976 | 35.68019 | −16.3546 | 35.55594 | −16.2711 | 34.981 |
| 68 | AST3A1_0311210759231204250045 | 12 | 5 | −16.2486 | 34.98611 | −16.3321 | 35.56098 | −16.889 | 35.4363 | −16.8053 | 34.85967 |
| 69 | AST3A1_0311210759321204250002 | 12 | 6 | −16.7827 | 34.8648 | −16.8665 | 35.44136 | −17.4233 | 35.31623 | −17.3393 | 34.73785 |
| 70 | AST3A1_0605210757211204250030 | 13 | 1 | −14.1411 | 35.67342 | −14.2236 | 36.24219 | −14.7809 | 36.11919 | −14.6981 | 35.5489 |
| 71 | AST3A1_0605210757301204250031 | 13 | 2 | −14.6756 | 35.55395 | −14.7583 | 36.12418 | −15.3155 | 36.00083 | −15.2325 | 35.42902 |
| 72 | AST3A1_0605210757381204250032 | 13 | 3 | −15.21 | 35.43408 | −15.293 | 36.00583 | −15.85 | 35.88204 | −15.7668 | 35.30866 |
| 73 | AST3A1_0605210757471204250033 | 13 | 4 | −15.7443 | 35.31375 | −15.8275 | 35.88707 | −16.3845 | 35.76283 | −16.3011 | 35.18782 |
| 74 | AST3A1_0605210757561204250062 | 13 | 5 | −16.2785 | 35.19292 | −16.362 | 35.76787 | −16.9189 | 35.64323 | −16.8353 | 35.06652 |
| 75 | AST3A1_0605210758051204250065 | 13 | 6 | −16.8127 | 35.07165 | −16.8964 | 35.64829 | −17.4533 | 35.5232 | −17.3693 | 34.94474 |
| 76 | AST3A1_0511010802461301230002 | 4 | 6 | −11.8385 | 33.49053 | −11.9242 | 34.06832 | −12.4815 | 33.94466 | −12.3955 | 33.36558 |
| 77 | AST3A1_0511010802551301230002 | 4 | 7 | −12.3728 | 33.37068 | −12.4588 | 33.94971 | −13.0159 | 33.82564 | −12.9296 | 33.24527 |
| 78 | AST3A1_0511010803041301230002 | 4 | 8 | −12.9071 | 33.25036 | −12.9934 | 33.83067 | −13.5504 | 33.70618 | −13.4639 | 33.12446 |
| 79 | AST3A1_0511010803131301230002 | 4 | 9 | −13.4412 | 33.1296 | −13.5277 | 33.71126 | −14.0847 | 33.58631 | −13.9979 | 33.00319 |