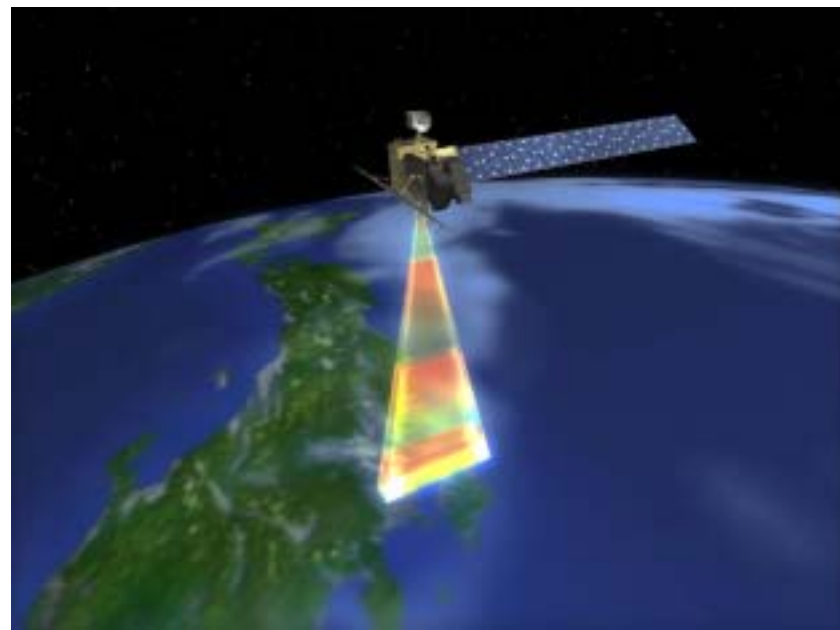
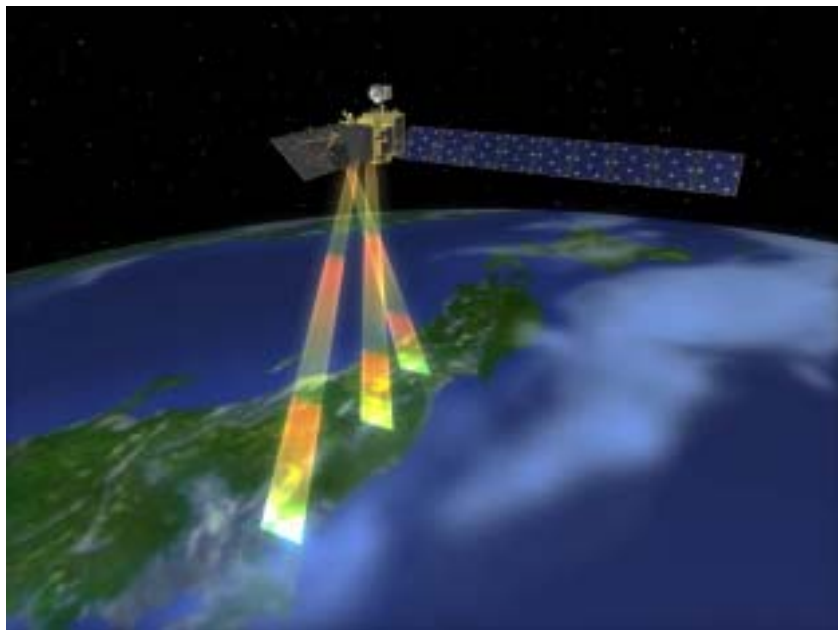


PRI SM and AVNI R-2 Information Update – Overview, Products, and Calibration/Validation Works –



T. Tadono, M. Shimada, A. Rosenqvist, M. Watanabe and H. Wakabayashi

Earth Observation Research Center, National Space Development Agency of Japan

Phone: +81-3-6221-9073, Fax: +81-3-6221-9113, E-mail: tadono@eorc.nasda.go.jp

■ **Introduction**

- Characteristics of PRISM and AVNIR-2

■ **Data Information**

- Definitions of product
- Development of the software to generate digital elevation model (DEM) using PRISM images

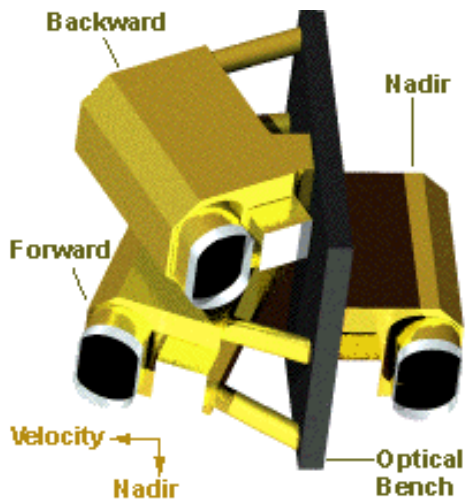
■ **Calibration and Validation**

- Target accuracies
- Calibration / Validation plan
- Mission operation scenario

■ **Summary**

ALOS Sensor - PRISM

Achromatic Remote-sensing Instrument for Stereo Mapping



0.52-0.77 μ m

Number of Optics : 3

(Nadir / Forward / Backward)

Base/Height ratio : 1.0 (F / B)

Spatial resolution : 2.5m at Nadir

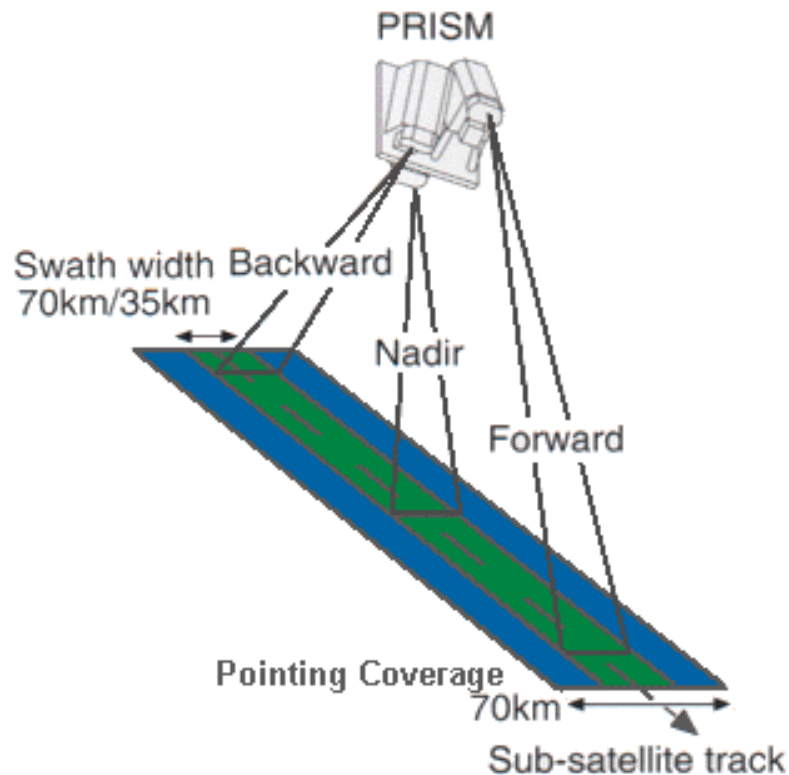
Swath width : 35km at Triplet mode
70km at Nadir only

Pointing angle : +/- 1.5 deg.

S/N : 70

Scanning method : Push broom

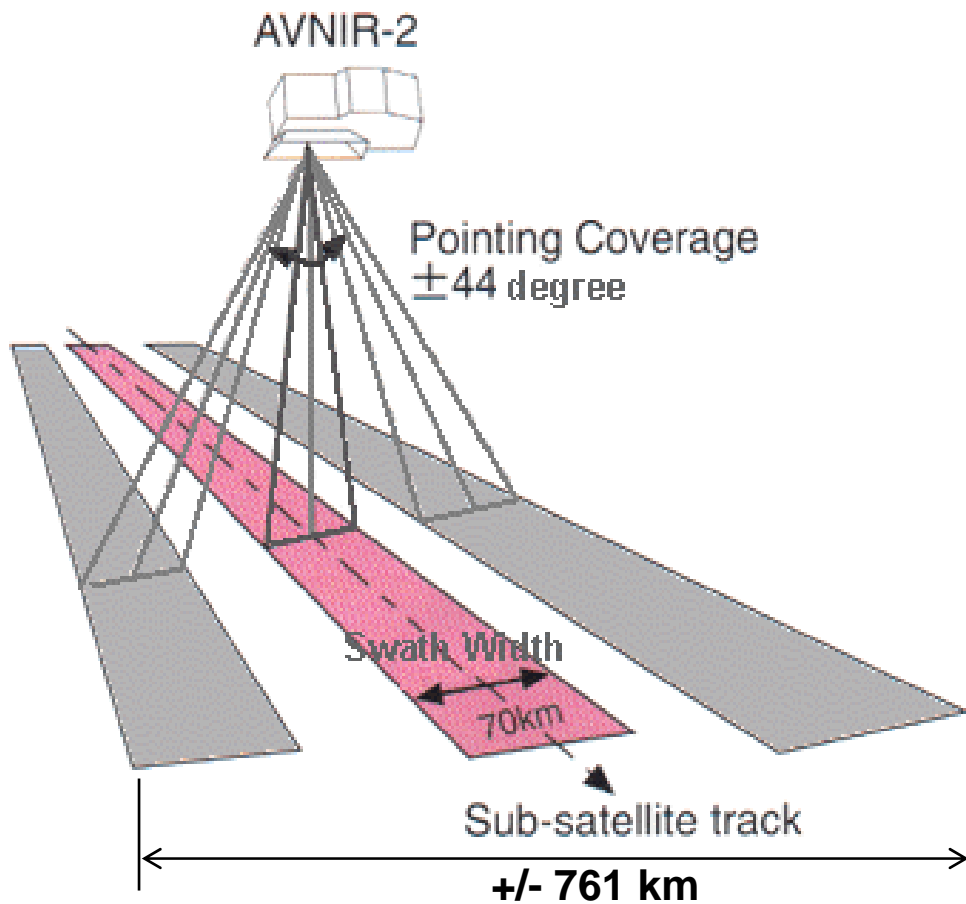
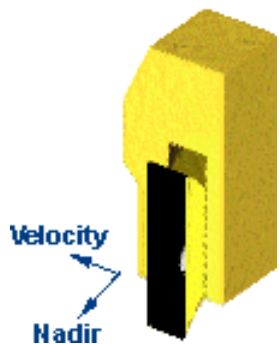
Quantization : 8 bits



❖ Two observation (+1.5 and -1.5 deg. pointing angle) per orbit are necessary for observing whole coverage by triplet mode except in high latitude areas.

ALOS Sensor - AVNIR-2

Advanced Visible and Near Infrared Radiometer type 2



Band 1 : 0.42-0.50 μ m

Band 2 : 0.52-0.60 μ m

Band 3 : 0.61-0.69 μ m

Band 4 : 0.76-0.89 μ m

Field of view : 5.8 deg.

Swath width : 70km at Nadir

Instantaneous FOV : 14.28 μ rad

Spatial resolution : 10m at Nadir

Number of detectors : 7000 /band

Pointing angle : +/- 44 deg.

S/N : 200

Scanning method : Push broom

Quantization : 8 bits

Definition of ALOS Data Products (1/2)

Standard Products : processed in Earth Observation Center (**EOC**), NASDA

AVNIR-2, PRISM – 1A : Uncorrected image, scene unit (Raw data)

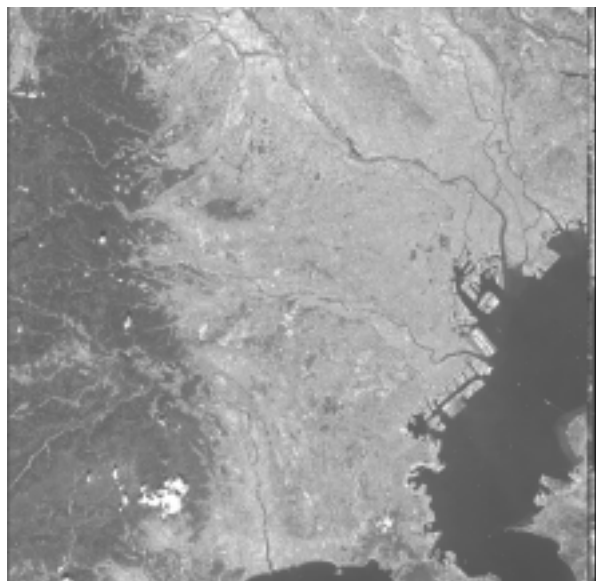
1B1 : Radiometrically corrected image

1B2 : Geometrically corrected image

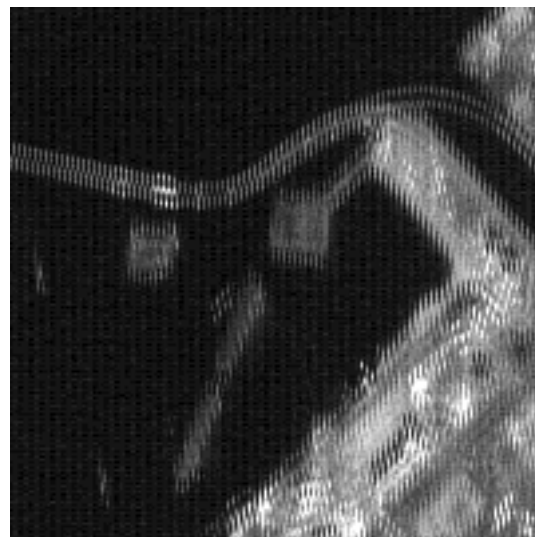
PALSAR – 1.0 : Uncorrected image, scene unit (Raw data)

1.1 : Single-Look Complex data on slant range (SLC)

1.5 : Multi look processed image (Amplitude)



10,000 pixel (80km)
ADEOS/AVNIR Pa image.



Example of Level 1A image.
(Stagger arrange, stripe noise)



Example of Level 1B1 image

Definition of ALOS Data Products (2/2)

High Level Products : will be generated at **EORC**.

PRISM : Digital Elevation Model (DEM) and Ortho-rectified image

AVNIR-2 : Ortho-rectified image

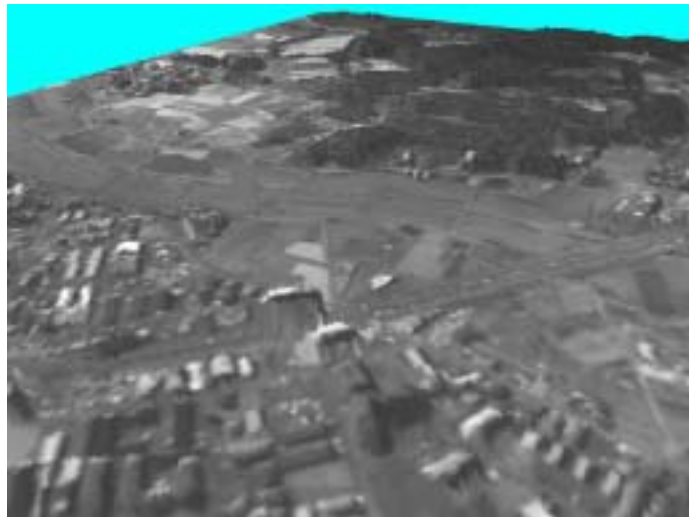
PALSAR : DEM by Interferometry, (and Ortho-rectified image)

Research Products (tentative) : will be produced at **EORC**.

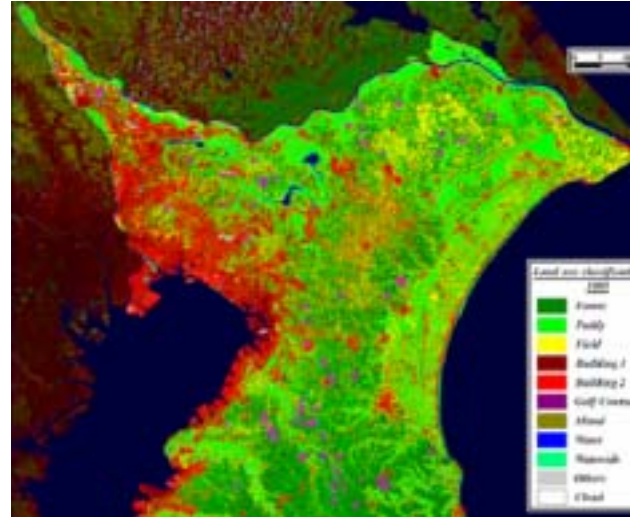
- Forest map, Deformation map, Biomass map, Sea-ice map, Soil moisture map, and Snow parameter map using **PALSAR** data
- Land-cover classification map, Albedo map, Vegetation map, Mountain and Glaciers map using **AVNIR-2** and **PRISM**



Simulated PRISM image by Free Line Scanner (TLS) image.

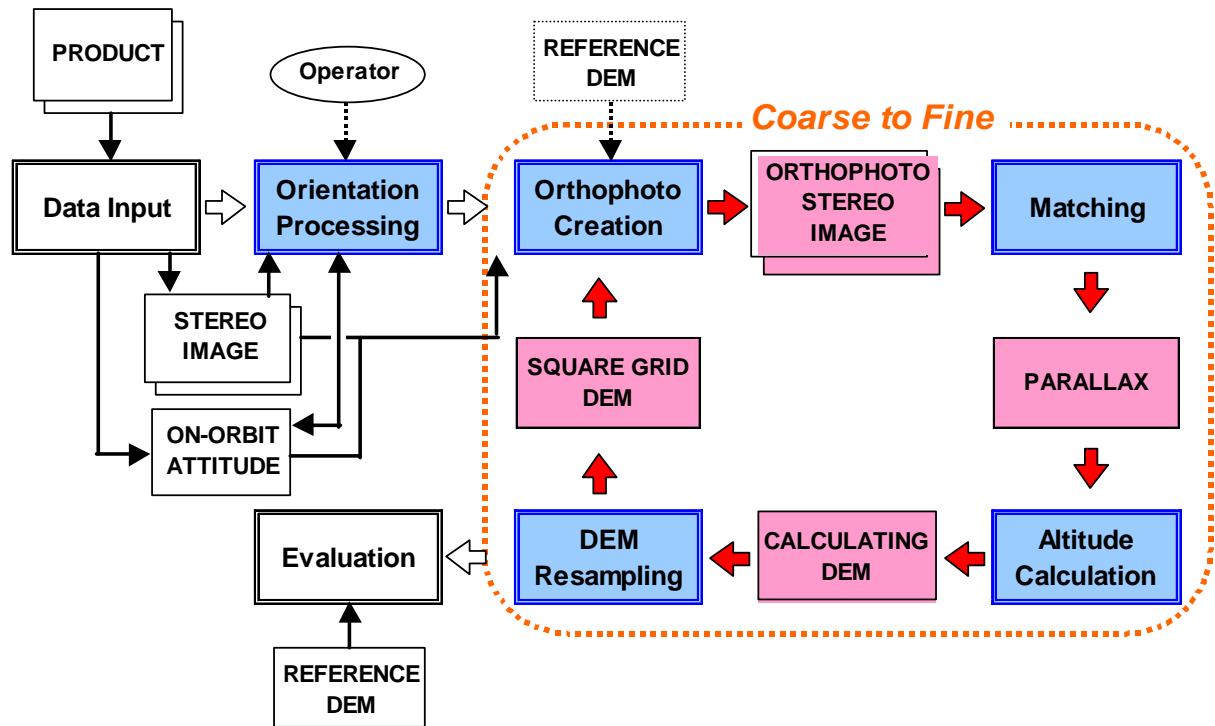


Bird's eye view using derived DEM from TLS images.



Example of land-cover classification Using Landsat/TM image.

DEM Generation Software by PRISM Triplet Images



Processing flowchart of DEM generation software using PRISM triplet images.

- ◆ **Input data** : 1A or 1B1 / Initial DEM and GCP (if available)
- ◆ **Triplet matching** : Semi-epipolar line estimation, aerial-based correlation matching, automatic window size optimization, and Coarse to fine (CTF)
- ◆ **Edit** : man-machine interface (MMI) for scheduling, setting the GCP, and correcting mismatching point
- ◆ **Mosaic** : to generate cloud-free DEM
- ◆ **Evaluation** : using GCP and reference DEM etc.
- ◆ **Output** : 10m/30m mesh DEM (UTM/PS), 500 scene/year will be generated

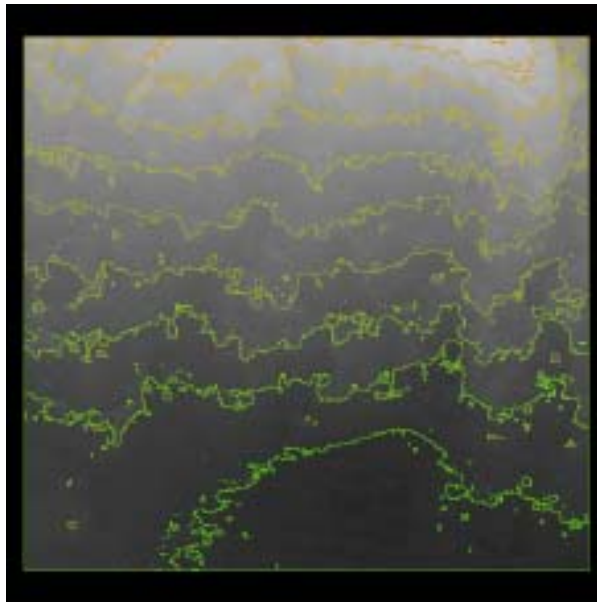
Study for Triplet Matching Algorithm

“Core” part for generating DEM

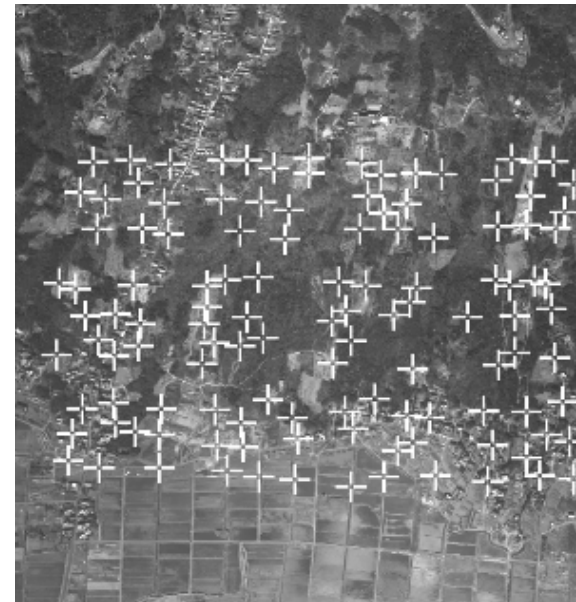
- PRISM simulated images from the Three Line Scanner (TLS) data onboard the helicopter.
 - ◆ One dimensional search along the semi-epipolar line
 - ◆ Triplet matching by aerial-based correlation matching
 - ◆ Automatic window size optimization



TLS data (nadir image)



Generated DEM



Evaluation point distribution

Evaluation of matching accuracy using 120 selected points

	Max.	Min.	RMS (pixel)
Nadir – Forward :	1.291	-1.321	0.390
Nadir – Backward :	1.081	-1.521	0.409

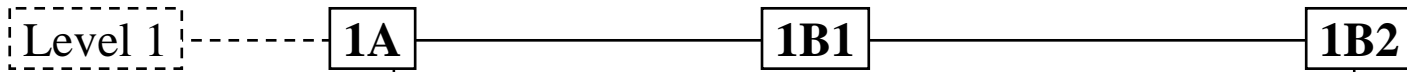
* Reference: J. Takaku *et al.*, IGARSS 2003

Target Accuracies of PRISM & AVNIR-2

PRISM	Radiometric Accuracy	Geometric Accuracy
1B2	Relative 5% (1) Absolute 10% (1)	+/- 6.0m (3) with Precise Pointing and Geolocation Determination System (PPGDS)
DEM	Attitude 5.0m (1)	Horizontal 2.5m (1) with PPGDS
Ortho-rectified image		Horizontal 5.0m (1) For nadir image
AVNIR-2	Radiometric Accuracy	Geometric Accuracy
1B2	Relative 5% (1) Absolute 10% (1)	+/- 283.7m (3), without GCP +/- 7.7m (3), with GCP at 0deg. of pointing angle
Ortho-rectified image		Horizontal TBD (1)

PRISM Calibration / Validation Plan

Data flow



Work flow

Geometric Calibration

- Relative alignment between CCD
- Pointing/attitude
 - ✓ Determination accuracy
 - ✓ Stability
 - ✓ Control accuracy
- Geometric correction accuracy

Establishing ground control point (GCP)

Sensor model

Aim to geometrical accuracy of 1B2

Rational Polynomial Camera (RPC) model

Stereo pair

Absolute orientation

Relative orientation

Matching

Absolute DEM

Relative DEM

Radiometric model

Image quality evaluation

- MTF, S/N
- Lossy, JPEG extension
- Matching accuracy
- Co-registration with AVNIR-2

Radiometric Calibration #1

- Evaluation of cal. mode data
- Stripe
- Linearity
- Offset and slope
- Relative accuracy between optics

Radiometric Cal. #2

- Absolute calibration

Aim to radiometric accuracy of 1B2

Cooperation with;

- ◆ AVNIR-2 for radiometric calibration and geometric calibration at nadir, and
- ◆ The Precise Pointing and Geolocation Determination System (PPGDS) for satellite position and attitude evaluations.

Summary

We introduced NASDA/EORC activities for ALOS project in particular,

- 1) PRISM and AVNIR-2 overviews, definition of products,
- 2) introduction of DEM generation software using PRISM, and
- 3) current plans of sensors calibration and products validation.

Almost of them are now considering. We will inform you them after decided on EORC web site as follows;

➤ **EORC/ALOS** : <http://www.eorc.nasda.go.jp/ALOS/>

For general information,

➤ **ALOS Project** : <http://alos.nasda.go.jp/>

➤ **HQ/Topics** : <http://www.nasda.go.jp/sat/alos/>

➤ **EOC/ALOS** : http://www.eoc.nasda.go.jp/guide/satellite/satdata/alos_e.html

