

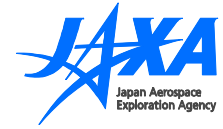
Agency Report of JAXA, Japan - Cal/Val Plan for ALOS -

9 November 2005

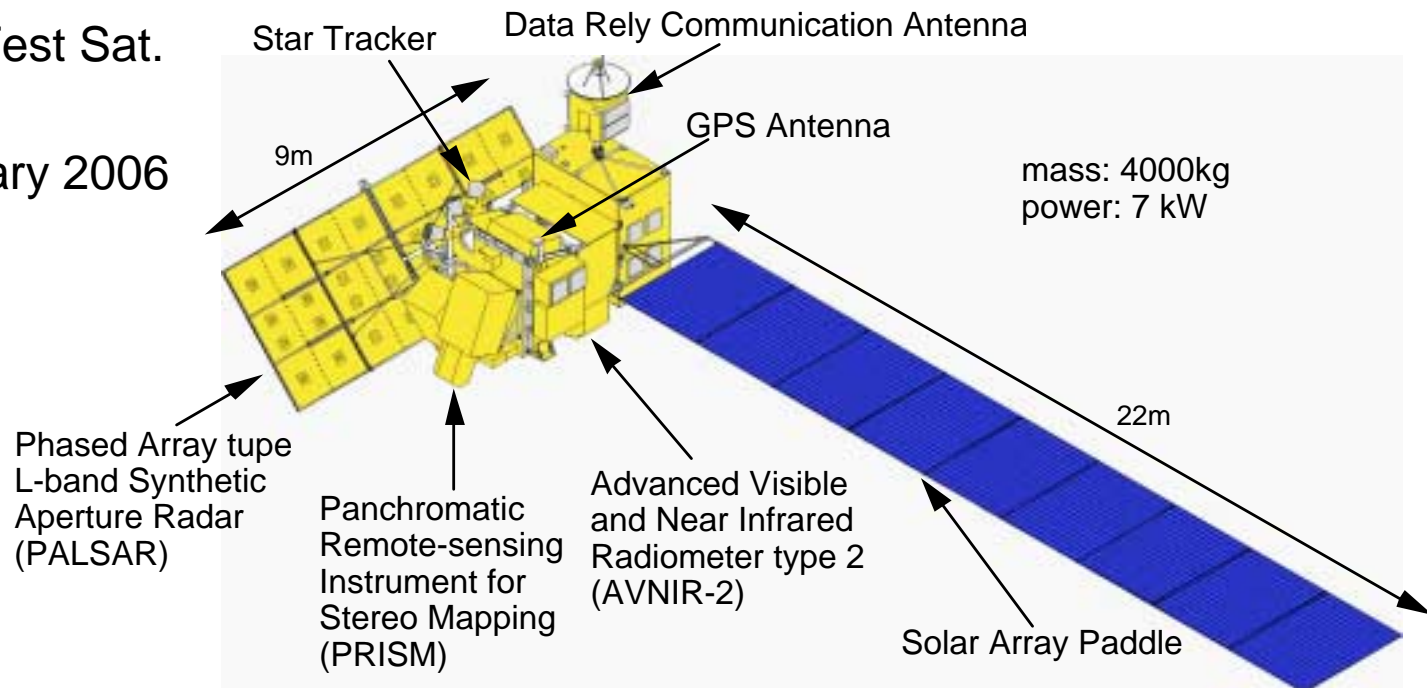
CEOS WGCV #24 @ESA/ESRIN, Frascati, Italy

Kazuo OHTA
JAXA/EORC

Advanced Land Observing Satellite -ALOS-



- JAXA's High-Resolution Earth Observing Satellite
- Mission
 - Generation of Maps (1/25,000)
 - Regional Environment Monitoring
 - Disaster Management Support
 - Resources Survey
- High-resolution (2.5m: PRISM)
- Global data collection by Data Relay Test Sat.
- 4ton, 7kW
- Launch in January 2006

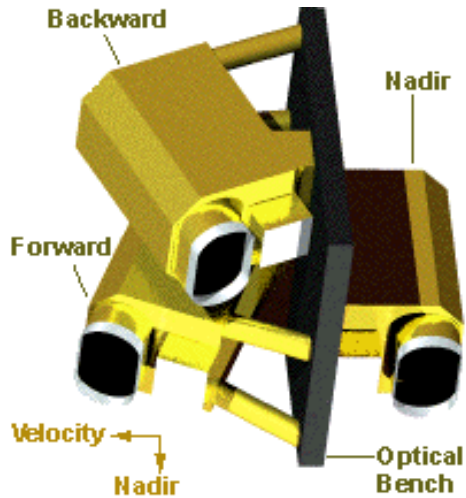


ALOS Characteristics

Orbit	sun-synchronous
Local Time at DN	10:30 \pm 15min.
Altitude	691.65km
Inclination	98.16 degrees
Period	98.7 minutes
Recurrent Period	46 days (Sub-cycle: 2 days)
Longitude Repeatability	+/-2.5km @Equator
Data collection	1 DRTS (Data Relay Test Sat.) + DT (X-band direct downlink)
Yaw steering	ON / OFF
Attitude error each axis	2.0e-4°(det), 0.1°(maintain)
Weight	4000 Kg



Panchromatic Remote-sensing Instrument for Stereo Mapping



0.52-0.77 μ m

Number of Optics : **3**, AT +/- 23.8 deg
(**Nadir / Forward / Backward**)

Base/Height ratio : 1.0 (F / B)

Spatial resolution : **2.5m at Nadir**

Swath width : **35km at Triplet mode**

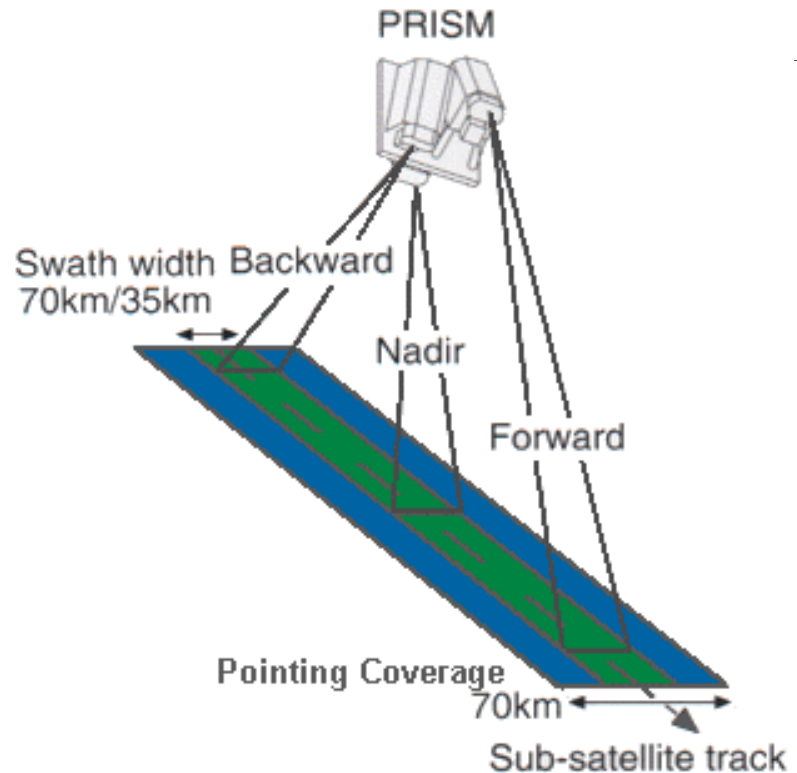
70km at Nadir only

Pointing angle : +/- 1.2 deg.

S/N : >70, MTF : >0.20

Scanning method : Push broom

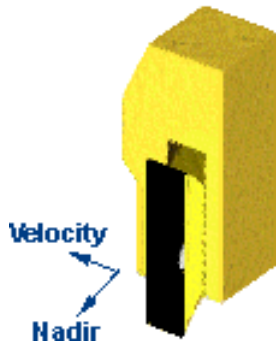
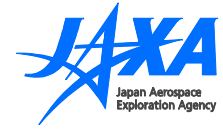
Quantization : 8 bits



❖ **Two observation (+/-1.2 deg. pointing angle) per orbit are necessary for observing whole coverage by triplet mode except in high latitude areas.**

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**

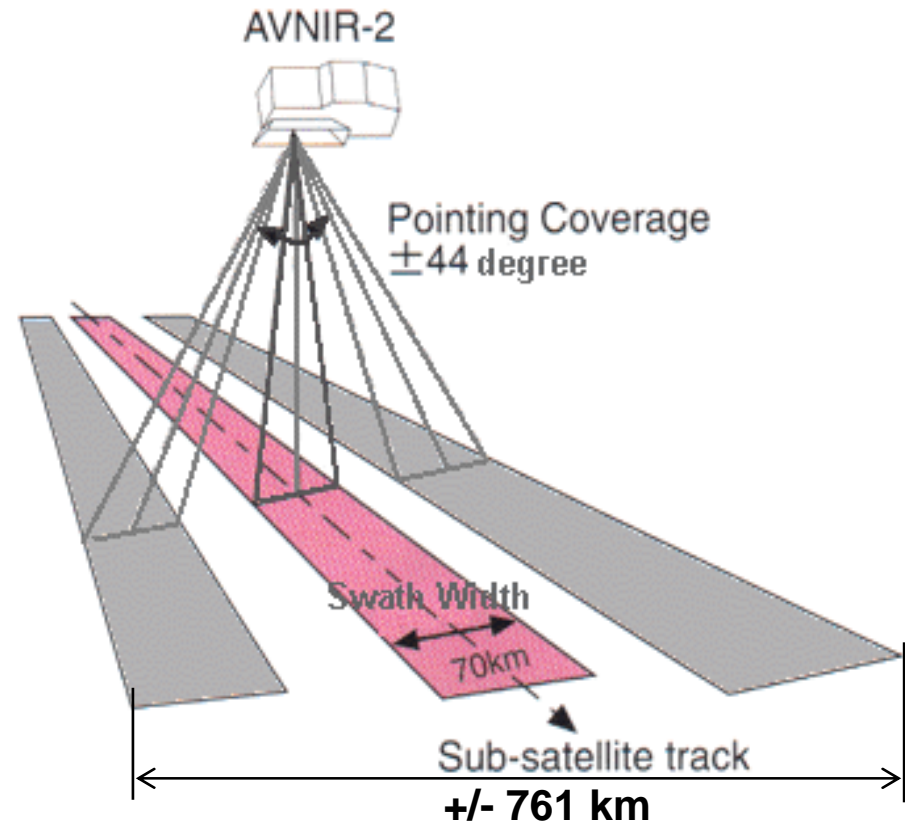
Number of detectors : 7000 /band

Pointing angle : **+/- 44 deg.**

S/N : >200, MTF : >0.25 (1-3), >0.20 (4)

Scanning method : Push broom

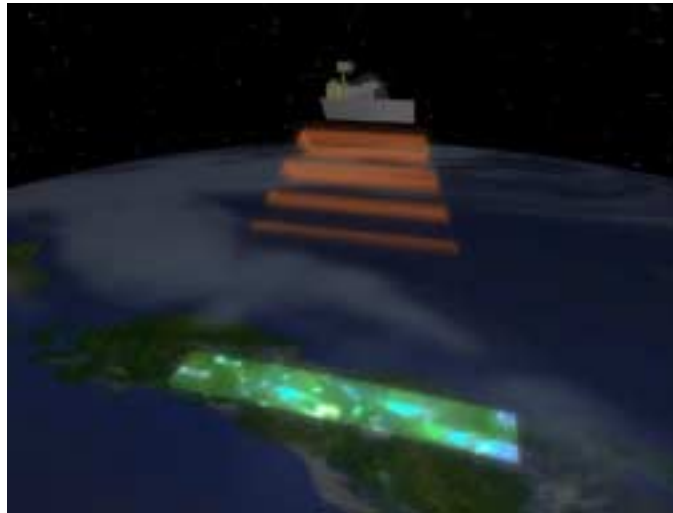
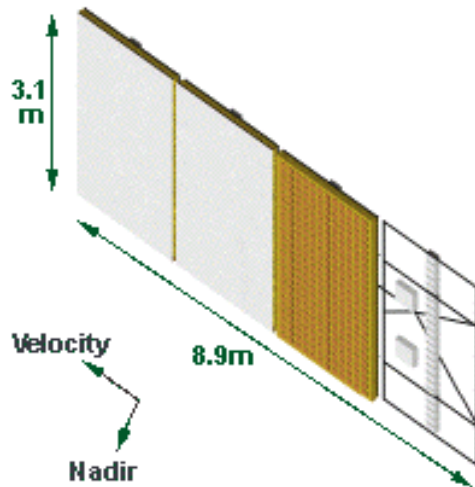
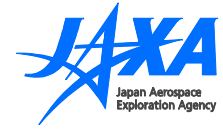
Quantization : 8 bits



- ❖ **Improvements in AVNIR-2 from AVNIR**
- ✓ **Resolution : 16 -> 10m**
- ✓ **Pointing angle : +/-40 -> +/-44 deg**
- ✓ **Calibration system : lamp 1, Solar 1 -> lamp 2**

PALSAR

Phased Array type L-band Synthetic Aperture Radar



L-band (1.27GHz)

Fine Resolution Mode

8.0-60.0 deg.

HH or VV / HH+HV or VV+VH

7.0-44.3m / 14.0-88.6m

40-70km / 40-70km

ScanSAR Mode

18.0-43.0 deg.

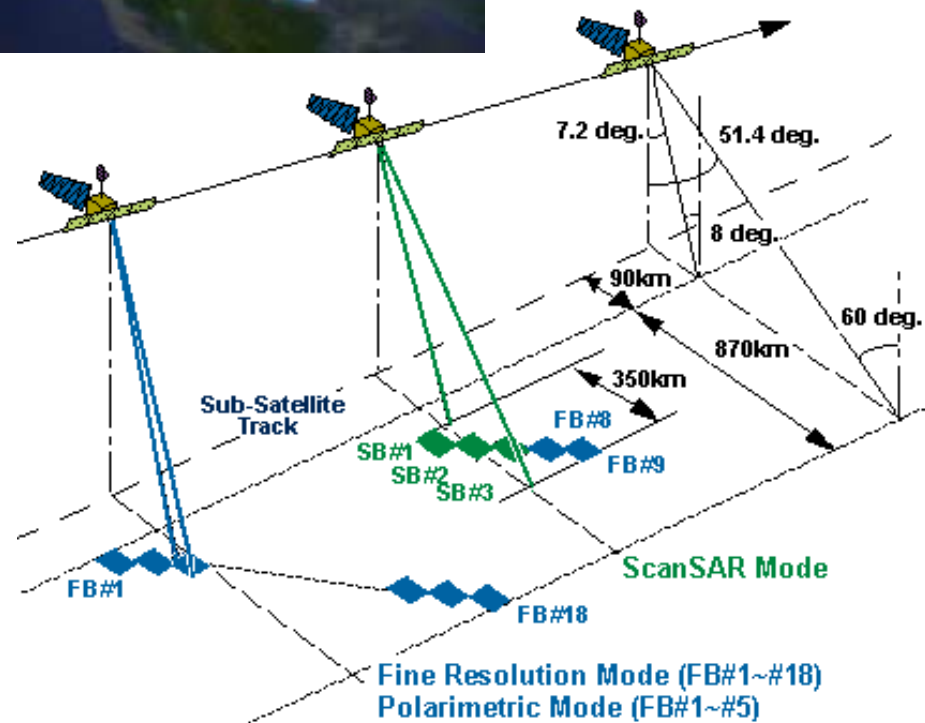
HH or VV / 100m / 250-350km

Polarimetric Mode

8.0-30.0 deg.

HH + HV + VH + VV

24.1-88.6m / 20-60km



Definition of Products – *PRISM* & *AVNIR-2*

Standard Products : @Earth Observation Center (**EOC**), JAXA

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

1B1 : Radiometrically corrected image

1B2 (1B2R/1B2G) : Geometrically corrected image

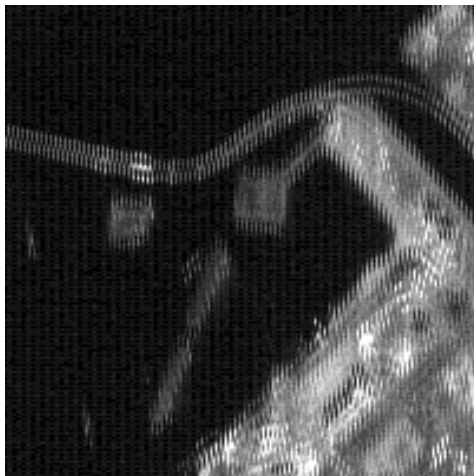
High Level Products : @Earth Observation Research & application Center (**EORC**), JAXA

PRISM : Digital Surface Model (DSM) and Ortho-rectified image

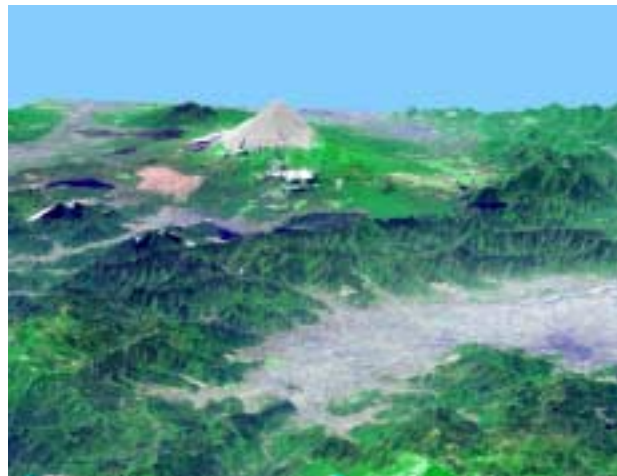
AVNIR-2 : Ortho-rectified image

Research Products (tentative) : @**EORC**.

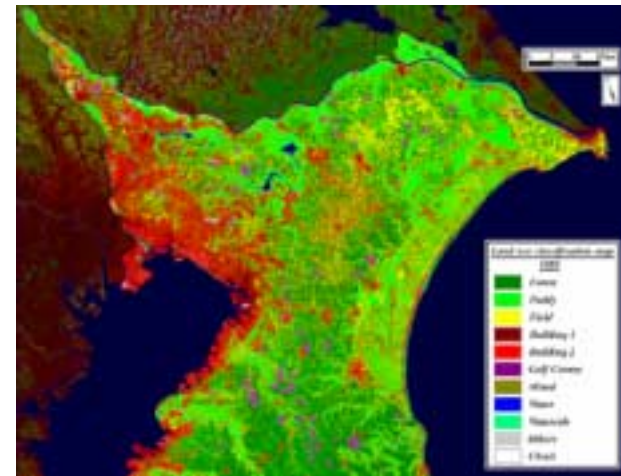
-LULC classification and vegetation, Albedo, Mountain and Glacier, Pan-sharpened image using **AVNIR-2** and **PRISM**, and Scene-DSM by **PRISM**



Example of AVNIR-2 1A.
(Stagger arrange)

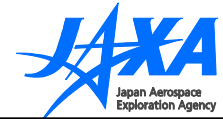


Mt. Fuji's DSM derived by
JERS-1/OPS stereo.



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

Target Accuracies – *PRISM* & *AVNIR-2*



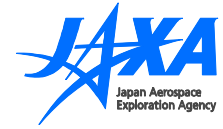
PRISM	Radiometric Accuracy	Geometric Accuracy
1B2	Relative 5% (1σ) Absolute 10% (1σ) Altitude 5.0m (1σ)	6.0m (3σ) with Precision Pointing and Geolocation Determination System (PPDS)
DSM *1 Relative/Absolute	(No obstacle area 5.0m (LE90)) Horizontal 2.5m (1σ) with PPDS and Relative/Absolute orientation	
Ortho-rectified image	Horizontal 5.0m (1σ) For nadir image	

AVNIR-2	Radiometric Accuracy	Geometric Accuracy
1B2	Relative 5% (1σ) Absolute 10% (1σ)	283.7m (3σ), without GCP *2 7.7m (3σ), with GCP at 0deg. of pointing angle
Ortho-rectified image	Horizontal 10m (1σ) at 0deg. of pointing angle	

*1 Digital Surface Model

*2 including 266m of pointing angle setting accuracy

PALSAR Products



Level Name		Contents
1.0	Raw	Raw+orbit+telemetry
1.1	Single look complex	4 bytes IEEE(I+Q) +Ancillary
1.5	Amplitude	2 byte Integer+Ancillary

Data volumes : min.~max./34.3 degrees/41.5degrees
Level 1.0 383.8MB~847M/772.4~816/800~847
1.1 ~
1.5 160~280M (6.25m)/40~71M(12.5m)

Data volume per day
450GB~315GB
1500~1050 scenes

Accuracy Goal and achievement (PALSAR)

Products	Accuracy Goal		Validation method
Standard Products 1.0 1.1 1.5	Geometry Radiometry	200 m 1.5 dB (abs.) 1.0 dB (relative) 5° (phase)	CR, ARC's location Validation CR, ARC Amazon
High level Ortho rectified DEM	geometry Radiometry	50 m (horizon) 30 m (vertical) 1.5 dB(ext. layover)	CR,ARC's location GCP,DEM Validation CR,ARC
Research Product Deformation Forest map Soil moisture Snow map Biomass Sea Ice	Geometry Radiometry	100 m 1.5 dB 5mm	Landsat images Amazon images GPS's positions

CR: Corner Reflector ARC: Active Radar Calibrator GCP: Ground Control Point

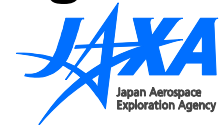
Calibration of PALSAR modes

Out of PALSAR's 132 modes, the following 6 (7) will be calibrated with high priority.

Mode	pol.	incidence angle	data rate
FBS(28MHz)	HH	21, 34, 41 degrees	240 Mbps
FBD(14 MHz)	HH+HV	41 degrees	240 Mbps
DIRECT(14)	HH	41	120 Mbps
SCANSAR	HH	5 SCANS	120 Mbps
Polarimetry	HH+HV+VH+VV	21 degrees	240 Mbps

6(7) modes

PALSAR Processor updates plan :contents and timing



Geometric parameters : ideally one for all modes.

- Azimuth time shift(s):

- Range time shift (s):

Radiometric parameters:

- Antenna elevation patterns (6 basic modes, new functions or updates)

- Antenna azimuth patterns (SCANSAR)

- Calibration factors (finally 1 parameter, independence of mode)

- Distortion matrices (polarimetry)

Interference filter

- Criteria change (currently 2 dB applied)

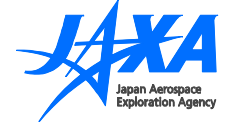
Attenuators' info.: will not be updated.

Timing:

- Several times in commissioning phase

- 2~3 times in initial calibration phase

Satellite schedule after the launch



Launch late Dec. (Y=0)

0 Rev.

Solar Paddle deployment

14 Rev.

Data Relay Antenna deployment

29, 30 Rev.

PALSAR deployment

Y+3

GPS receiver starts

Y+12 (TBD)

GPS time system ON

Y+39

High precision attitude system ON

Y+75

Yaw steering ON

Bus check

First month

Mission sensor check

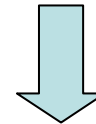
Second month

System operation1

First 2 weeks of third month

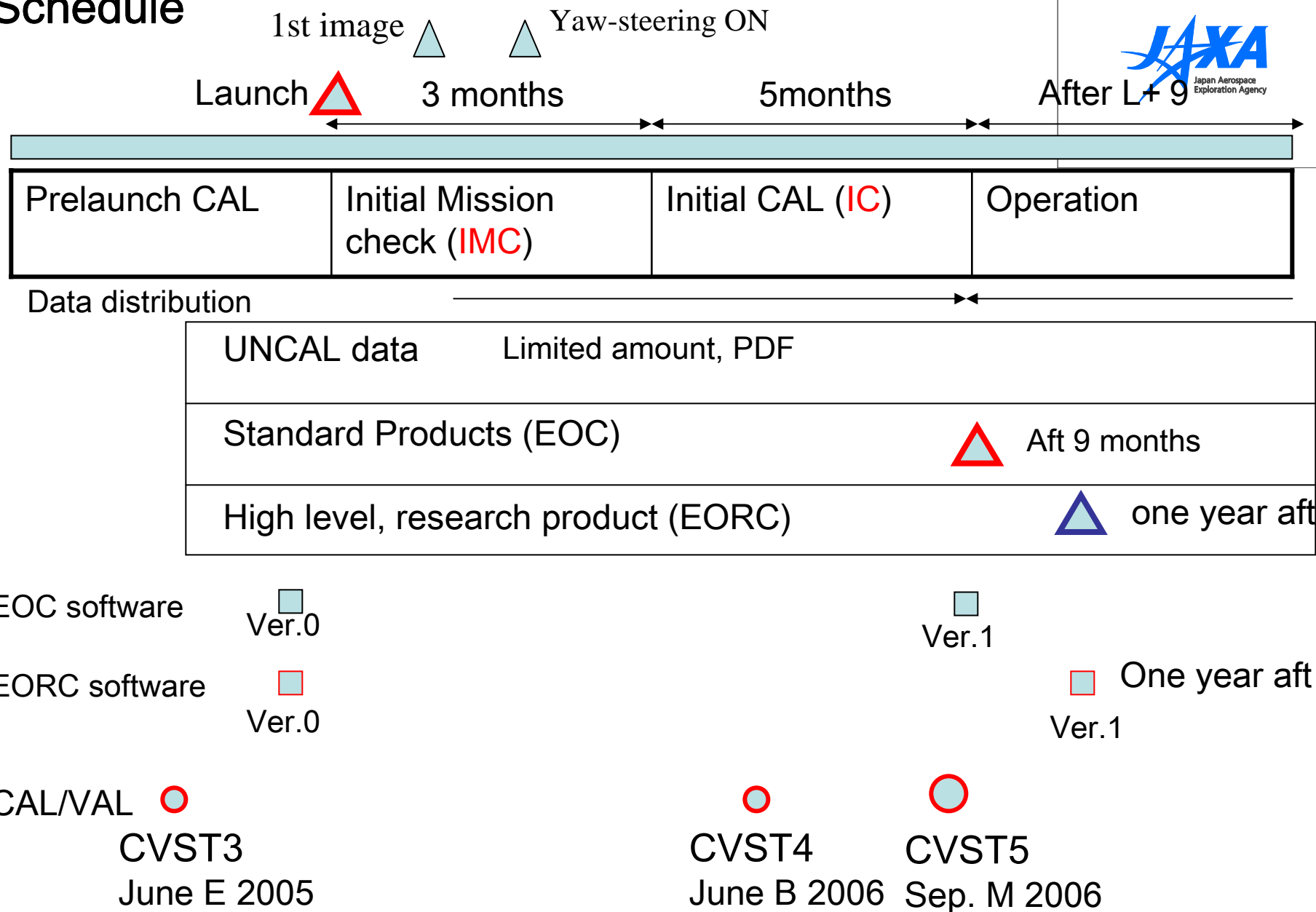
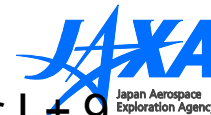
System operation2

Second 2 weeks of third month



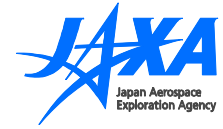
Possible to observe
Cal. test sites

Schedule



Launch : Late January 2006 (TBD)

Cal/Val & Science Team (CVST) #4



Objectives: Joint effort of JAXA and selected Cal/Val PIs for the assessment of the initial calibration results.

Roles:

JAXA: Updating the cal/val results between Y+0 ~ Y+5m

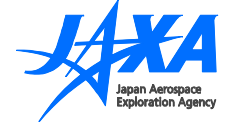
Selected Cal/Val PIs: Evaluating the initially calibrated data, commenting for the image improvement.

Place: EORC/JAXA

Dates: Early June 2006 (2~3 days)

Goals: Feedback to step forward, and check acquisition and distribution of the PIs' test sites data from JAXA/EORC.

CVST#5



Objectives: Assessment of the initial calibration, and final judgment for proceeding to the operation phase.

Roles:

JAXA: Summarizing the cal/val results between Y+0 ~ Y+8m

Selected Cal/Val PIs: Evaluating all the calibrated and uncalibrated data obtained through the cal/val phase, and reporting the results.

Place: EORC/JAXA

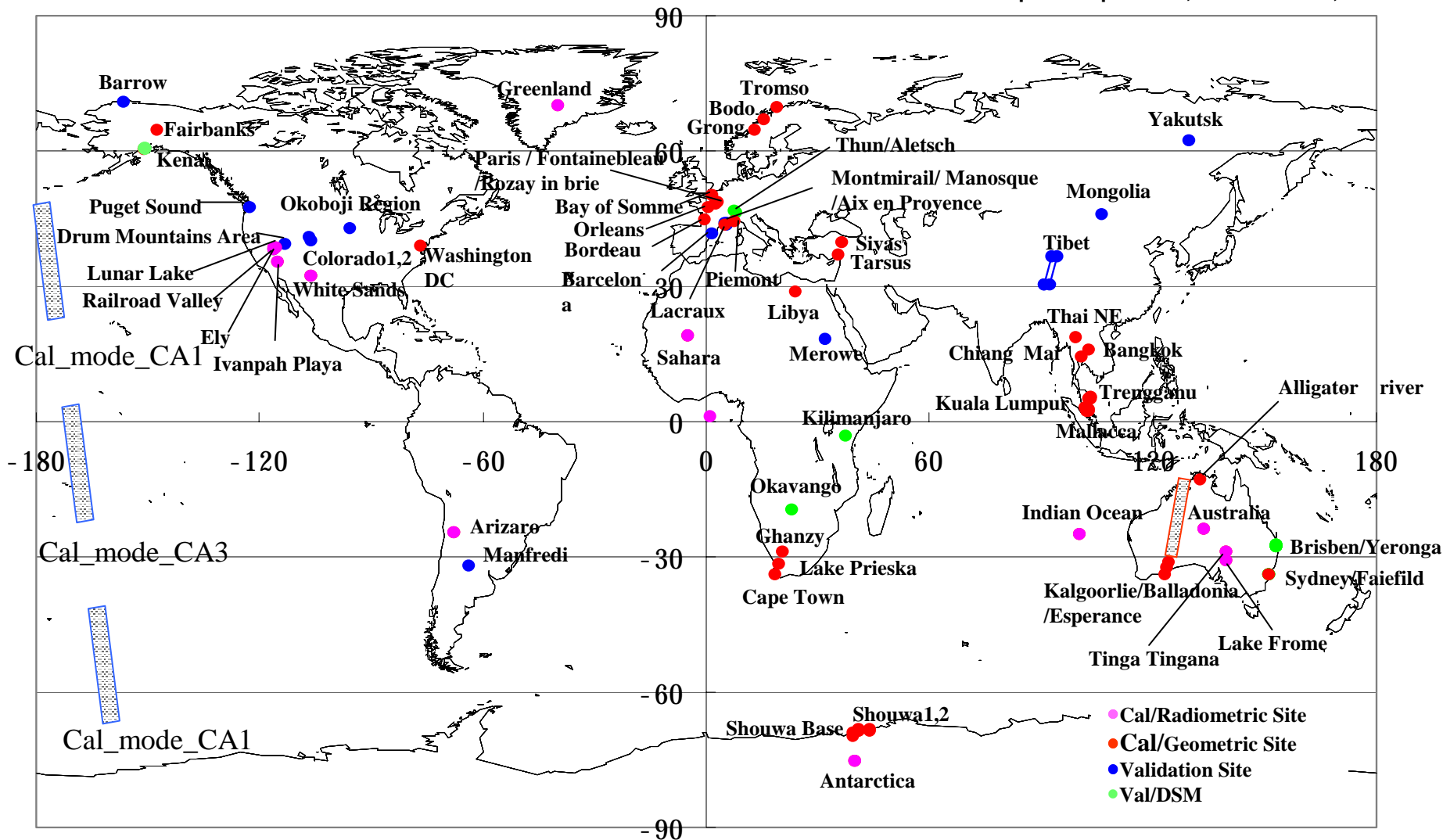
Dates: Mid September 2006 (2~3 days)

Goals: To successfully step forward to the operation phase.

Cal/Val Test Sites for PRISM & AVNIR-2



Except for Japan area, As of June 10, 2005

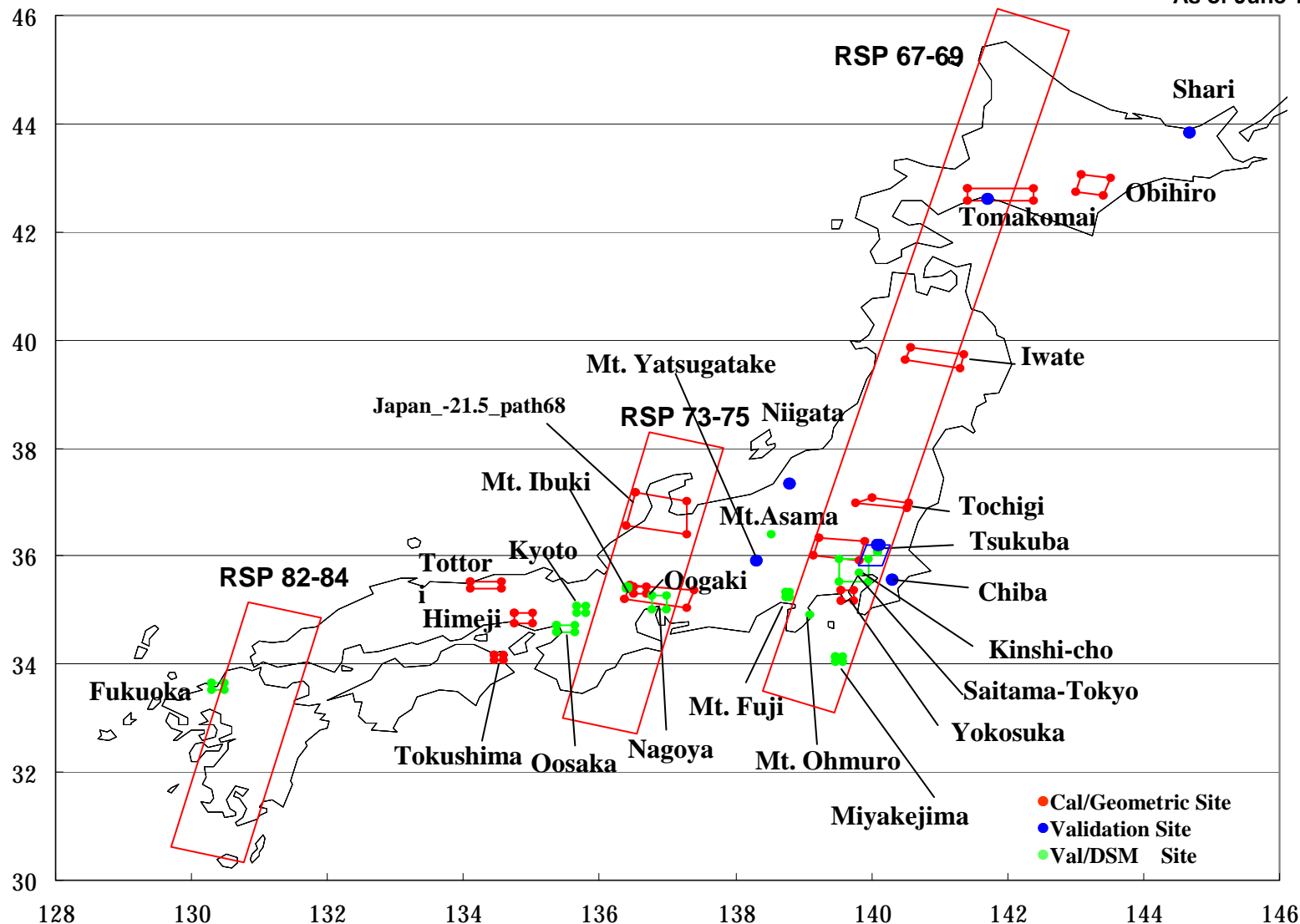


Location of Cal/Val Test Sites for PRISM and AVNIR-2 in the world.

Cal/Val Test Sites for PRISM & AVNIR-2



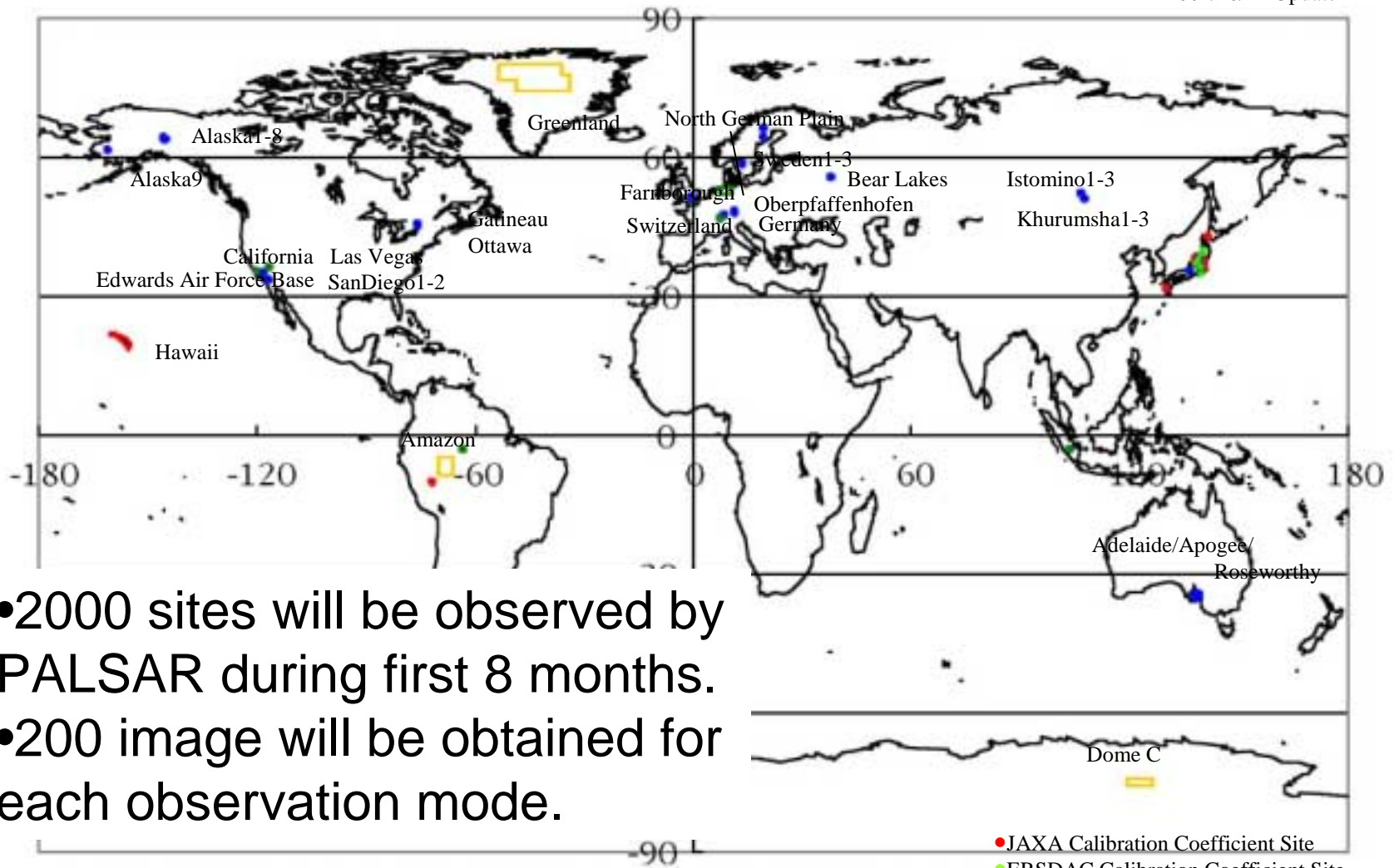
As of June 10, 2005



Location of Cal/Val Test Sites for PRISM and AVNIR-2 in Japan.

PALSAR calibration site

2004/10/12 Update



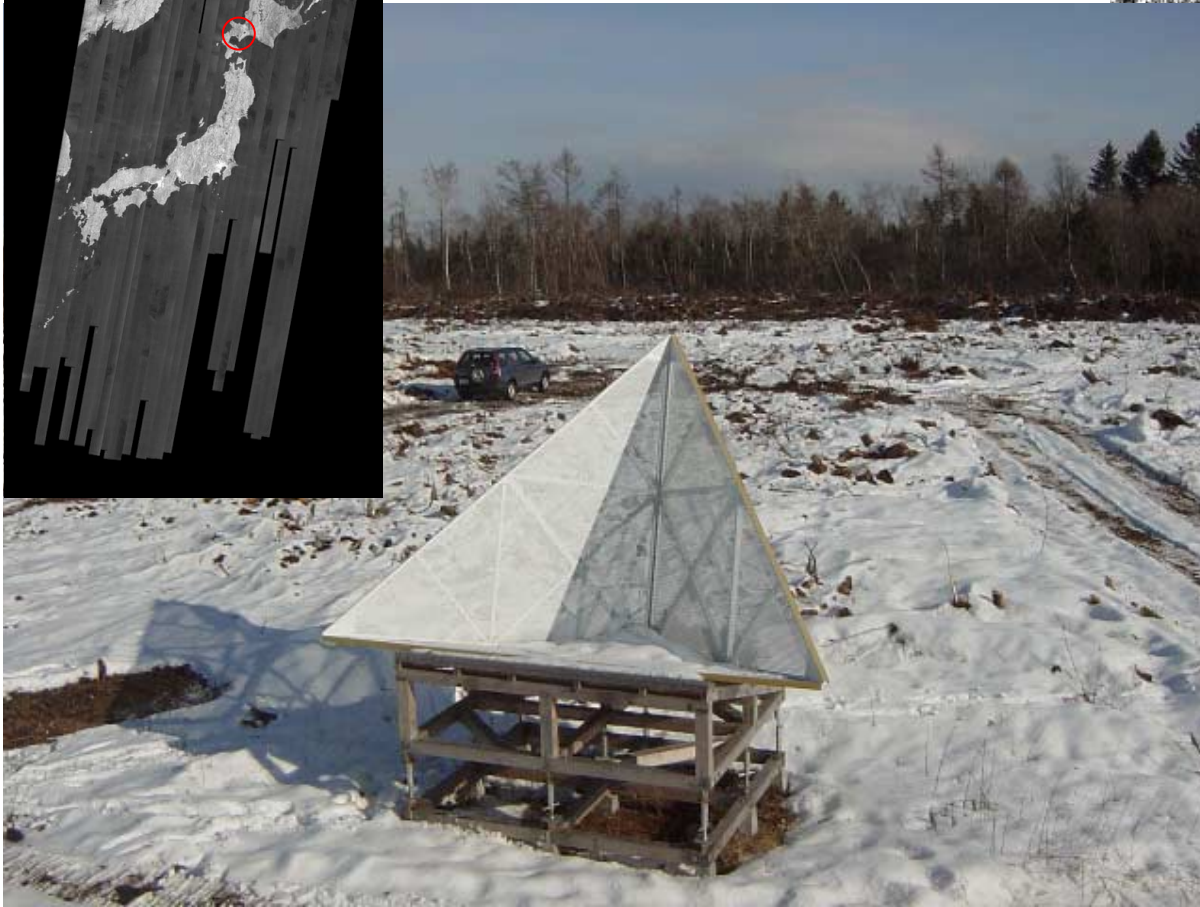
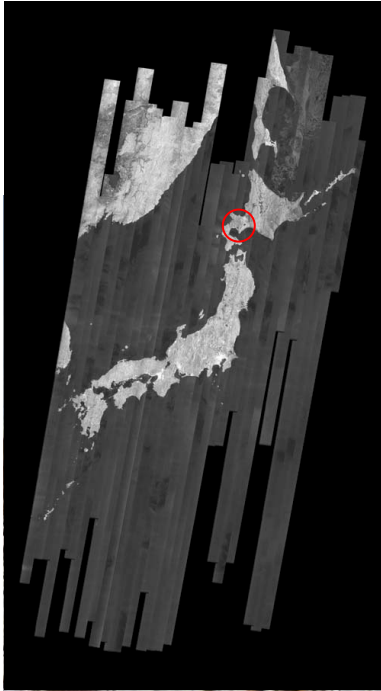
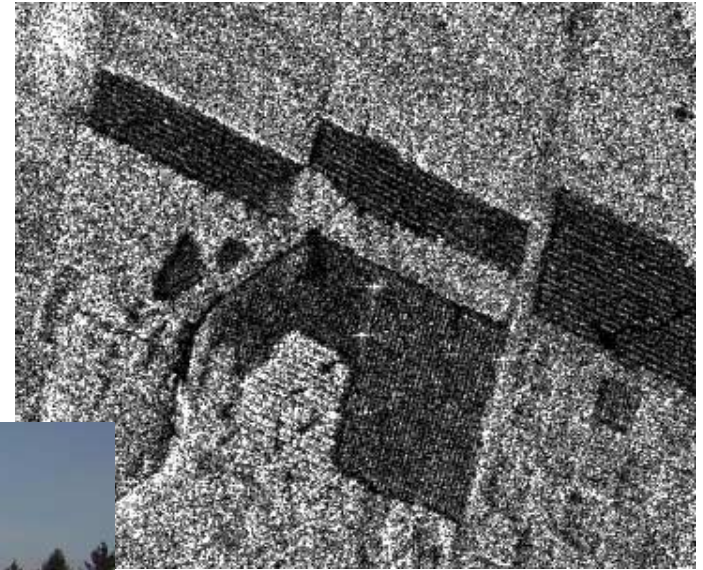
- 2000 sites will be observed by PALSAR during first 8 months.
- 200 image will be obtained for each observation mode.

PALSAR Calibration Site(World)

- JAXA Calibration Coefficient Site
- ERSDAC Calibration Coefficient Site
- Cal-PI Calibration Coefficient Site
- Antenna Pattern Site
- Cal-Theme PI Calibration Site

Tomakomai-Calibration Site

Hokkaido, Japan
Pine, managed Forest



3m trihedral CRx2

1 - descending

1 - ascending

38 dBm2

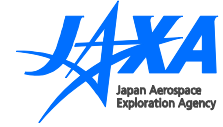
lat :42.6(deg)

lon:141.7 (deg)

height:

All the PALSAR modes

For More Information – ALOS Web Sites



For Cal/Val, research, application and science,

- **EORC/ALOS** : Example of data utilization, RA, K&C, and the technical documents
<http://www.eorc.jaxa.jp/ALOS/index.htm>

For satellite and sensors development status,

- **ALOS Project Team** :
<http://alos.jaxa.jp/index-e.html>

For data search and general information,

- **EOC/ALOS** : Data search using Alos User Interface Gateway (AUIG) after launch
http://www.eoc.jaxa.jp/satellite/satdata/alos_e.html
- **HQ/Topics** : General information
http://www.jaxa.jp/missions/projects/sat/eos/alos/index_e.html

