JAXA's plan for creation of the high resolution L-SAR mosaic classification for monitoring the forest carbon changes using the JERS-1 to ALOS

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GEO SIT

Background of the project

Forest change and its global monitoring from the space is the issue for the global environmental monitoring.

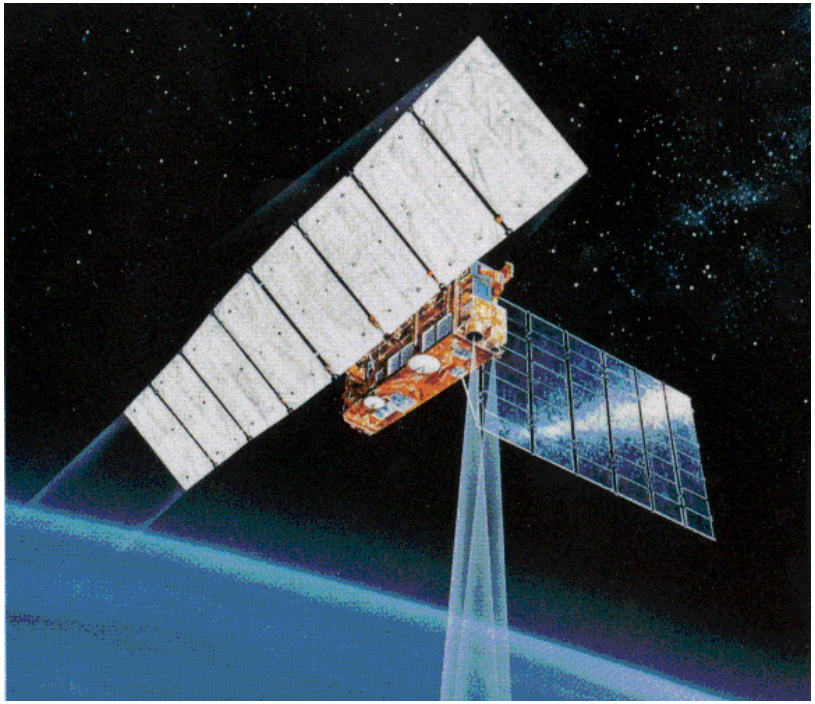
JAXA continues the satellite program from 1990s using the L-band SAR: JERS-1 (1992~1998), ALOS (2006~).

JERS-1/ALOS science project watches the forest.

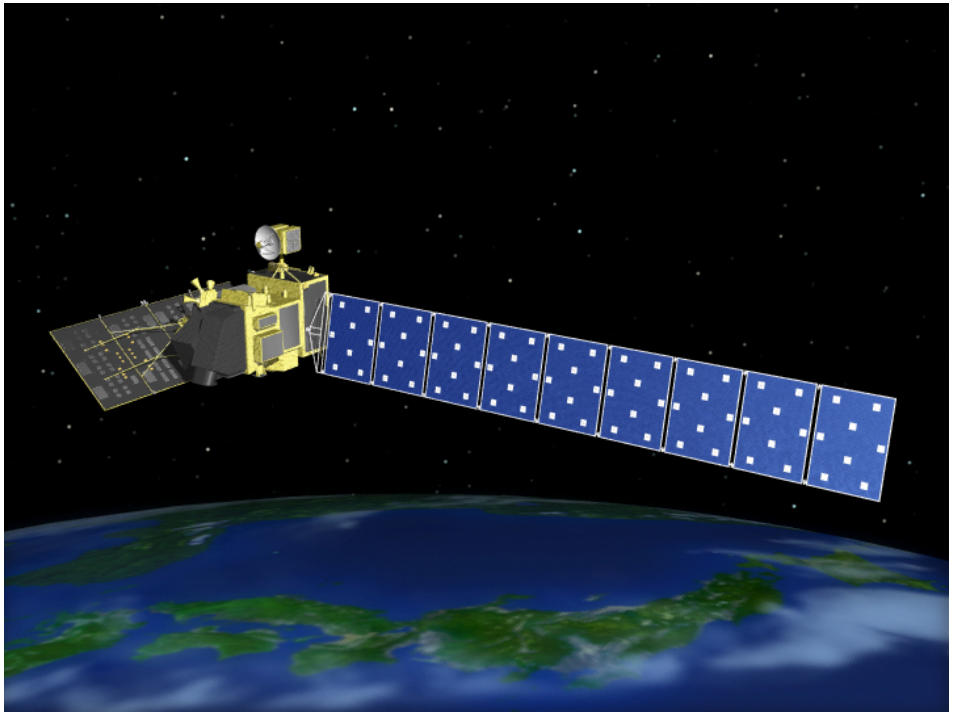
Global worming and estimation of the terrestrial carbon

L-band SAR global data archives : 1992~

Large archives available for the global forest change monitoring.

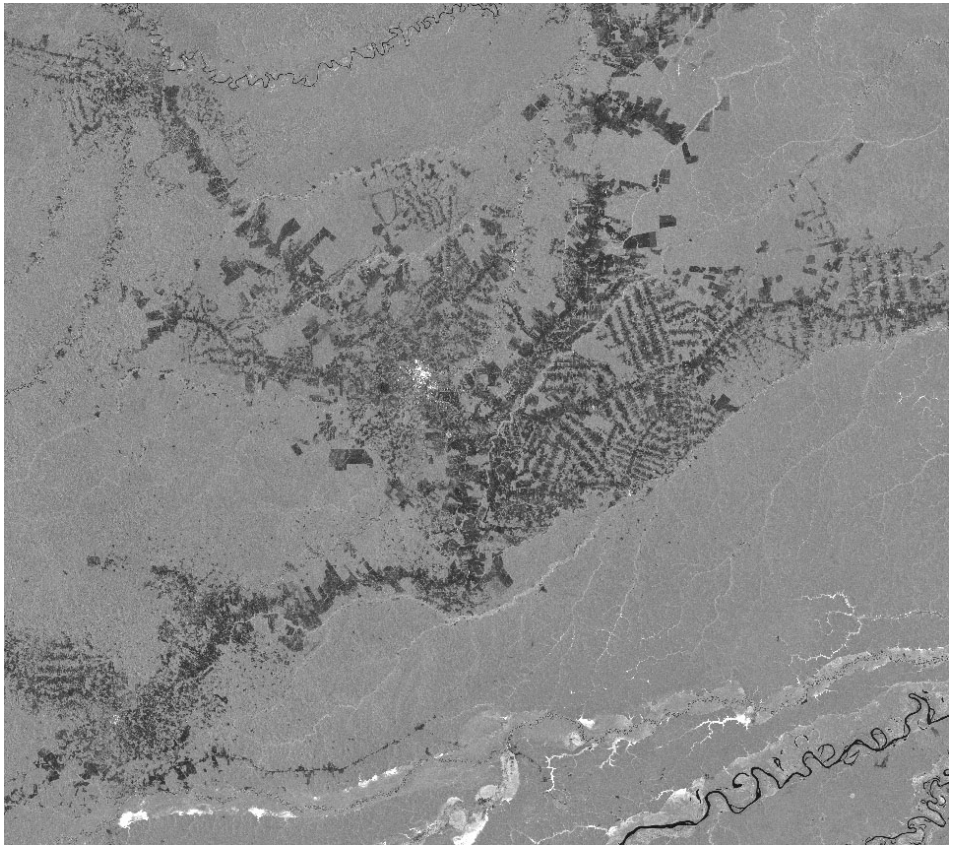


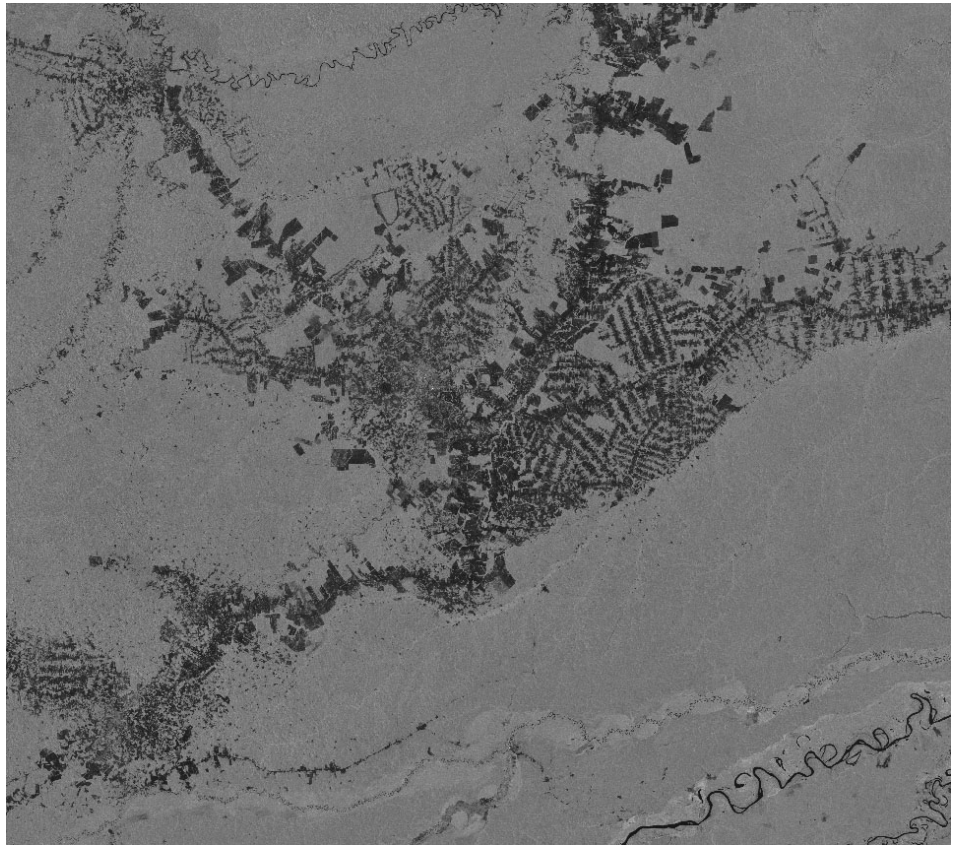
JERS-1
1992~1998
L-HH



ALOS
2006~
L-HH-HV-POL-ScanSAR

２．アマゾン地域の経年変化(Land cover change of Amazon for 14 years)
２．３ RioBrancoの経年変化(PALSAR, 2009年、左画像HH: 右画像:HV)

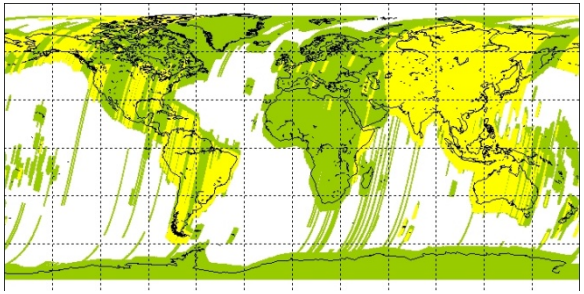




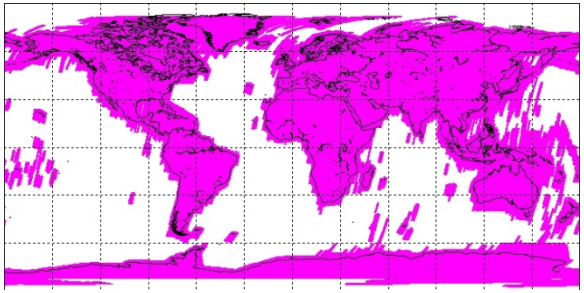
Mission Planning Status

<Observation Result>
(May 16, 2006 – Sep. 30, 2009)

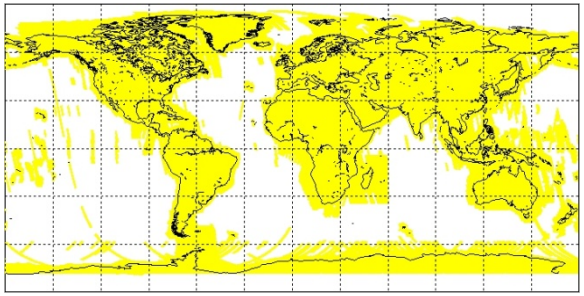
PRISM: 1,850,000 scenes (450k scenes increased from the prev. report)
AVNIR-2: 840,000 scenes (210k scenes increased from the prev. report)
PALSAR: 1,380,000 scenes (280k scenes increased from the prev. report)



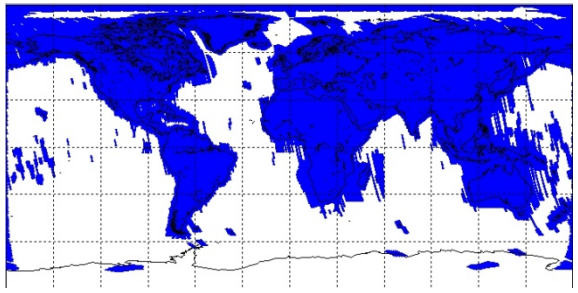
PRISM



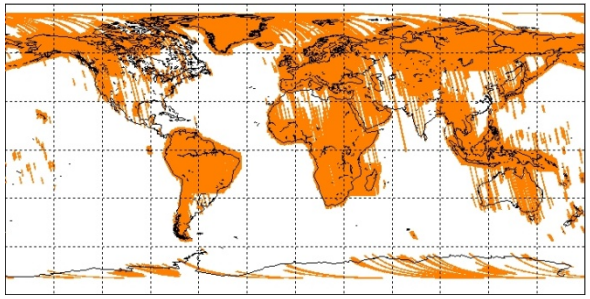
AVNIR-2



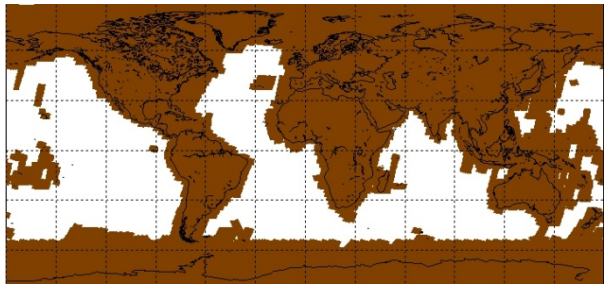
PALSAR(FBS)



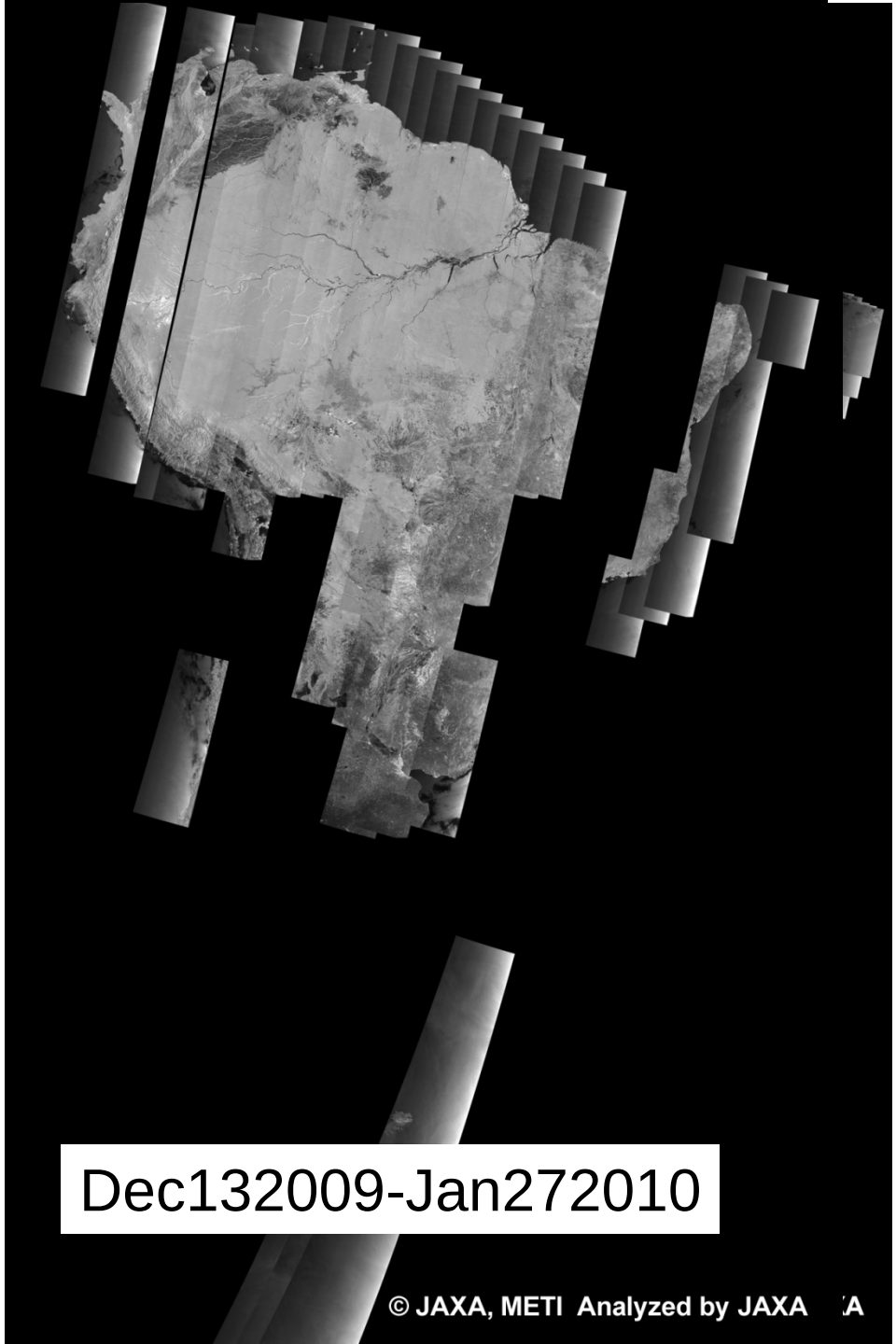
PALSAR(FBD)



PALSAR(PLR)



PALSAR(WB1/WB2)


Dec132009-Jan272010
© JAXA, METI Analyzed by JAXA

Under the agreement with the Brazilian agency (IBAMA and INPE), JAXA is conducting the operational quick image acquisition-downloading-processing and distribution of the PALSAR ScanSAR data to IBAMA for assisting the forest monitoring.

The time delay between the observation and the image distribution to IBAMA is 5~7 days.

These quasi data chain is highly utilized in IBAMA for decreasing the forest decrease in Brazil.

Amazon Deforest Watch (Santarem) JERS-1 & ALOS

Acquisition Term

1993/6/26
～2007/9/13

JERS-1
- 1993/6/26
- 1997/5/4
- 1997/7/31

ALOS
- 2007/6/13
- 2007/9/13

Lat : S 2° 34’
Lon : W 54° 45’

SCANSAR Examples

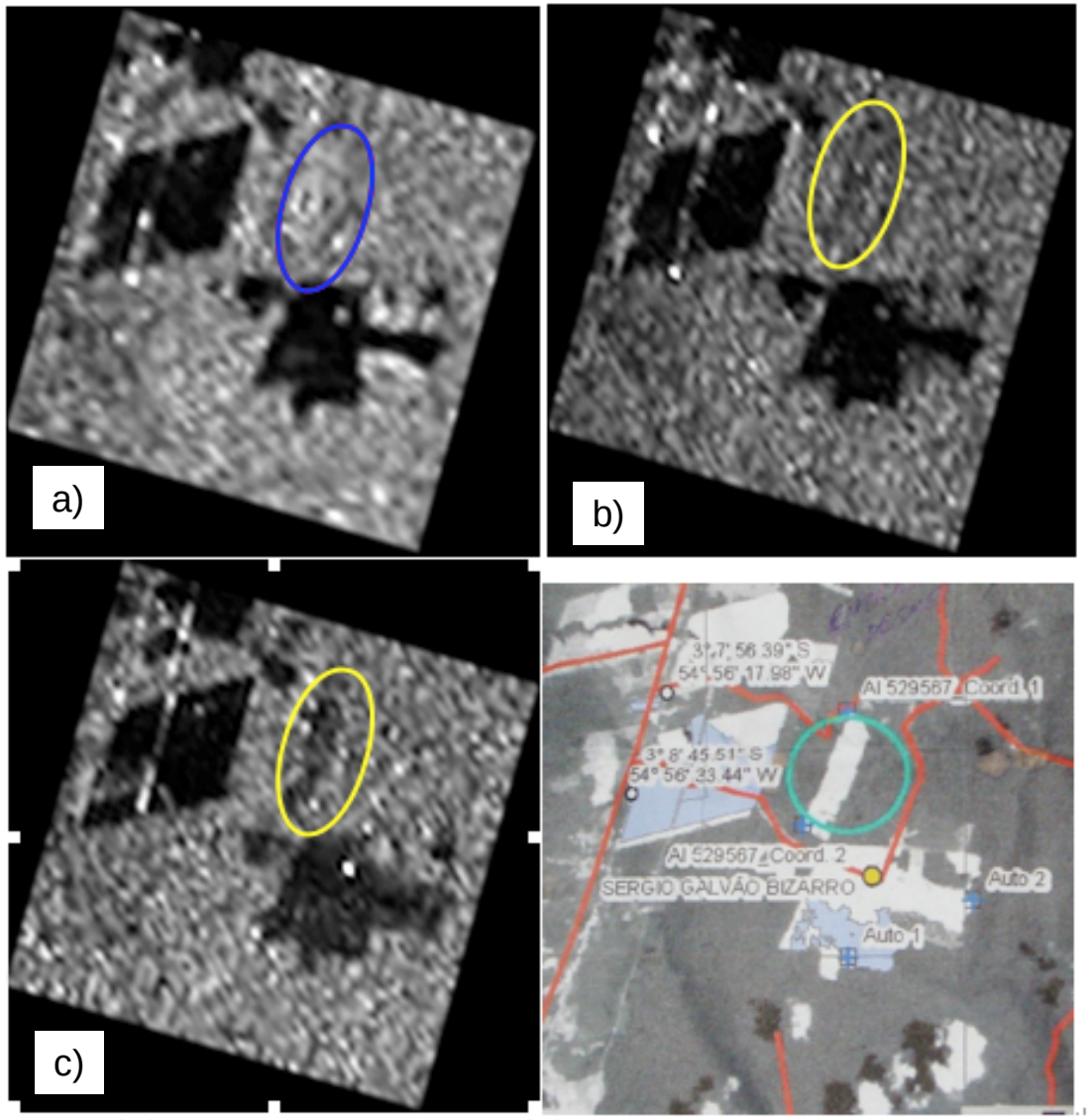


図 5　左上 RSP406　2008/8/30　WB1、　右上 RSP406　2008/10/15　WB1、
左下 RSP406　2008/11/30　WB1、　現地図（まるでかこったところが伐採があったところ）

a)before logging, b) mid of the cutting,c) after cutting.

These images are provided to IBAMA and use for the monitoring the logging.

Tapajos,PARA State, Brazil

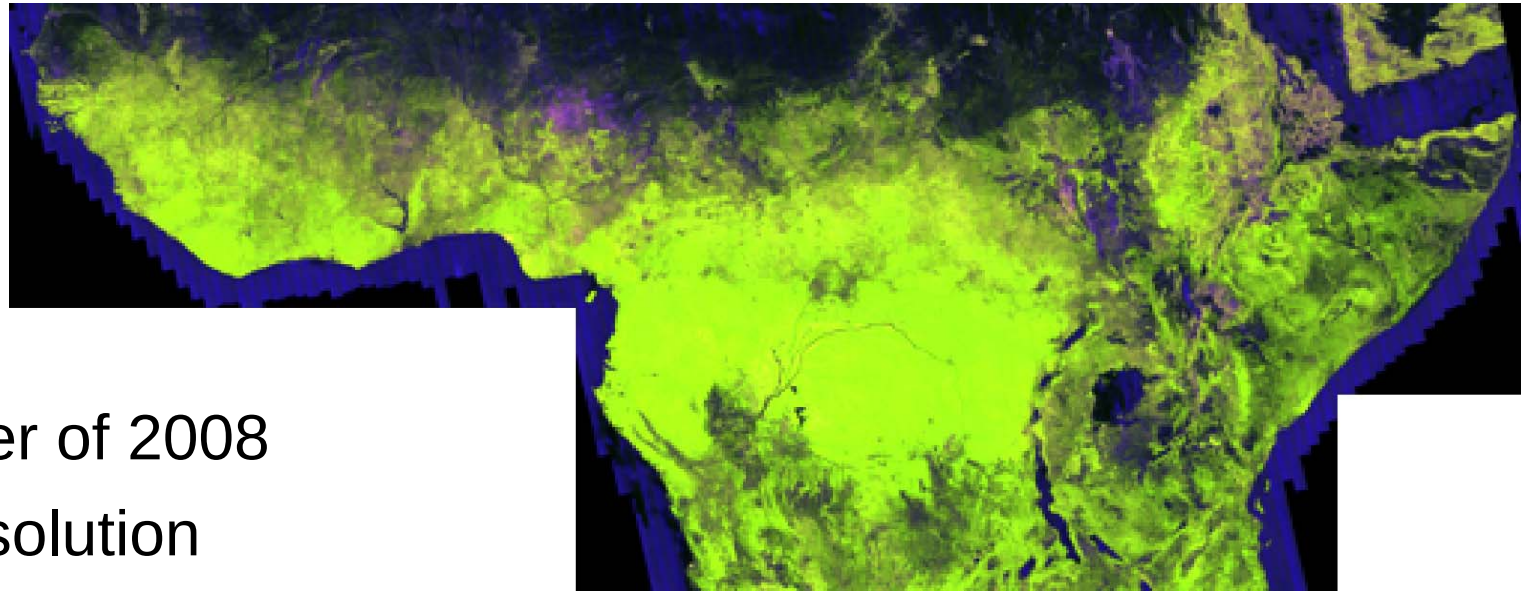
Logging place

Utilization of the PALSAR data for the Forest issue (Under JAXA project)

Production of 50 meter global mosaic collaborating the JPL and JRC.

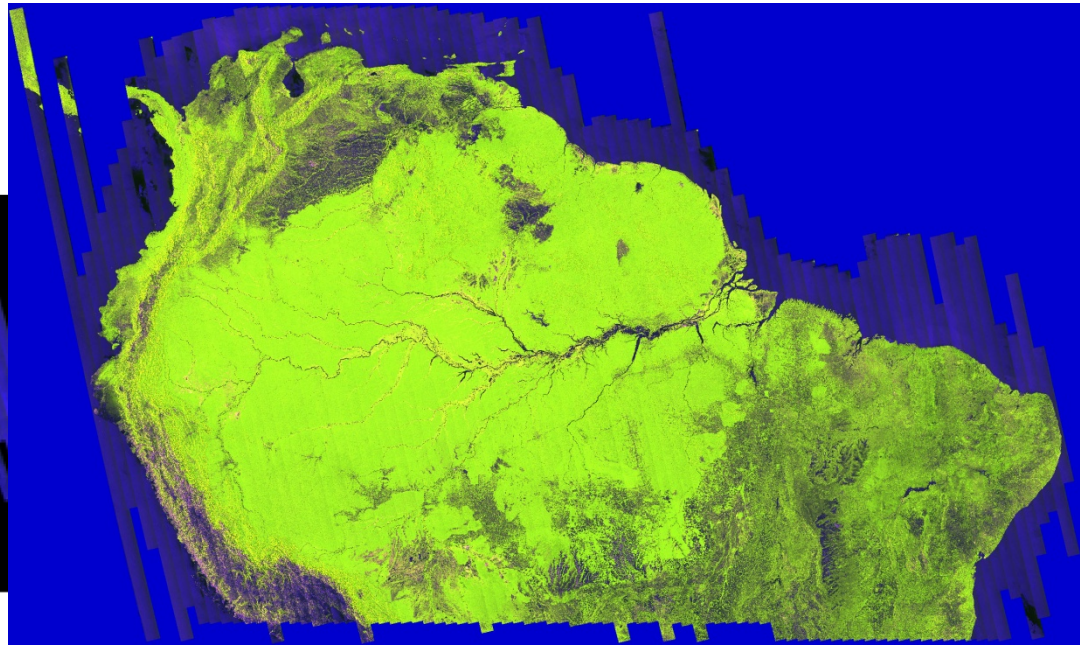
JAXA has been producing the Asian and Australia mosaic since 2007 and recently started to cover whole area (incld. Africa and Amazon) after 2008.

Global Mosaic examples



Summer of 2008

50m resolution



New Goal: Generations of the global forest SAR data (Monitoring Slow and quick change of Forest/Nonforest)

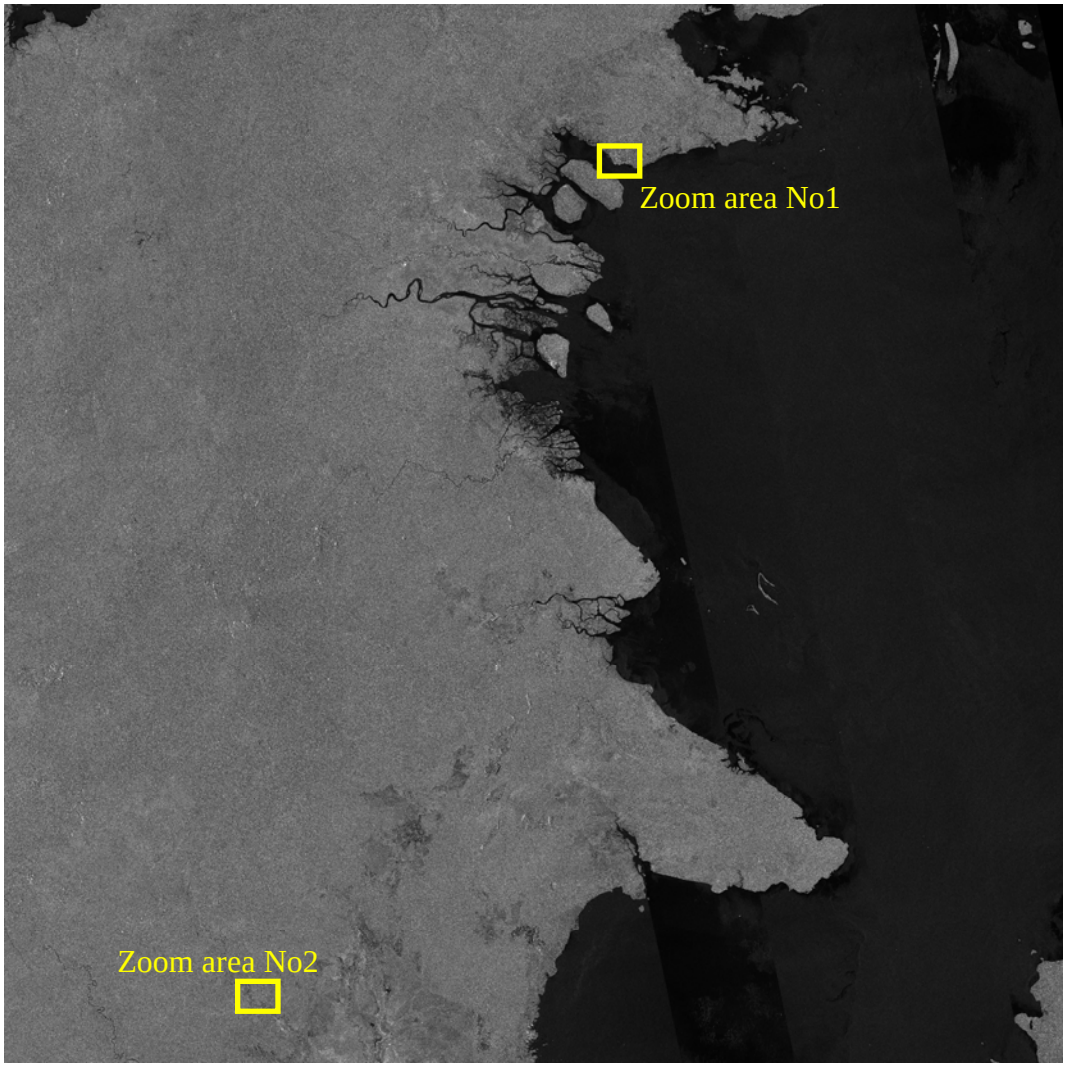
Product: Ortho-rectified and slope corrected high resolution global forestry data (**gamma-naught, classification, (biomass))**

Resolution: **10m, 25m, 50m**
Latitude: +- 60 degrees
Sensor: JERS-1 SAR/ALOS-PALSAR
Reprocessing all the EORC/JAXA SAR archives
Dates: 1994-1996-1998~2007,2009 (dual seasons)
Products:**Horizon1/2 + Mosaic**
Aug. E, 2010

10m mosaic sample product

Mode:FBD34.3, HH/HV
Obs.Date:June/July, 2009
Spacing:10m
Map projection:EQR
Slope corrected:ON
Latitude:0.0N-5.0N, Longotude:115.0E-120.0E

High resolution SAR data mosaic

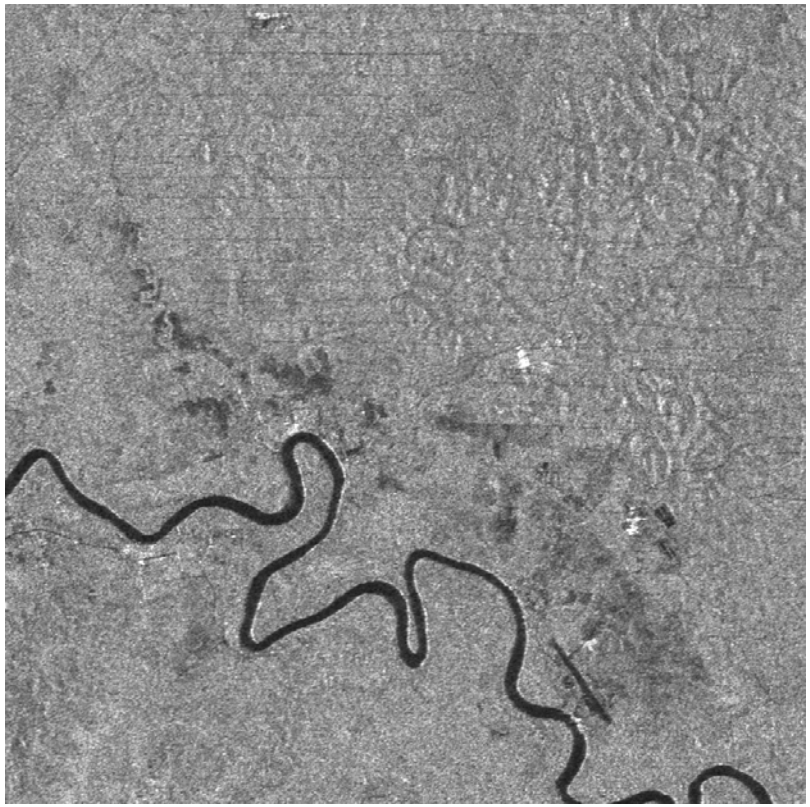


Zoom area No2 (20km × 20km)

10m spacing image

50m spacing image

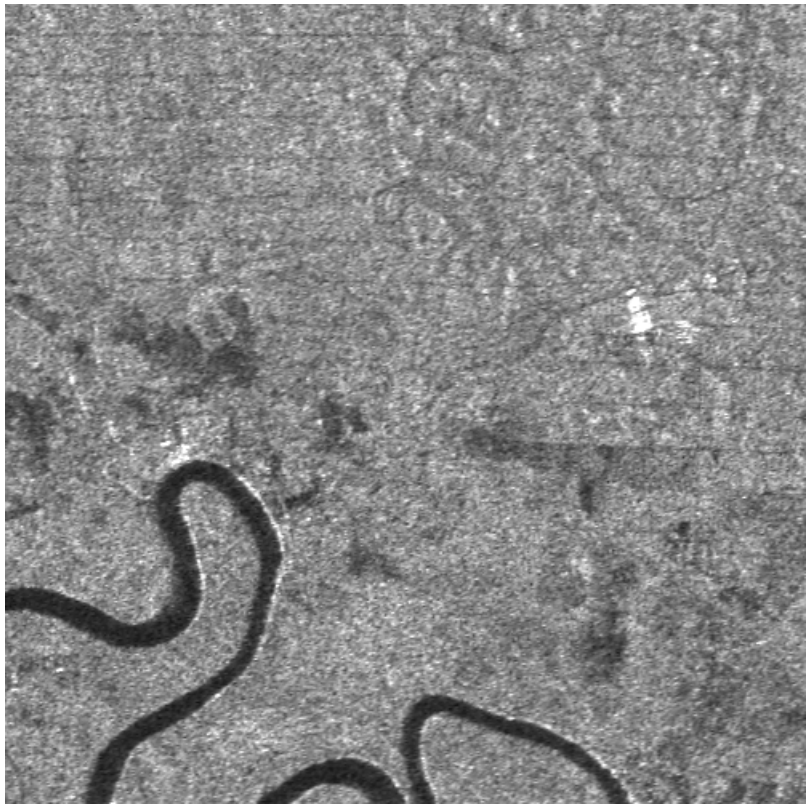
Zoom area No2 (10km × 10km)



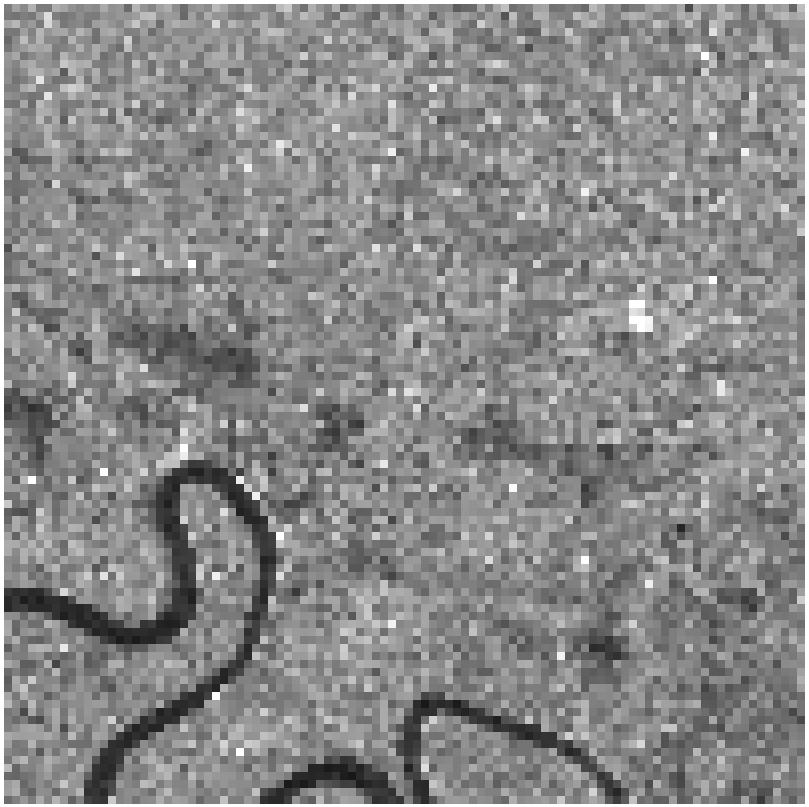
10m spacing image

50m spacing image

Zoom area No2 (5km × 5km)

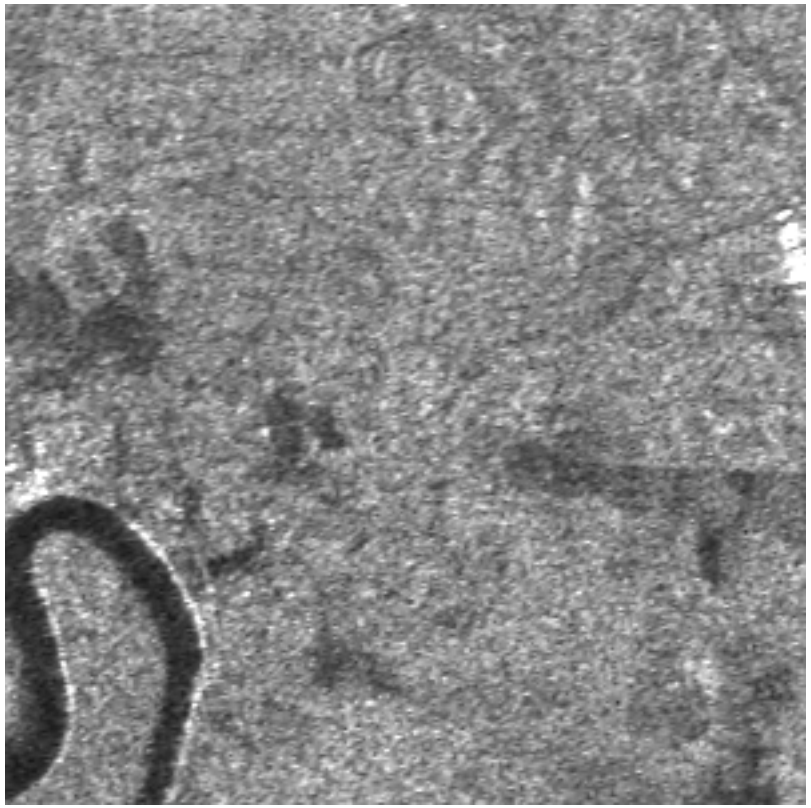


10m spacing image

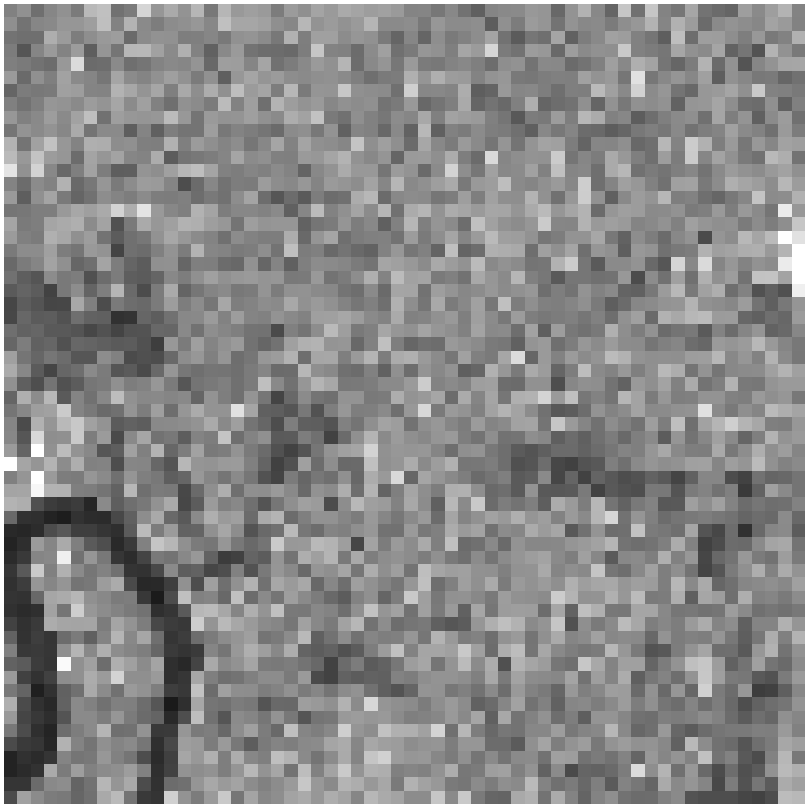


50m spacing image

Zoom area No2 (3km × 3km)



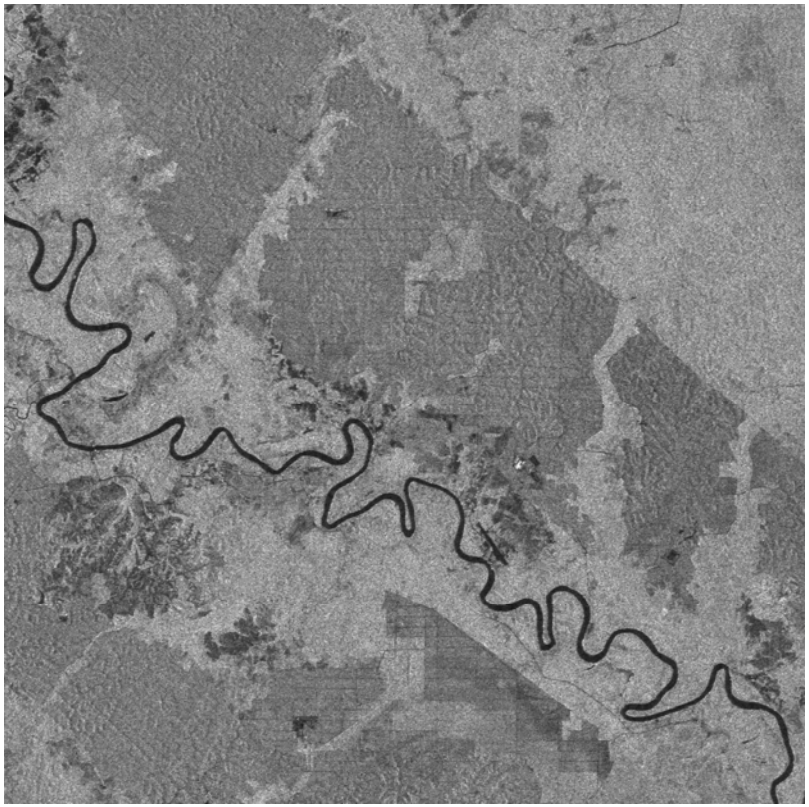
10m spacing image



50m spacing image

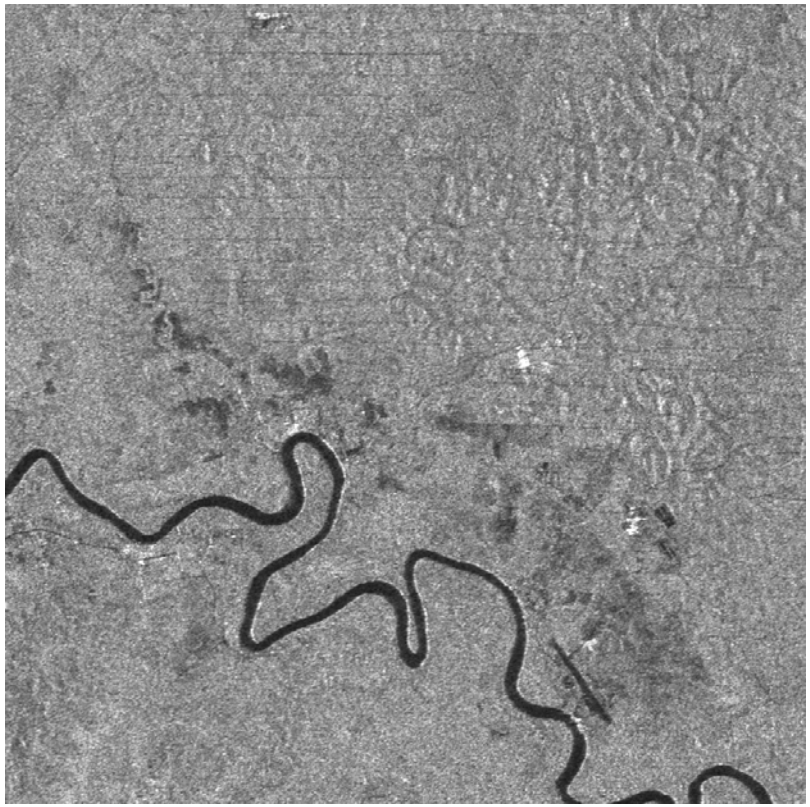
Zoom area No2 (20km × 20km)

HH image

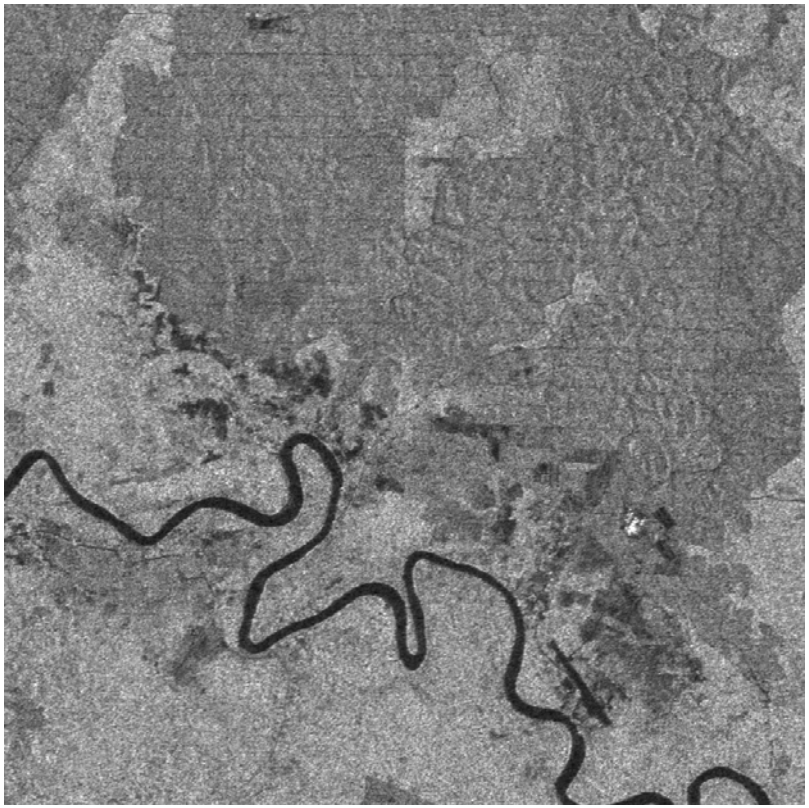


HV image

Zoom area No2 (10km × 10km)

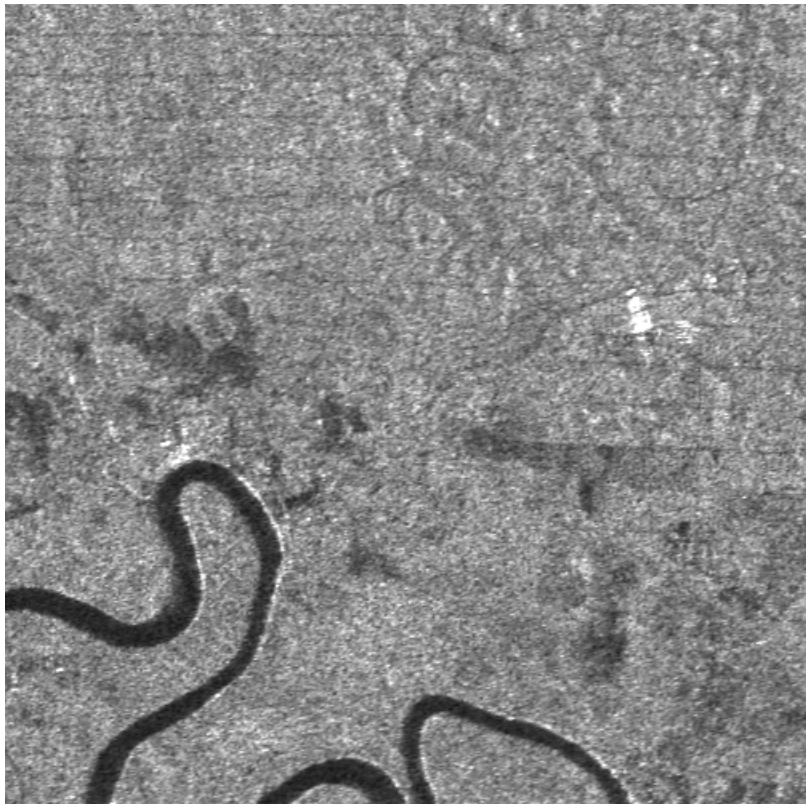


HH image

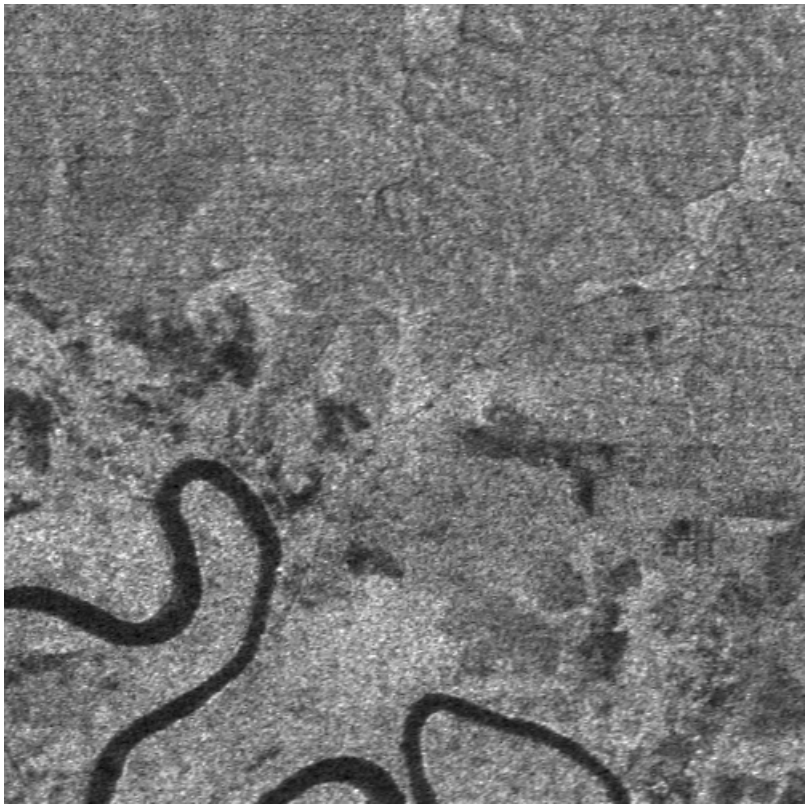


HV image

Zoom area No2 (5km × 5km)

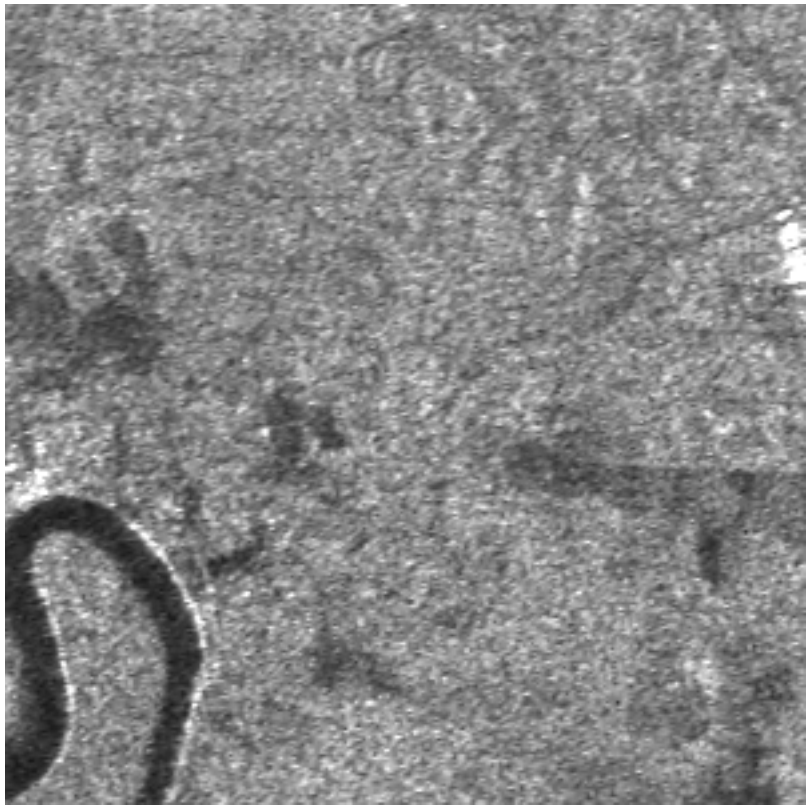


HH image

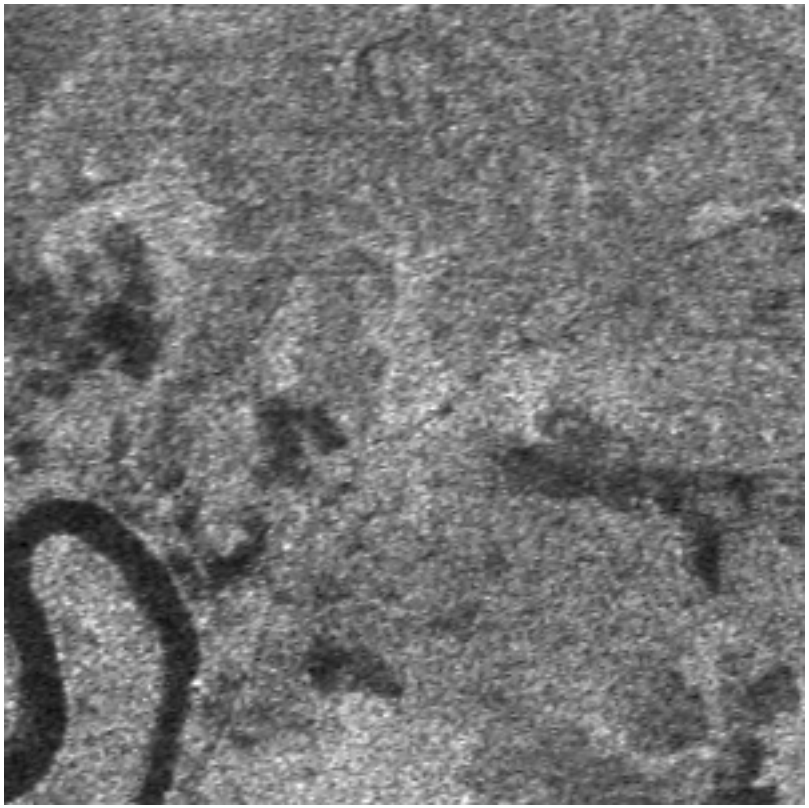


HV image

Zoom area No2 (3km × 3km)

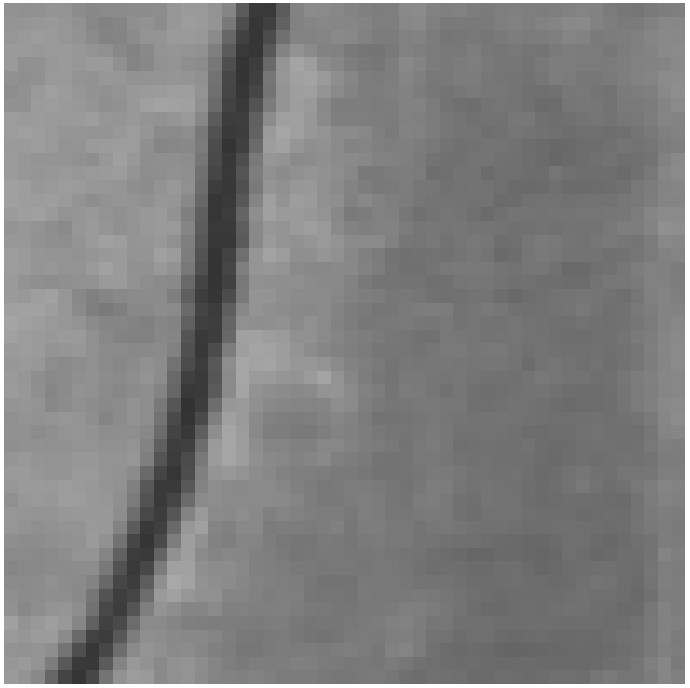


HH image

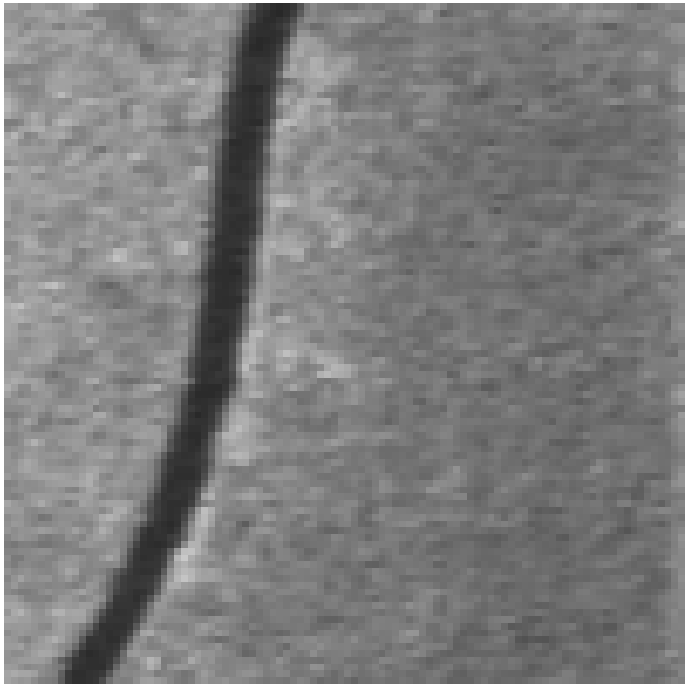


HV image

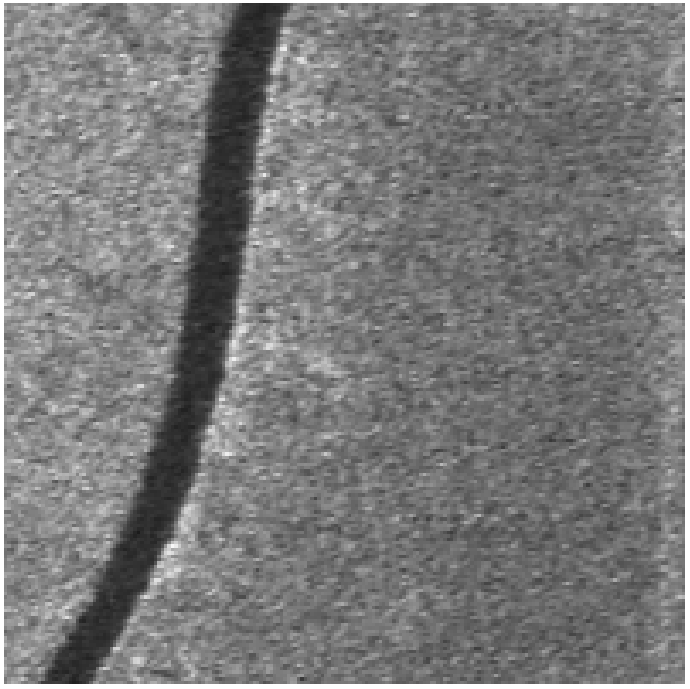
50m
解像度



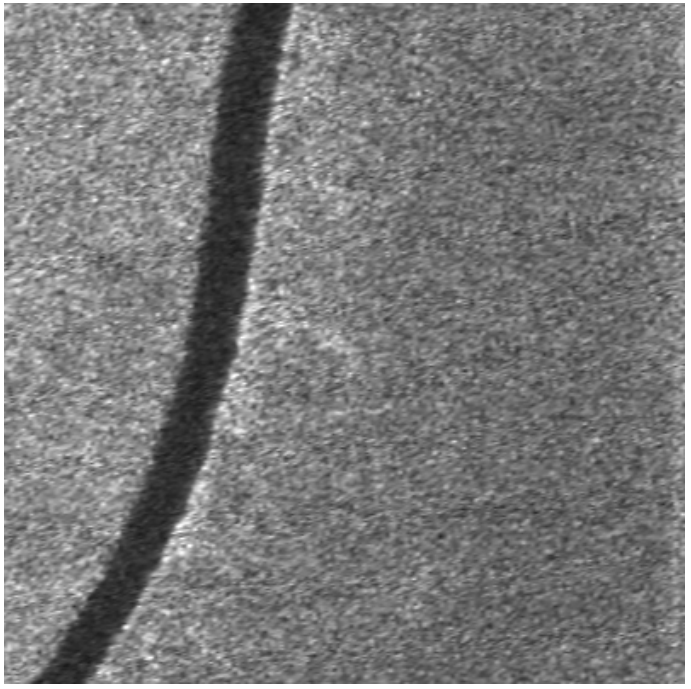
25m
解像度



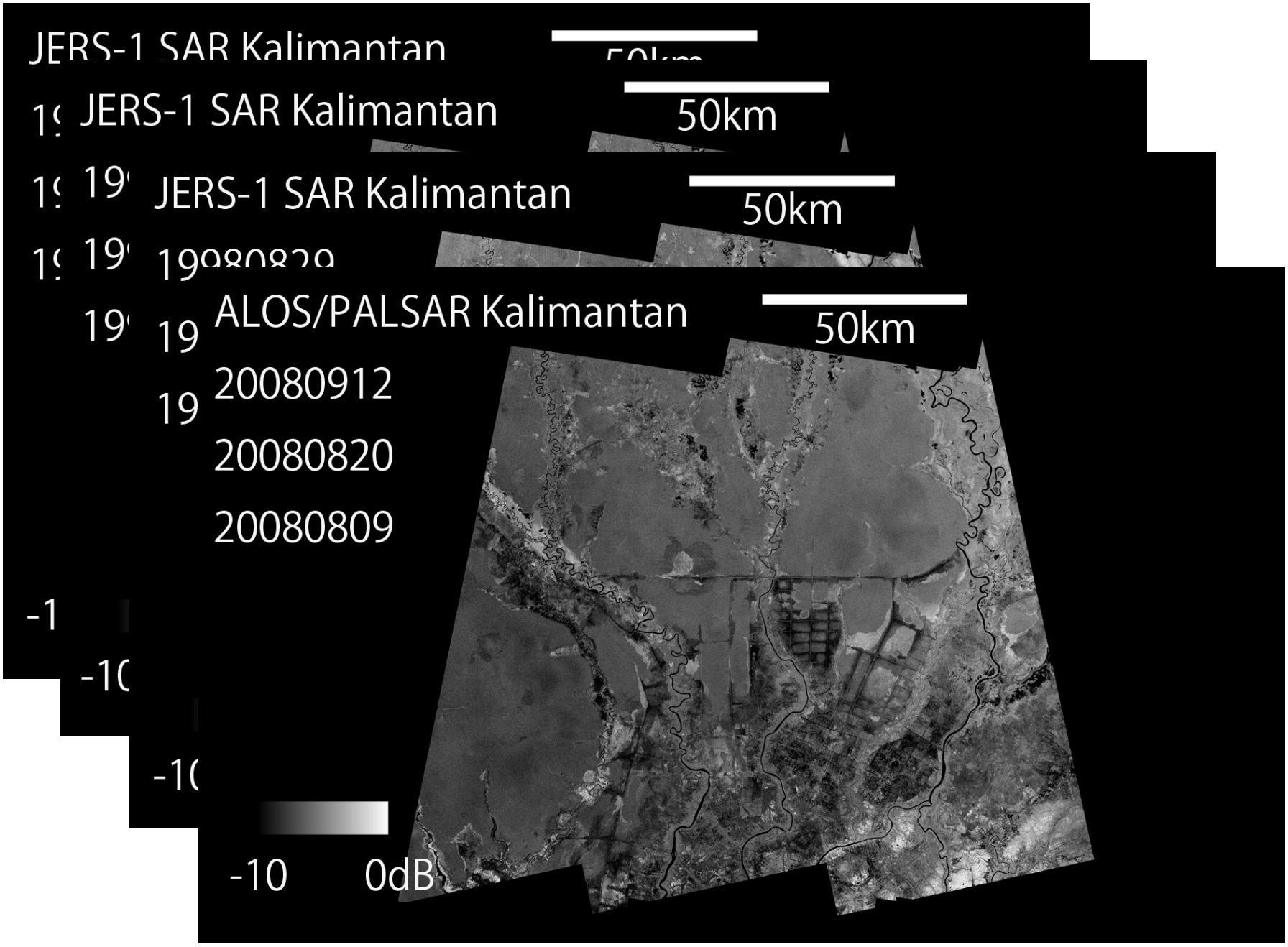
12.5m
解像度



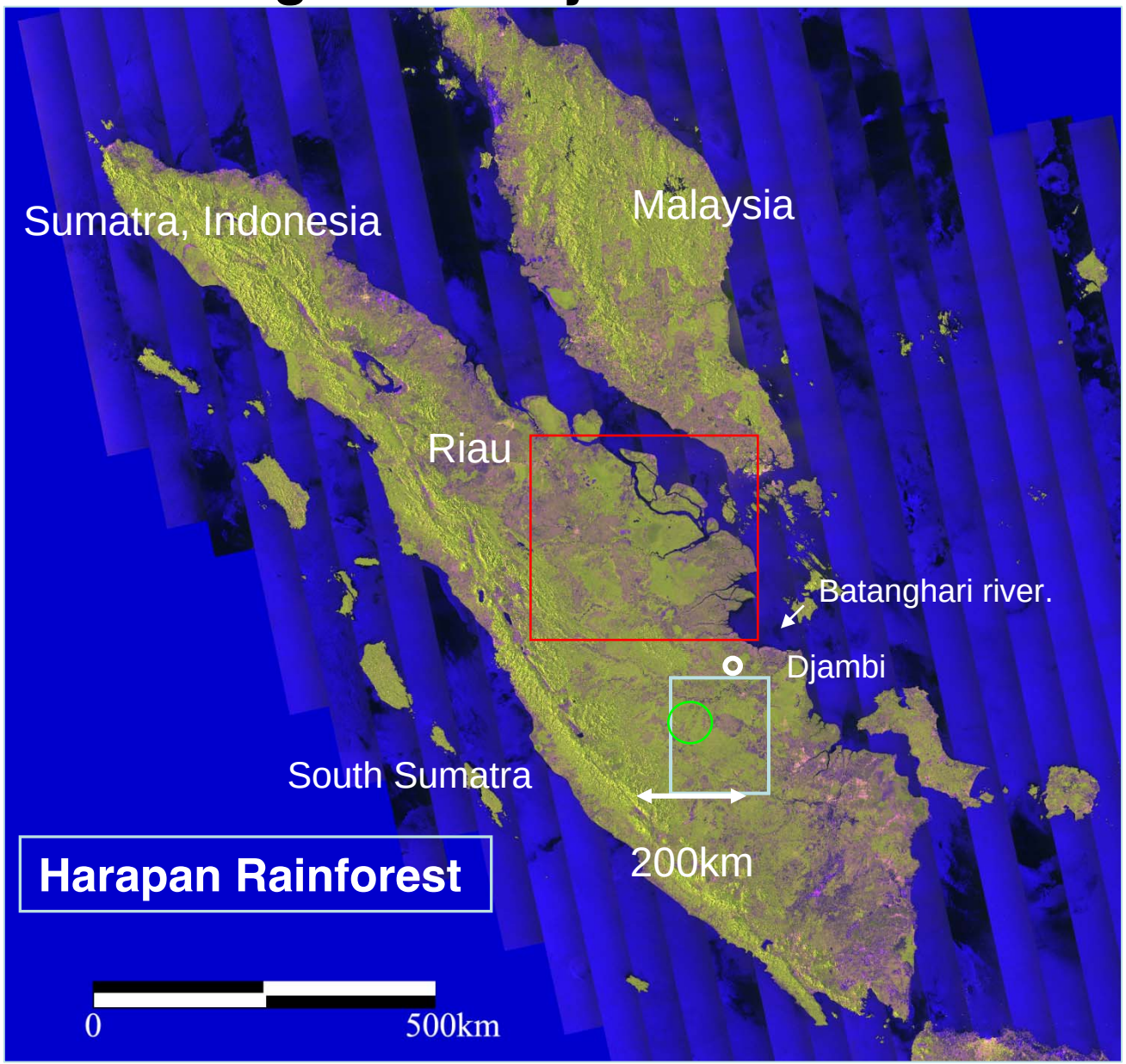
6.25m
解像度



※画像は2.5km四方


JERS-1 SAR Kalimantan
50km
JERS-1 SAR Kalimantan
50km
JERS-1 SAR Kalimantan
50km
ALOS/PALSAR Kalimantan
50km
20080912
20080820
20080809
-10
0dB

PALSAR Sumatra データ July, 2007 and change over 15 years



One season mosaic colored with three values, **HH**, **HV**, **HH/HV.**

Coverage: Malaysia and Sumatra

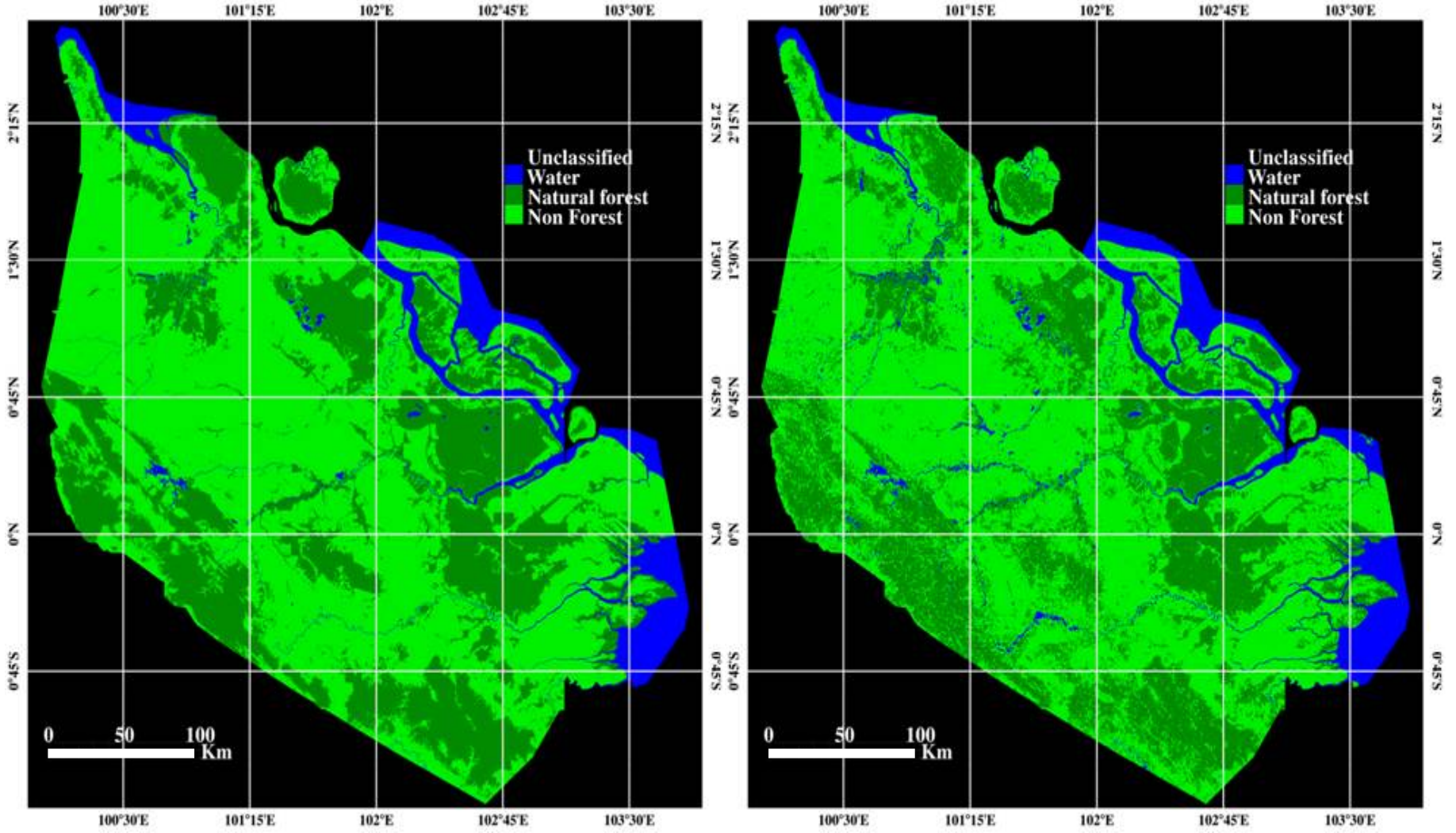
Green: forest
Purple:clear cut

PALSAR : FBD(Fine beam dual, 10m resolution)

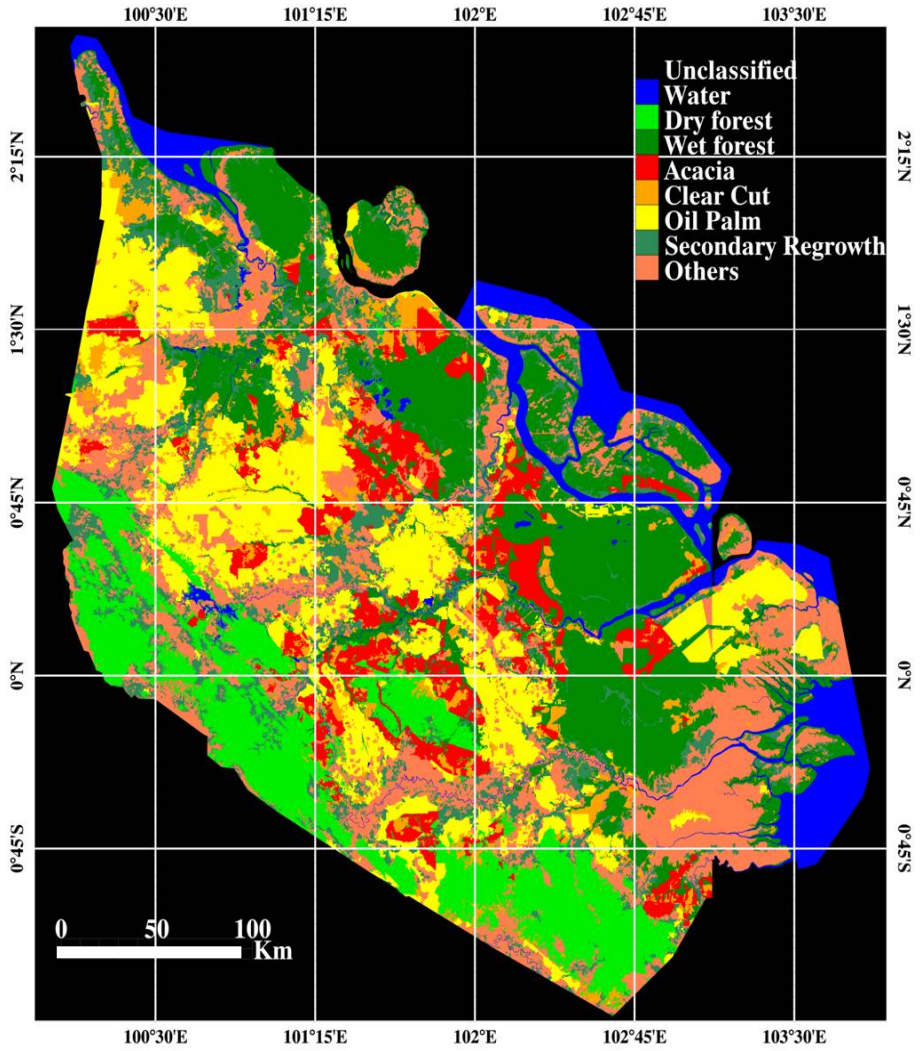
– Forest classification at 50m resolution over Riau province, Indonesia

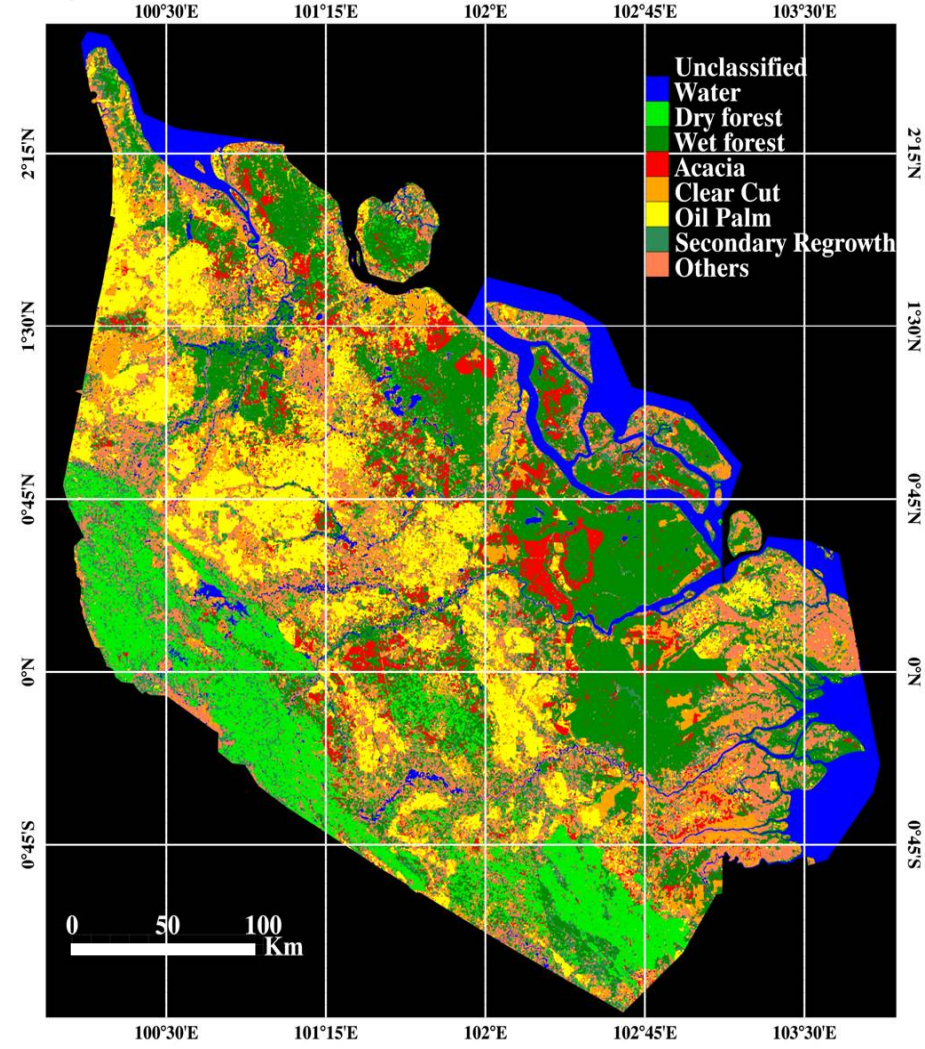
– Size: 111 186,5 km²

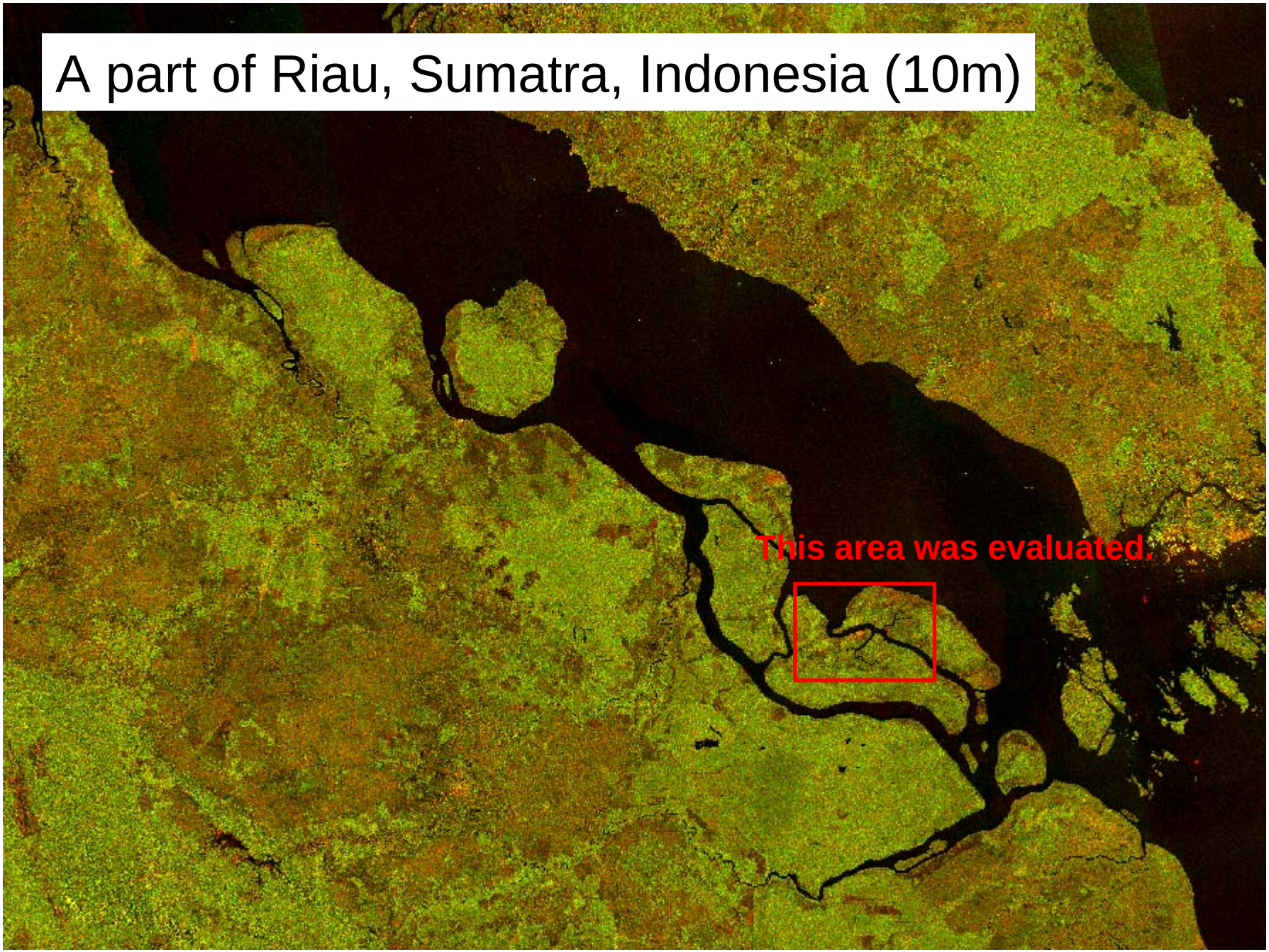
Accuracy 37.816.387 / 44.474.591 (85 %)



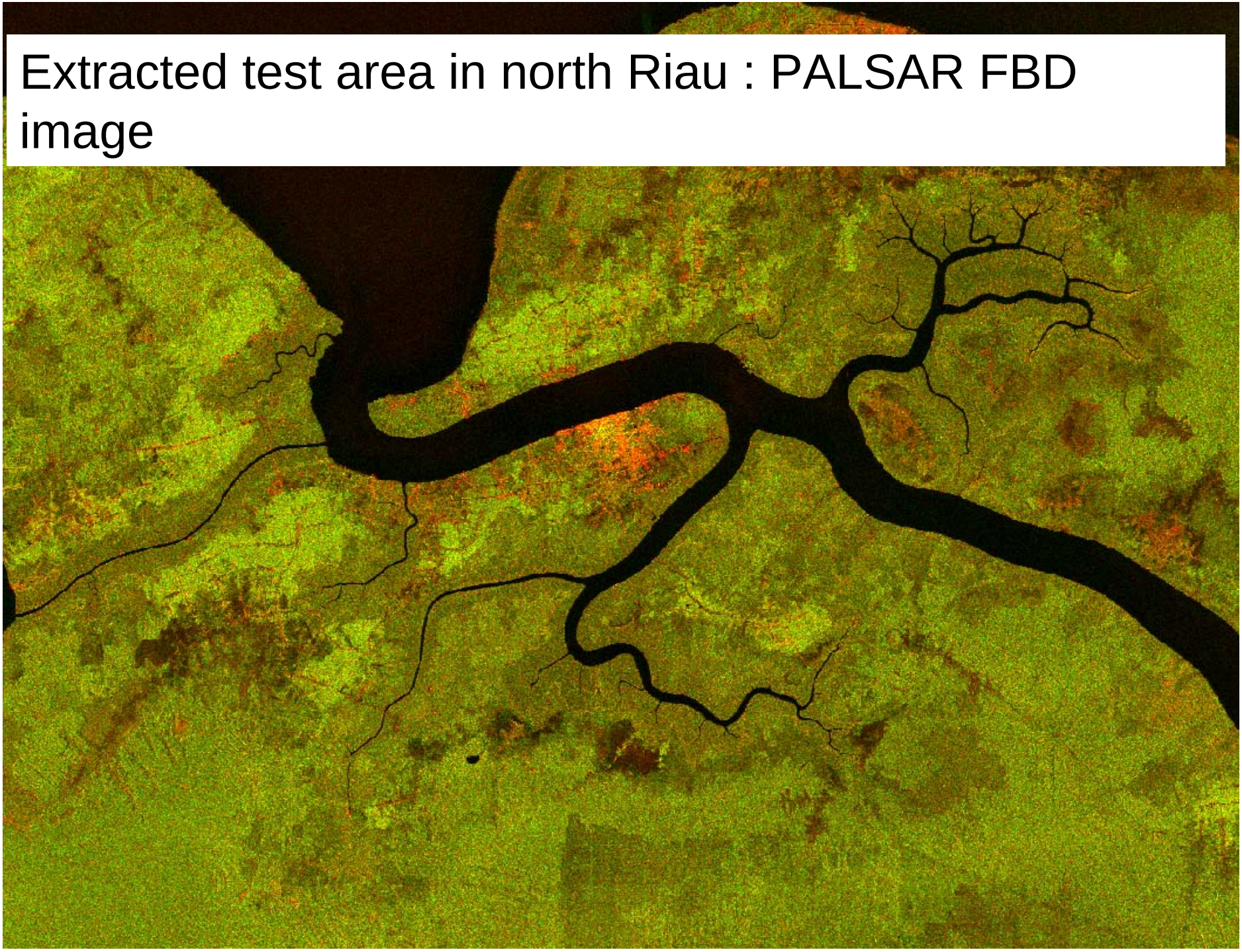
- Land cover classification at 50m resolution over Riau province, Indonesia
  - Important criteria: time consumption for the learning phase
    - Small training dataset (≈ 22 000 pixels) compared to data to process (≈ 44 000 000 pixels)



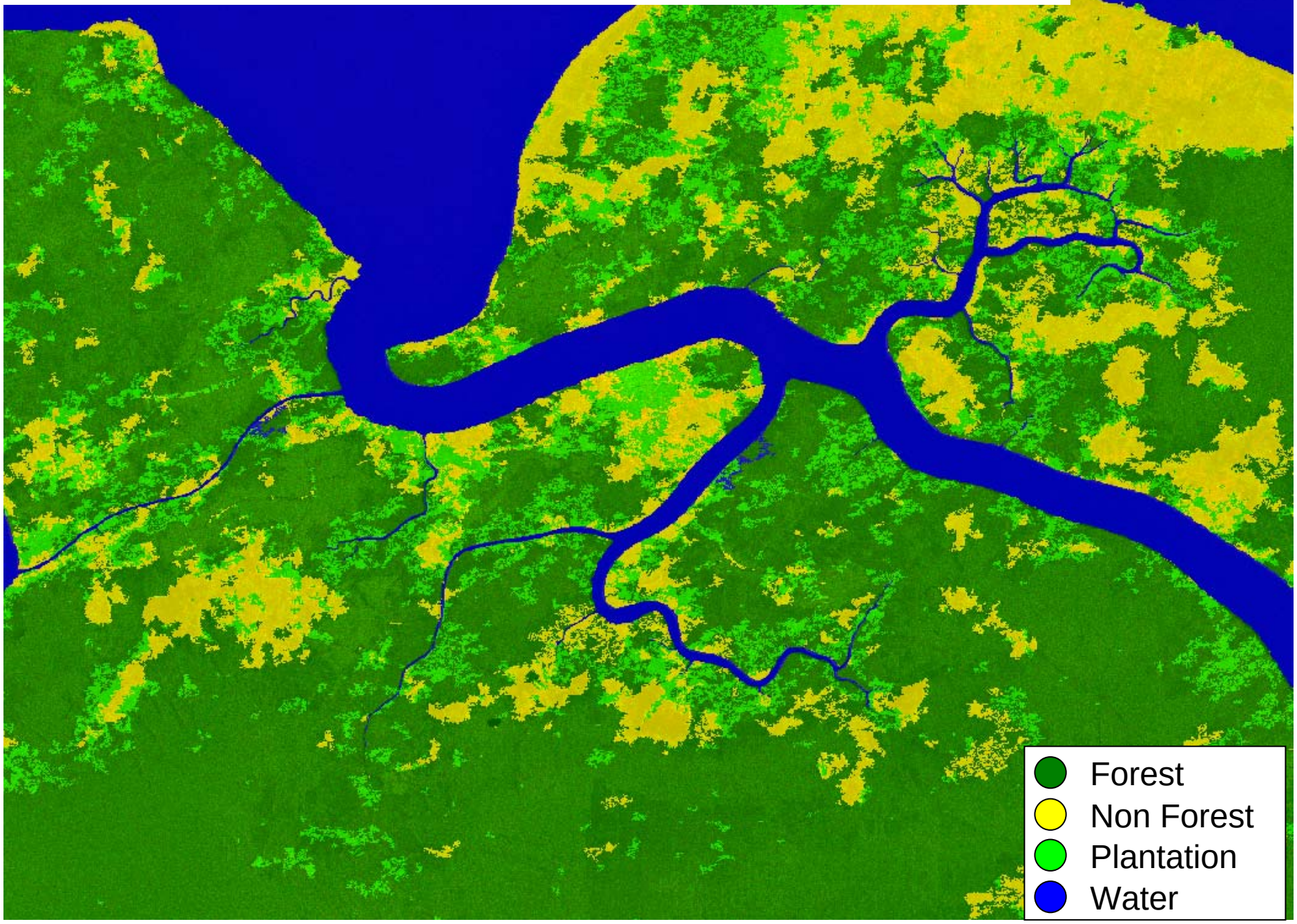



A part of Riau, Sumatra, Indonesia (10m)
This area was evaluated.

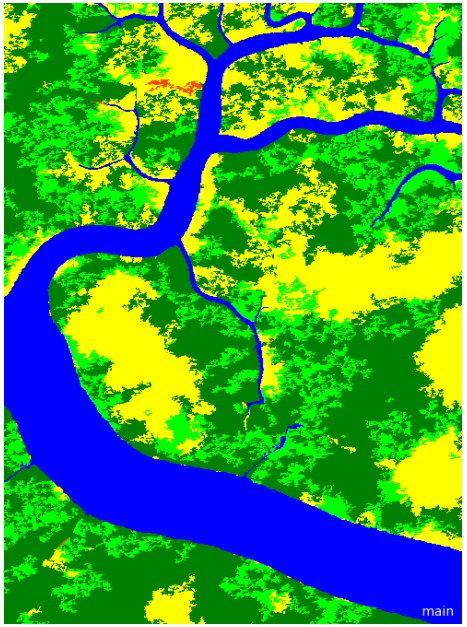
Extracted test area in north Riau : PALSAR FBD image



Classification Extracted test area in north Riau



Comparative study on the forest classification (from 50 m to 10 m)



10m mosaic

Higher resolution image improves the classification details.

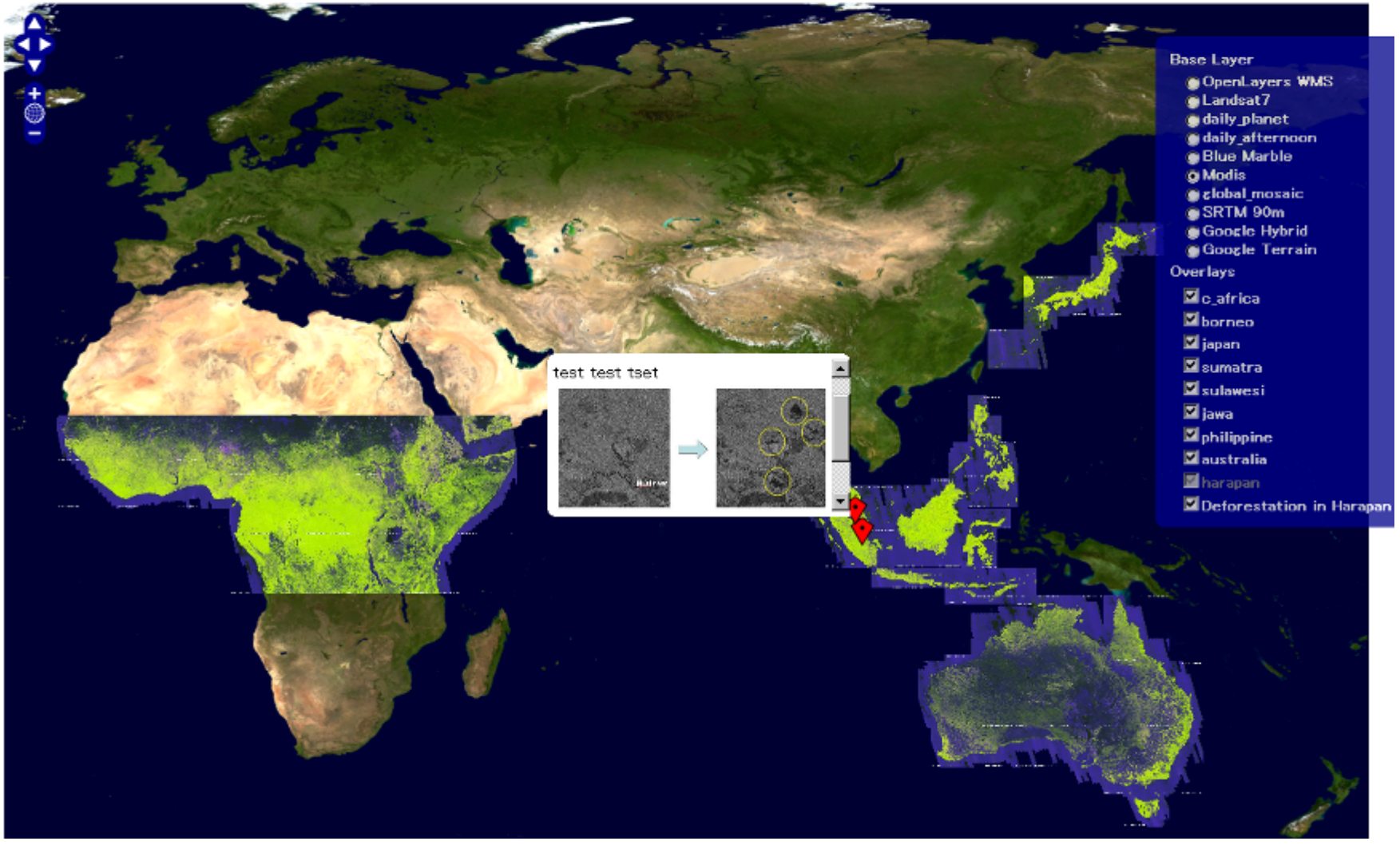
50m mosaic

- Forest
- Non Forest
- Plantation
- Water

Demonstration by the OpenLayers

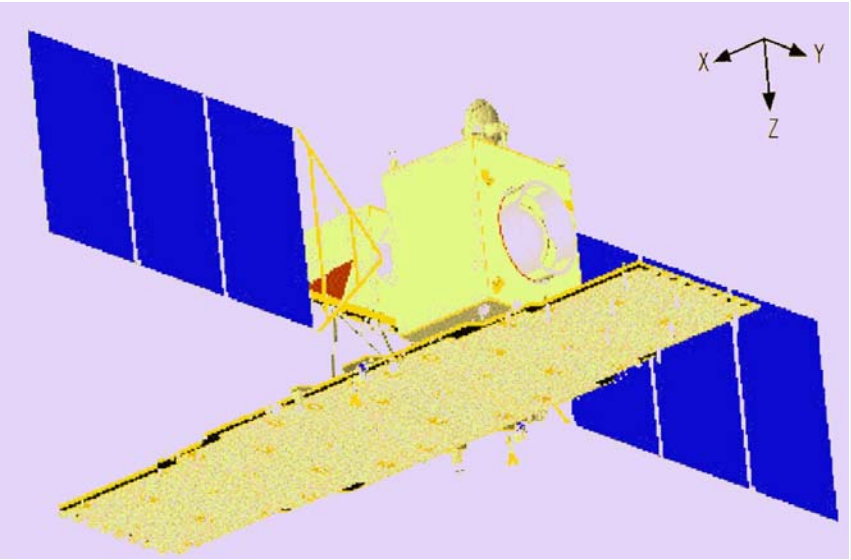
PALSAR Global Forest Map

Demonstrate overlaying PALSAR 50m Mosaic(R=HH,G=HV,B=HH/HV) and icons for timeseries dataset.



ALOS-2

JAXA's future planning



Moving direction

Artistic view

orbit	type	sun synchronous
	height	~630km
	LST	12：00（local noon） descending
Designed life		Five years
Launch	time	Winter, JFY2012
	Launcher	H-2A
satellite	mass	2 ton type
	paddle	2 paddles
Mission data		Direct transmission and Ka band DRTS
SAR frequency		Lband (1.2 GHz)
Main observation modes	High resol.	1～3m、swath25km
	Basic obs.	3m、swath：50km
	Wide obs.	100m、swath：350km
Main target areas		Deformation, volcano, change detection, resource finding.
		Forest, Sea ice, river, rice field monitoring

Conclusions

ALOS/PALSAR will continue to observe the Earth globally and systematically (based on BOS).

Using more than ten years SAR archives from mid 1990s, JAXA will produce high resolution L-band SAR mosaic and forest classification of horizon 1 or higher.

Conclusions

Shifting to the

Products 1: Mosaic dataset (10m or higher)

Gap reduction: stitching method (Shimada et al., 2002, 2010)
HH®-HV(G)-HH/HV(B)
spacing 10m
original data 2 look slant range data
ortho rectification: interpolation minimized to 1 time

Product2: Forest classification (10m or lower)

- SAR based classification combined with the ground truth data and optical sensor data
JAXA's algorithm (Preesan, Longepe, Isoguchi) + E-cognition+Restec people

Product3 : Biomass change

Priduct4: Deforestation monitoring for Brazil, Indonesia and Africa

ALOS status

1. After the launch on Jan. 24 2006, the satellite keeps observing the earth systematically in time and space consistently following the basic observation scenario (BOS)although it was often interrupted by the urgent observation.

2. It acquired more than 1600000 PALSAR scenes during the four years.

3. The BOS was programmed to cover the forest at least twice a year frequency, one in dry season and one in wet seasons.

4. These data were being image-processed for generation of SAR mosaics an for the higher utilizations (e.g., the forest classification).

Contents

1. Current status of the satellite operation (data acquisitions)

2. K&C project and Forest monitoring support for Brazil

3. New plan in 2010 for Forest monitoring
   2-1 Examples (Kalimantan)

4. Conclusions

Processor: Plan : 600T byte HD and 32 CPUs Intel based machine (soon…)

L0 Data: convert all 3000 SDLT -> LT04

Reprocess all the necessity data

SAR processor: Sigma-SAR (latest version) :

Imaging
Mosaicking

Processing routines are introduced in the JSATR-journal, and prepared for the other journals