

# ALOS ACHIEVEMENT SUMMARY AND ALOS-2/3

Masanobu Shimada<sup>1</sup>, Takeo Tadono<sup>1</sup>,  
Masuo Takahashi<sup>1</sup>, Masato Ohki<sup>1</sup>,  
Yousuke Miyagi<sup>1</sup>, Manabu  
Watanabe<sup>1</sup>, Takeshi Motooka<sup>1</sup>,  
Tomohiro Shiraishi<sup>1</sup>, Nobuyuki  
Kawano<sup>1</sup>, and Rajesh Tapa<sup>1</sup>

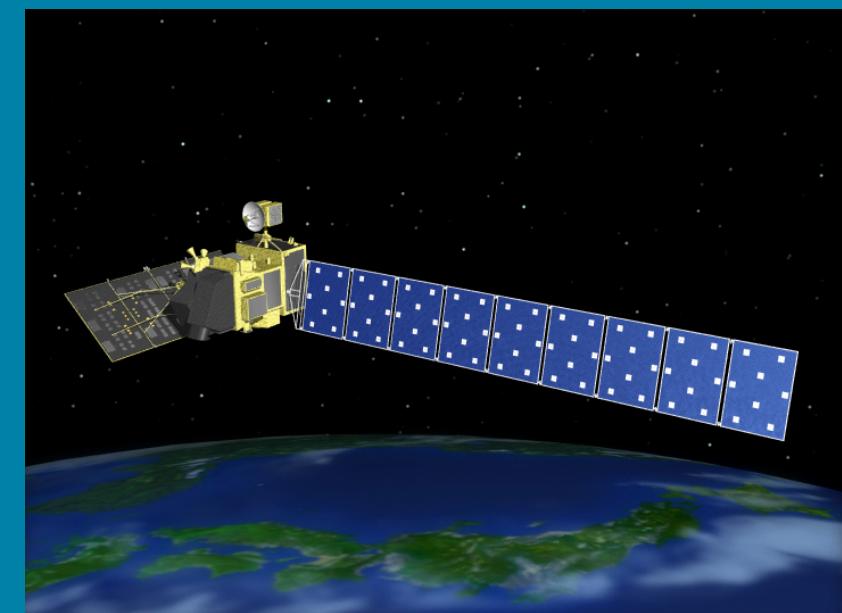
Japan Aerospace Exploration  
Agency

OCT. 17 2011



NL Agency  
*Ministry of Economic Affairs, Agriculture and  
Innovation*

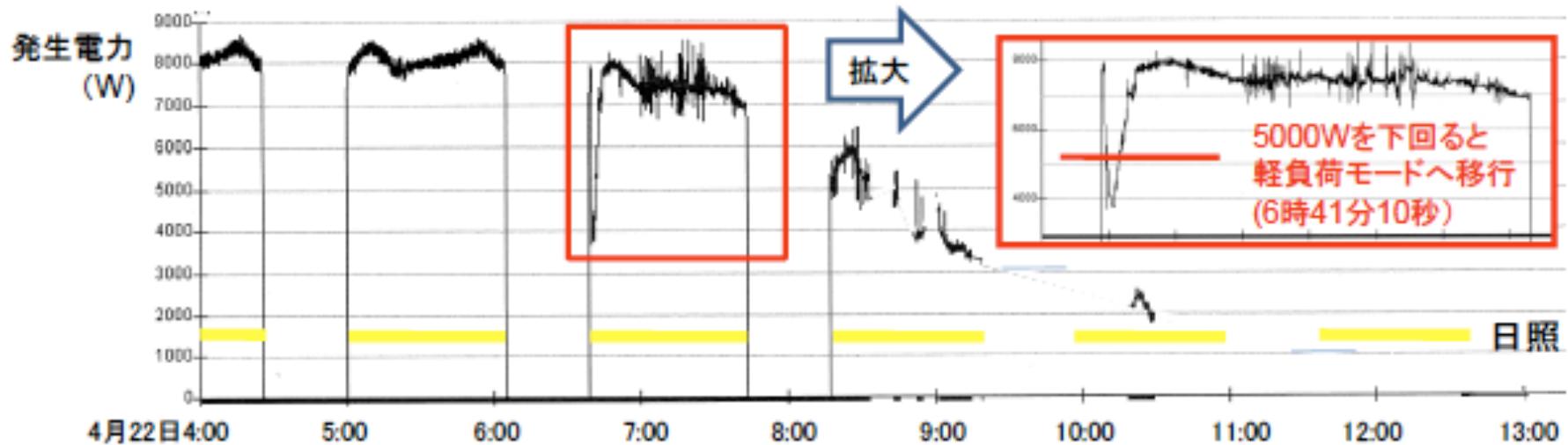
## ALOS ACHIEVEMENT SUMMARY AND ALOS-2/3



en

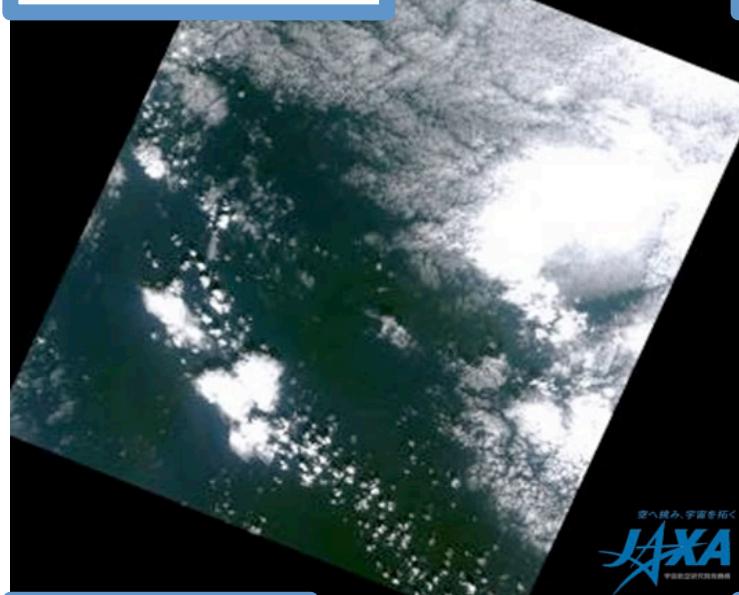
## 1.1 History of the satellite status around the power anomaly(cont.)

(3) After that, solar power decreases gradually. We continued to reproduce the telemetry data on the data recorder and switched off the heater for reduce the power consumption.



(4) Telemetry data reception was succeeded through Santiago station for 23:44-23:58. Telemetry from April 23, 00:49 through Kiruna Station was not received. After that, no telemetry was received.

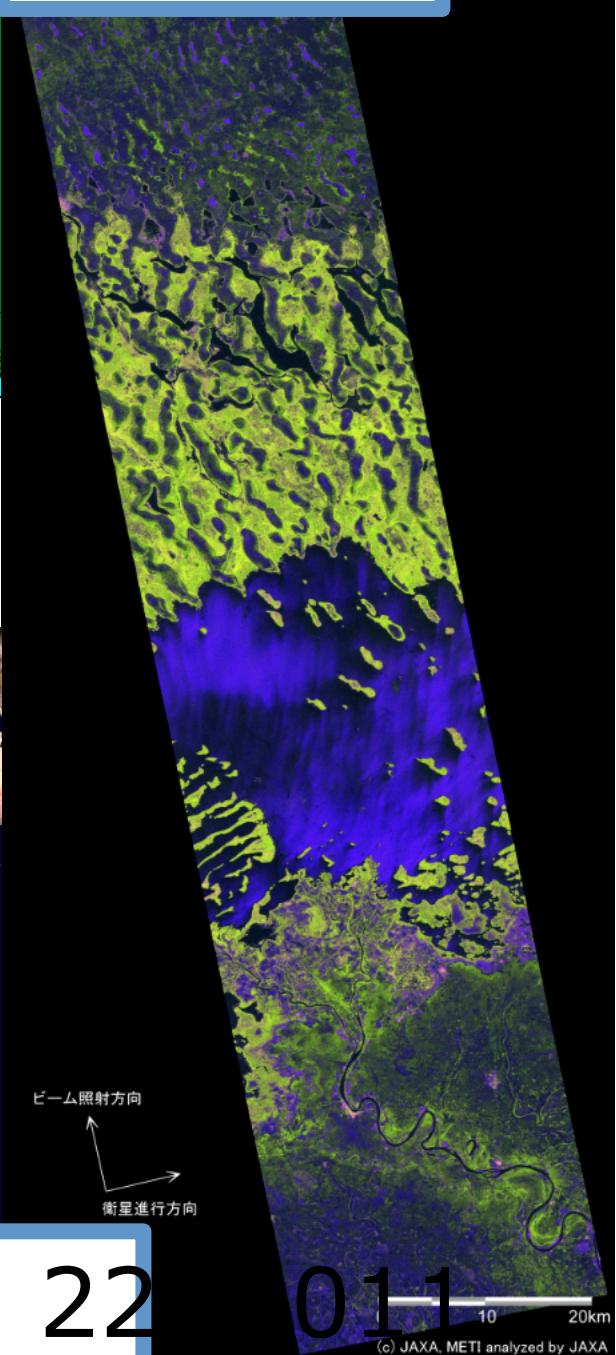
Final - AVNIR-2



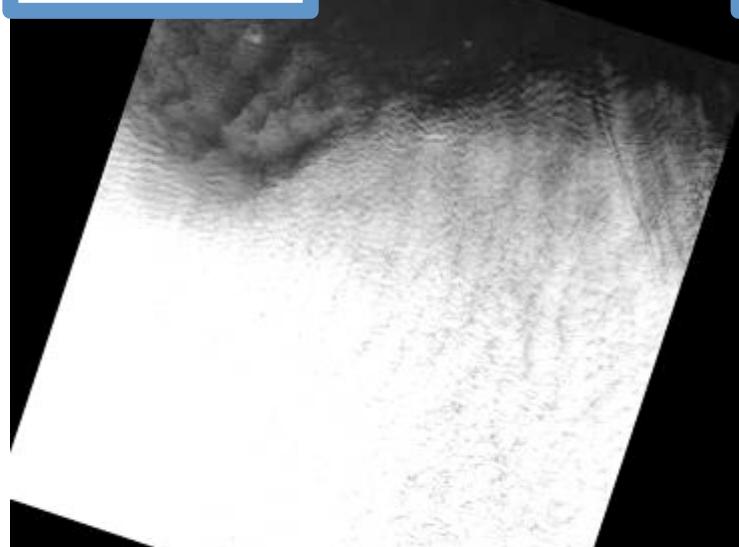
AV2/PRISM-track



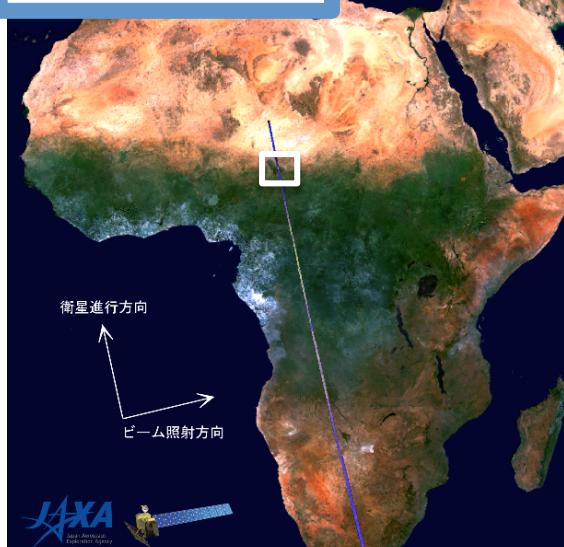
PALSAR - FULLP



Final-PRISM



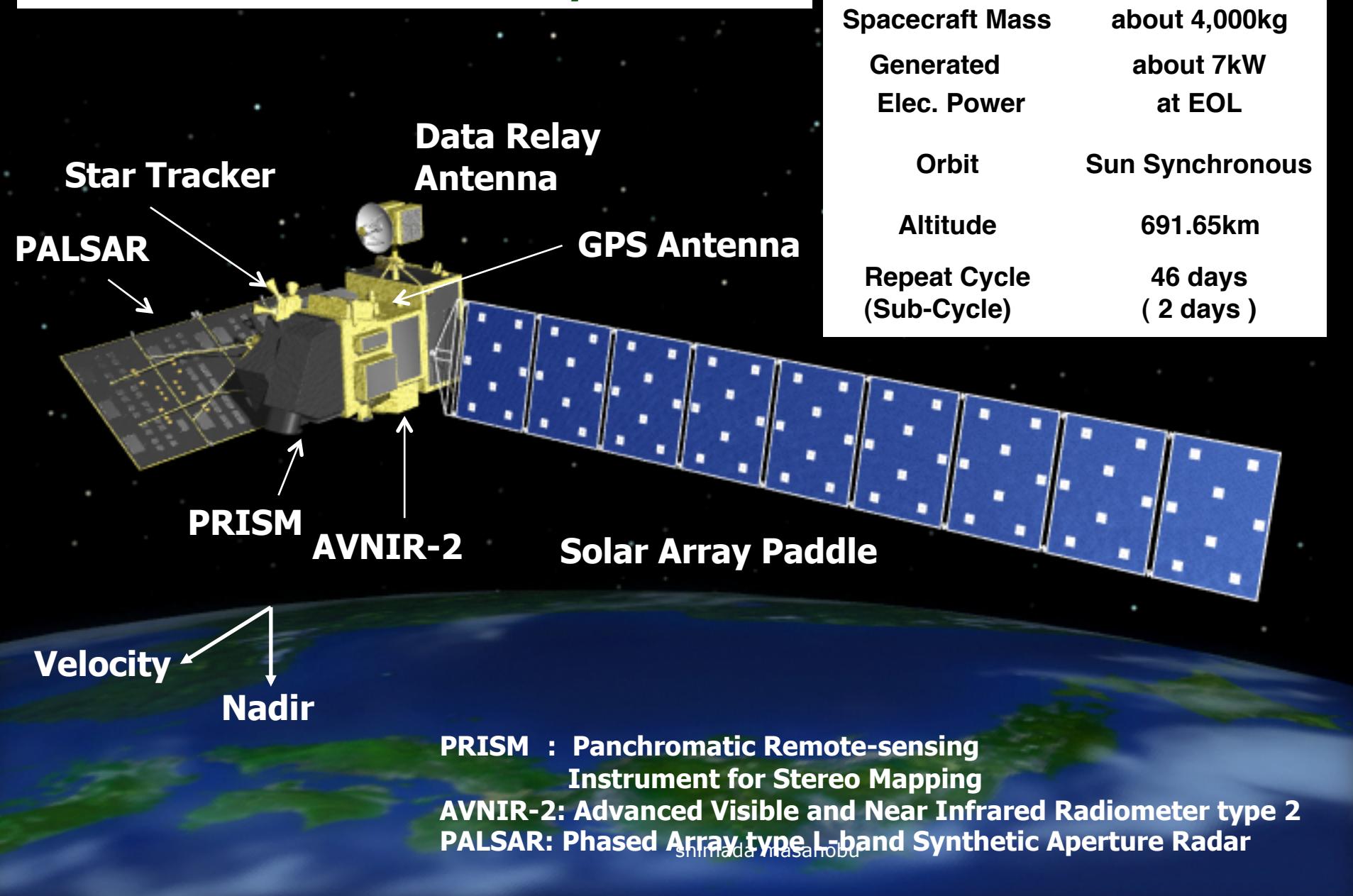
PALSAR-track



Final ALOS Images of April 22

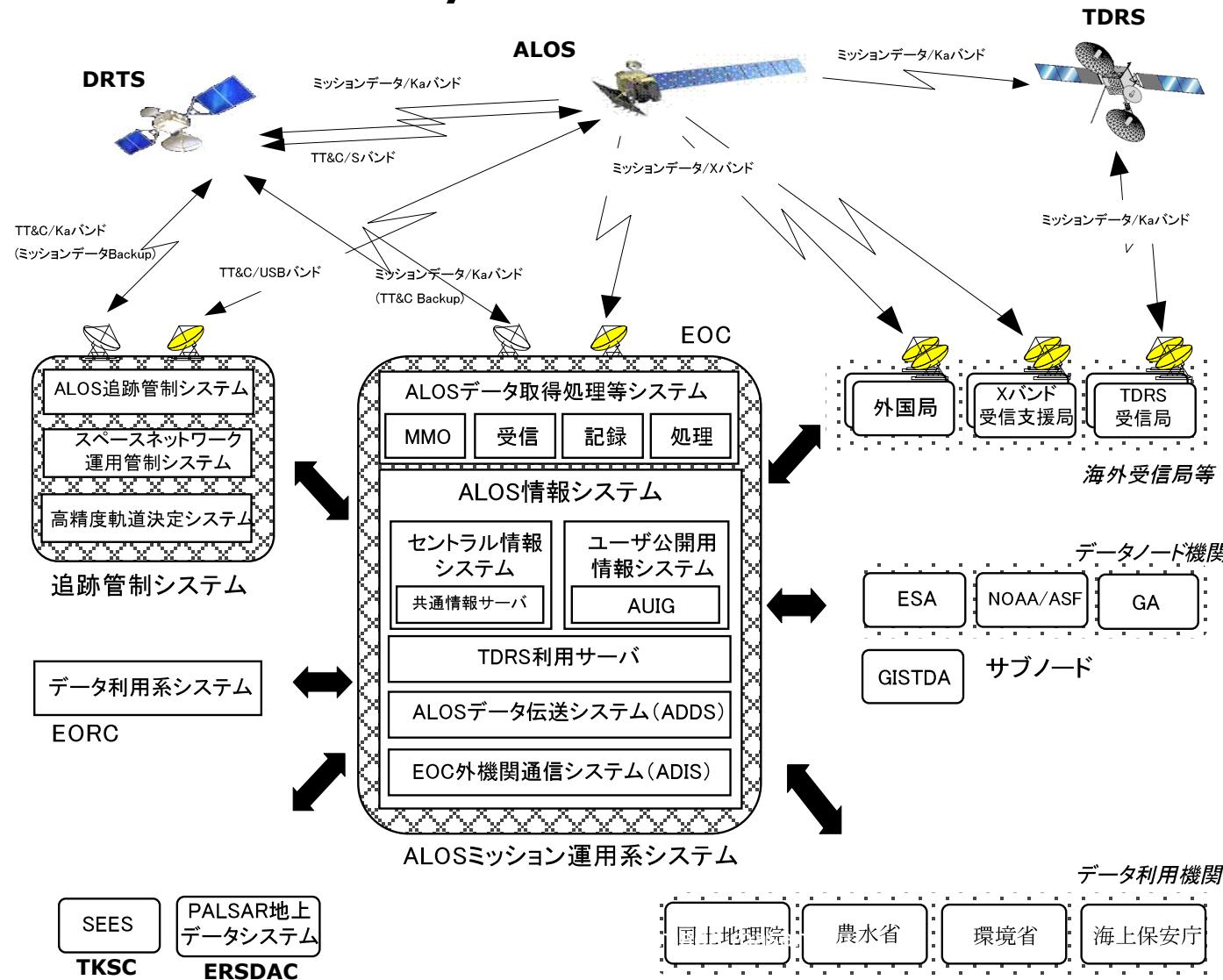
011  
10 20km  
(c) JAXA, METI analyzed by JAXA

# ALOS Satellite System



# ALOS mission operation and the data acquisition

## 1. All the ALOS system



# Mission Status

## 3. Observation

Priority	Obs. purpose	Rate in operation phase(%)	Rate in late operation phase(%)	Observations 後期利用段階: 2009/1/24～2011/1/23	
				Durations(s)	%
1	Disaster	—	—	12,615	0.06
2	Calval	3	2	312,266	1.42
3	BOS	BOS	46	12,130,732	55.18
				1,149,547	5.23
		JAXA	14	1,275,895	5.80
4	Collaboration-based observation	5	5	1,036,688	4.72
5	Data node based observation(incl. commercial)	27	37	5,375,740	24.45
6	R&D	5	5	689,519	3.14
合計		100	100	21,983,002	100.00

# Mission Status

## 3.Observation Results

2006/5/16～2011/1/23)

Sensor	Total(scenes)	BT
AVNIR-2	1.26M	93T
PRISM	8.2M	245T
PALSAR	2M	590T
subtotal	11.46M	928T

All the data were archived at EOC.

# CALVAL and Application

CALVAL of the sensor and the standard product

Accuracy assessment

High-level product

Ortho and DSM generation

Research Product generation

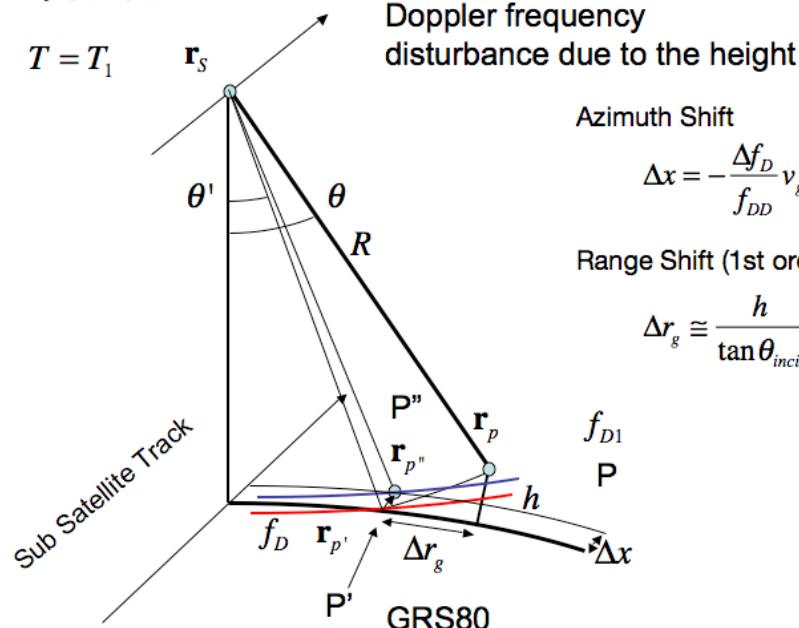
Surface deformation

Forest monitoring

Land use map

# PALSAR CAL/VAL and ortho product generation

SARの倒れ込み



## Geometric Evaluation Result

Geo error (ortho) > Geo error (slant)

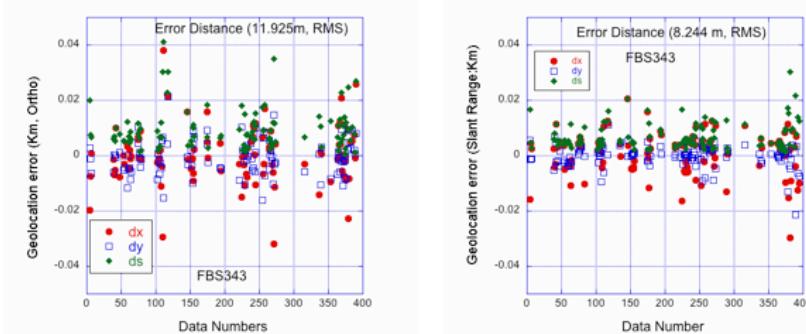


TABLE IV Geolocation Accuracy Measurement for the Ortho-rectification Image and Slant Range Image

Off-nadir Angle (°)	Geolocation Error (ortho: m)	Geolocation Error (Slant: m)
21.5	17.383 (7.211, 21)	13.19 (5.267, 28)
34.3	11.925 (7.266, 104)	8.244 (4.716, 124)
41.5	9.488 (5.127, 50)	7.286 (4.017, 56)
Total Value in RMSE	12.103 (6.718, 175)	8.885 (4.619, 208)

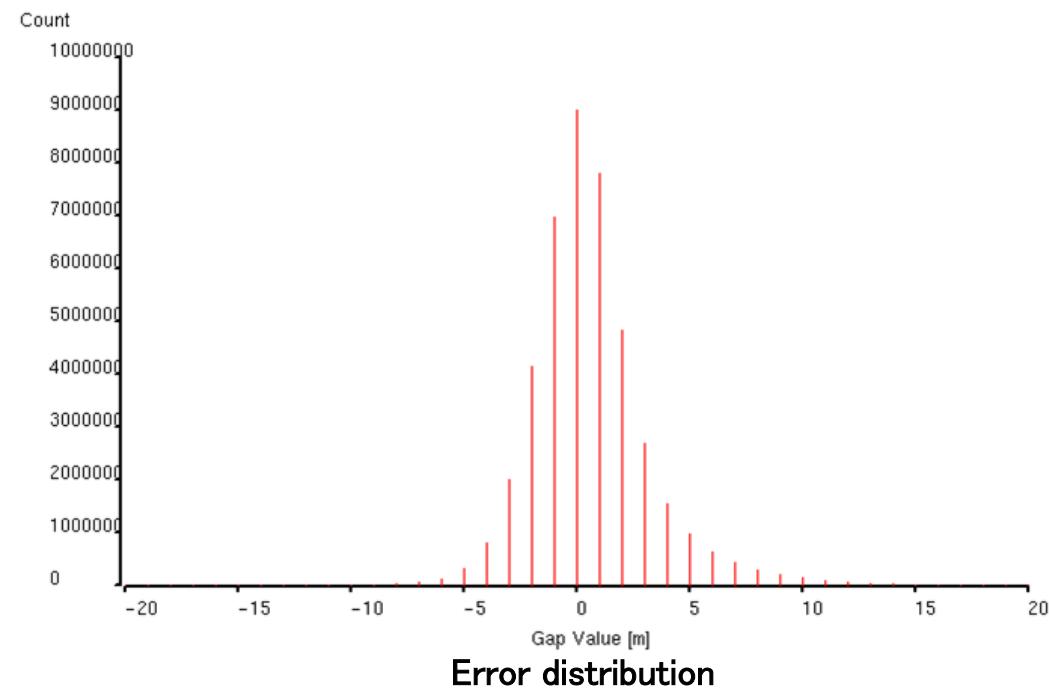
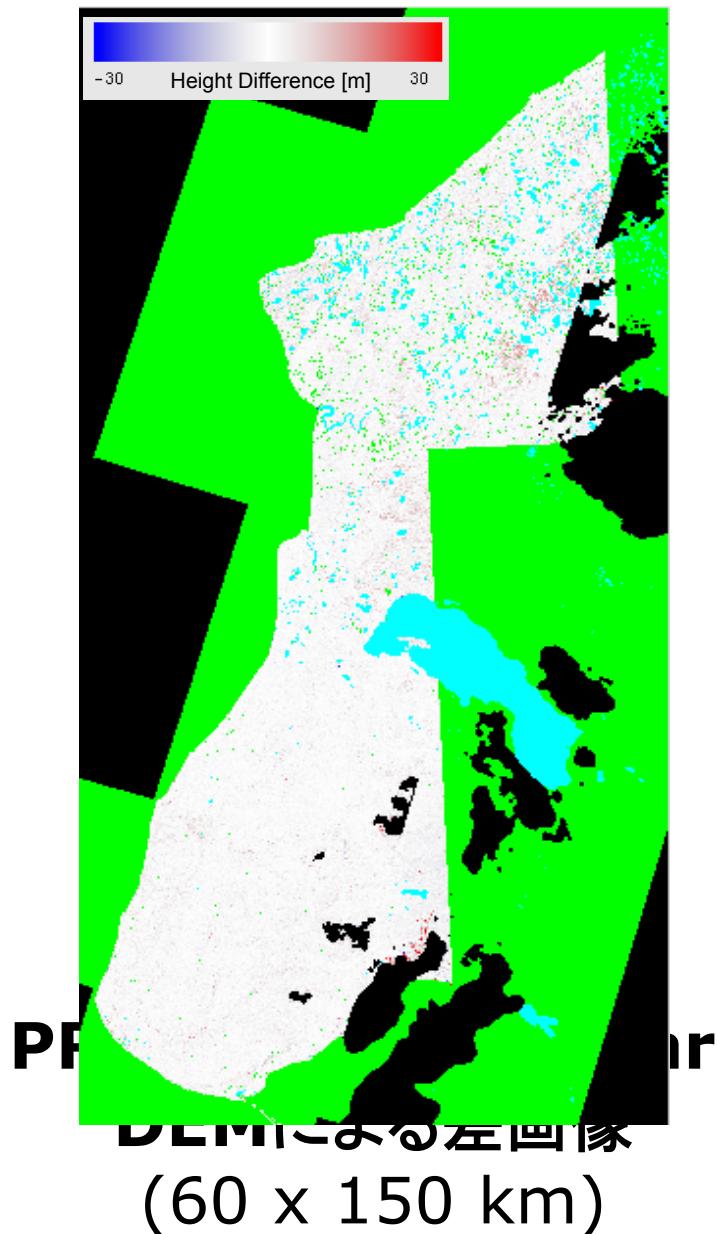
Note: Values in each element are RMSE defined Eq. (28) (standard deviation, number of samples)

: Ge\_err\_ortho ~12.10m (RMSE)

## Validation

All the CRs deployed in the world  
SRTM  
ALOS orbit data  
3 off-nadirs

## 2.2 PRISM, AVNIR-2 PRISM DSM



### PRISM/DSM validation results : KenaiLidar DEM

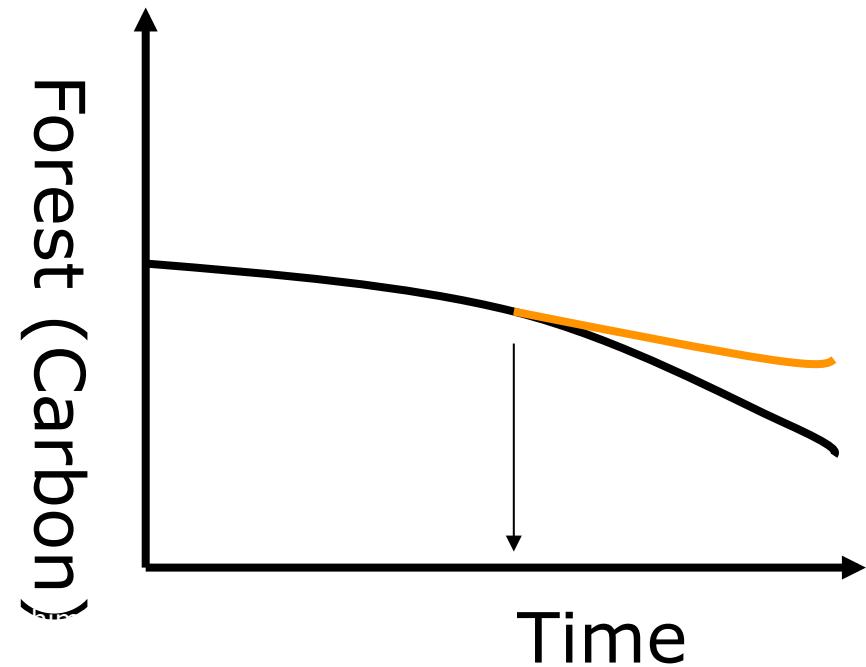
- ✓ Accuracy (43,669,079 points)  
2.88m (RMSE), 2.82m ( $1\sigma$ ), 0.60m (bias) < 5m (spec.)

## **Applications**

<b>Oil Spill</b>	<b>Change Detections</b>
<b>Fire scare</b>	<b>Rice Paddy Monitoring</b>
<b>Flooding</b>	<b>Illegal Logging Monitoring</b>
<b>Land Slide (Flash water and Slow moving)</b>	<b>Ocean Wind Speed distribution</b>
<b>Subsidence</b>	<b>DSM generation (PRISM, PALSAR by InSAR)</b>
<b>Volcano</b>	<b>Ionospheric Disturbances</b>
<b>Earthquake</b>	<b>Radio Frequency Interference</b>
<b>Forest, REDD+, Wetland</b>	<b>Ortho-rectification</b>
<b>Polar Ice/Glaciers</b>	<b>Soil Moisture</b>
<b>Coastal Erosions</b>	
<b>Drift Ice monitoring</b>	

# **REDD: Reducing the emission from deforestation and the forest degradation.**

- Estimation of Forest/Non-forest areas
  - Estimation of carbon ( $\text{CO}_2$ )
  - Temporal variation of the above parameters
- -> Carbon Credit



# **Global Forest Monitoring Using L-band Spaceborne SAR Dataset**

Goal: Monitoring the global forest status and changes using the multi-year L-band SAR data, i.e., geometrically co-registered time-series ortho-rectified and slope corrected high resolution global forestry data

Resolution: 10m-25m

Sensor: JERS-1 SAR/ALOS-PALSAR

Reprocessing all the EORC/JAXA SAR archives

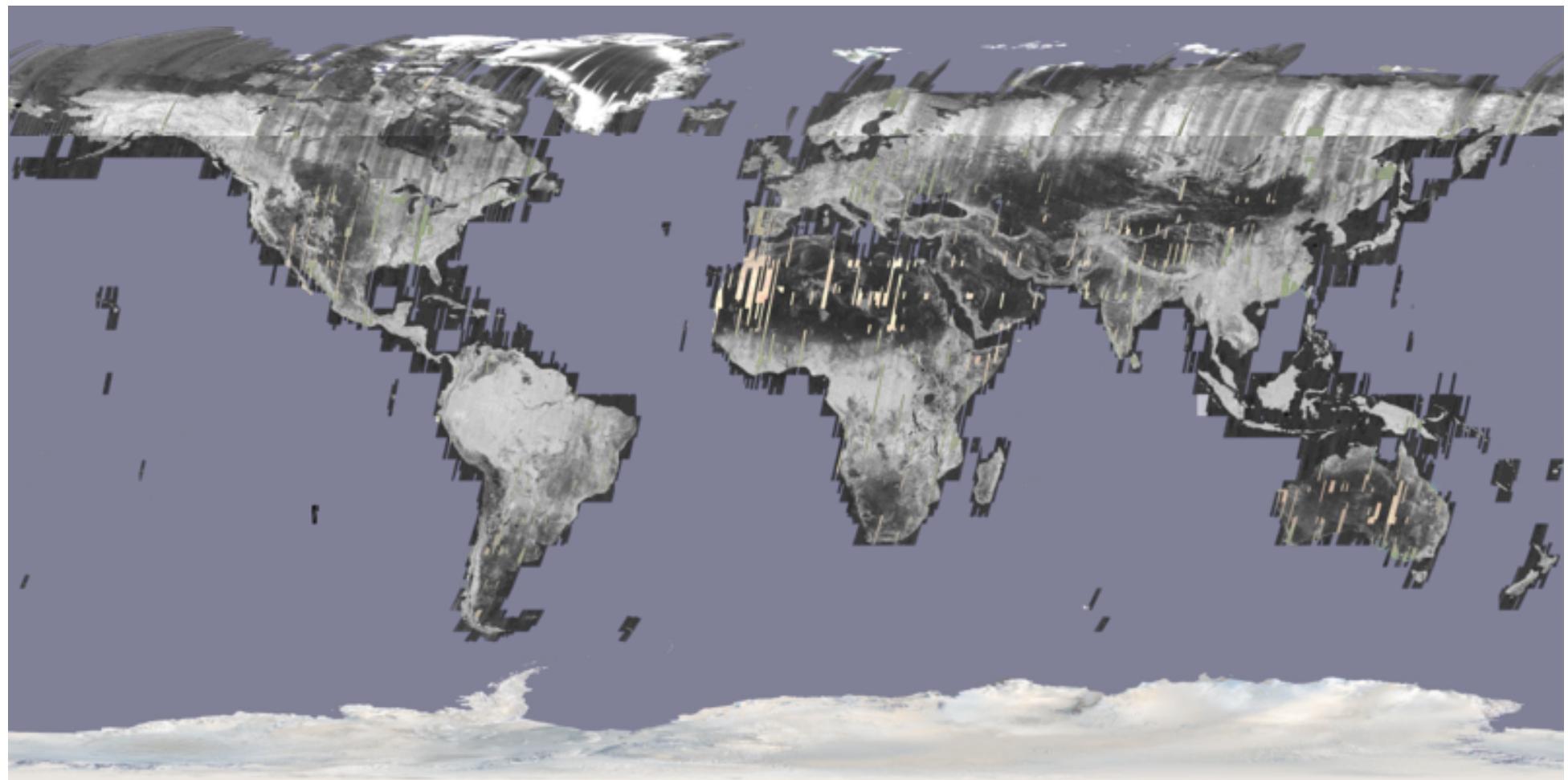
Dates: 1994-1996-1998~2007,2009, 2010

Products: Horizon1/2 + Mosaic

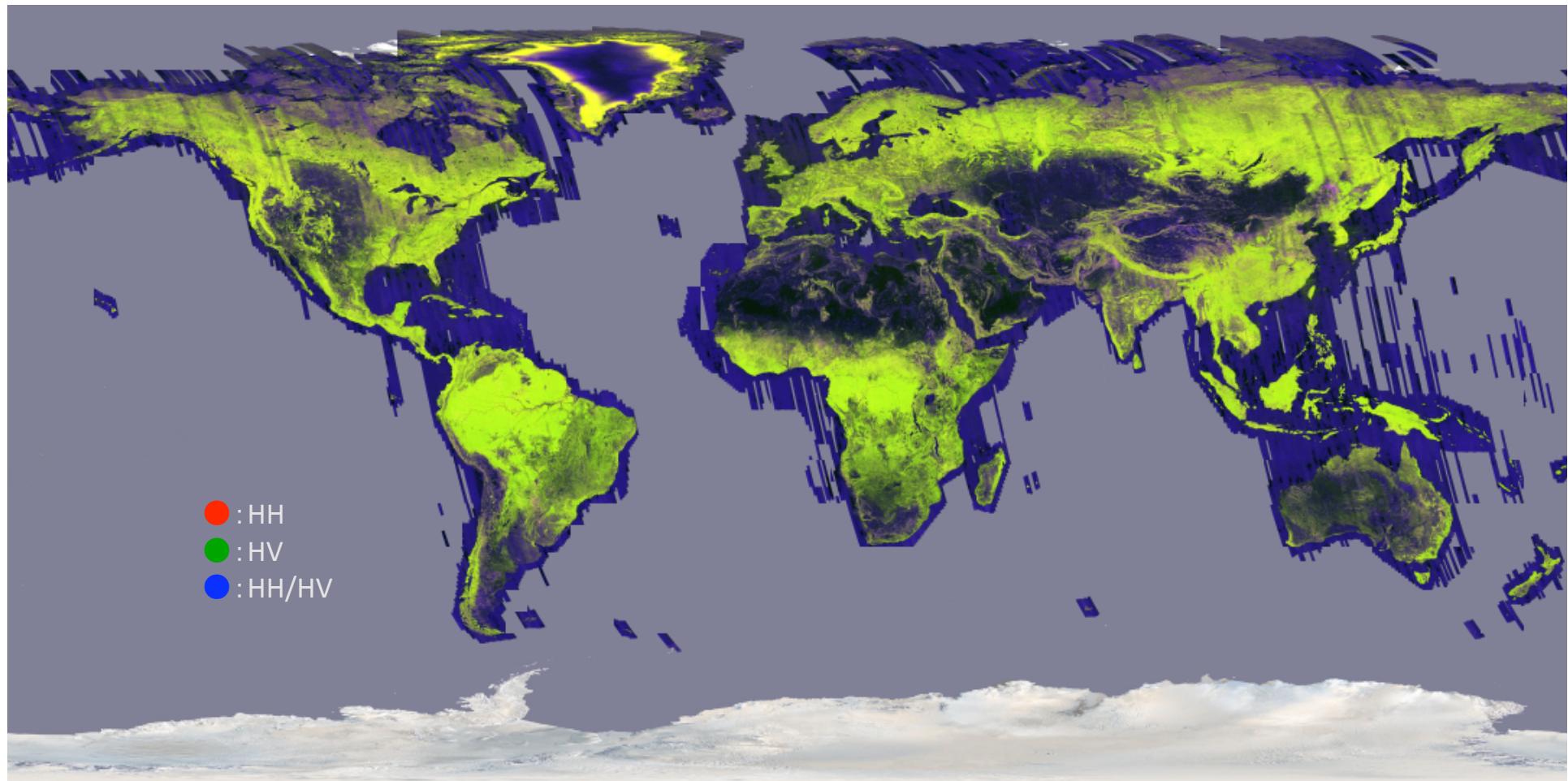
Classification method: SVM, Least distance, level slicing  
(under evaluation)

# JERS-1 SAR 10m Mosaic- 1995

## HH Image

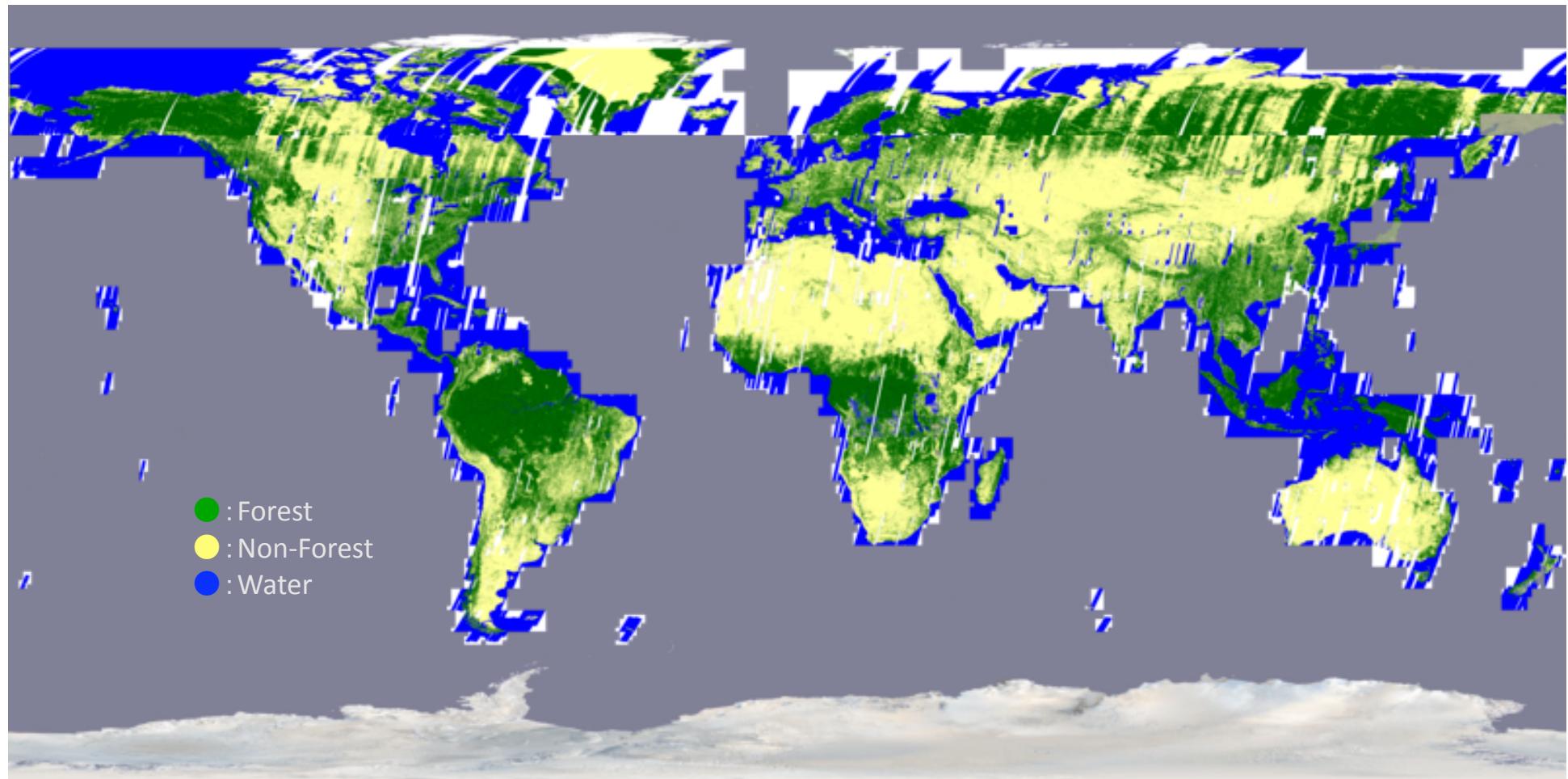


# PALSAR 25m Mosaic 2010 RGB Composite Image

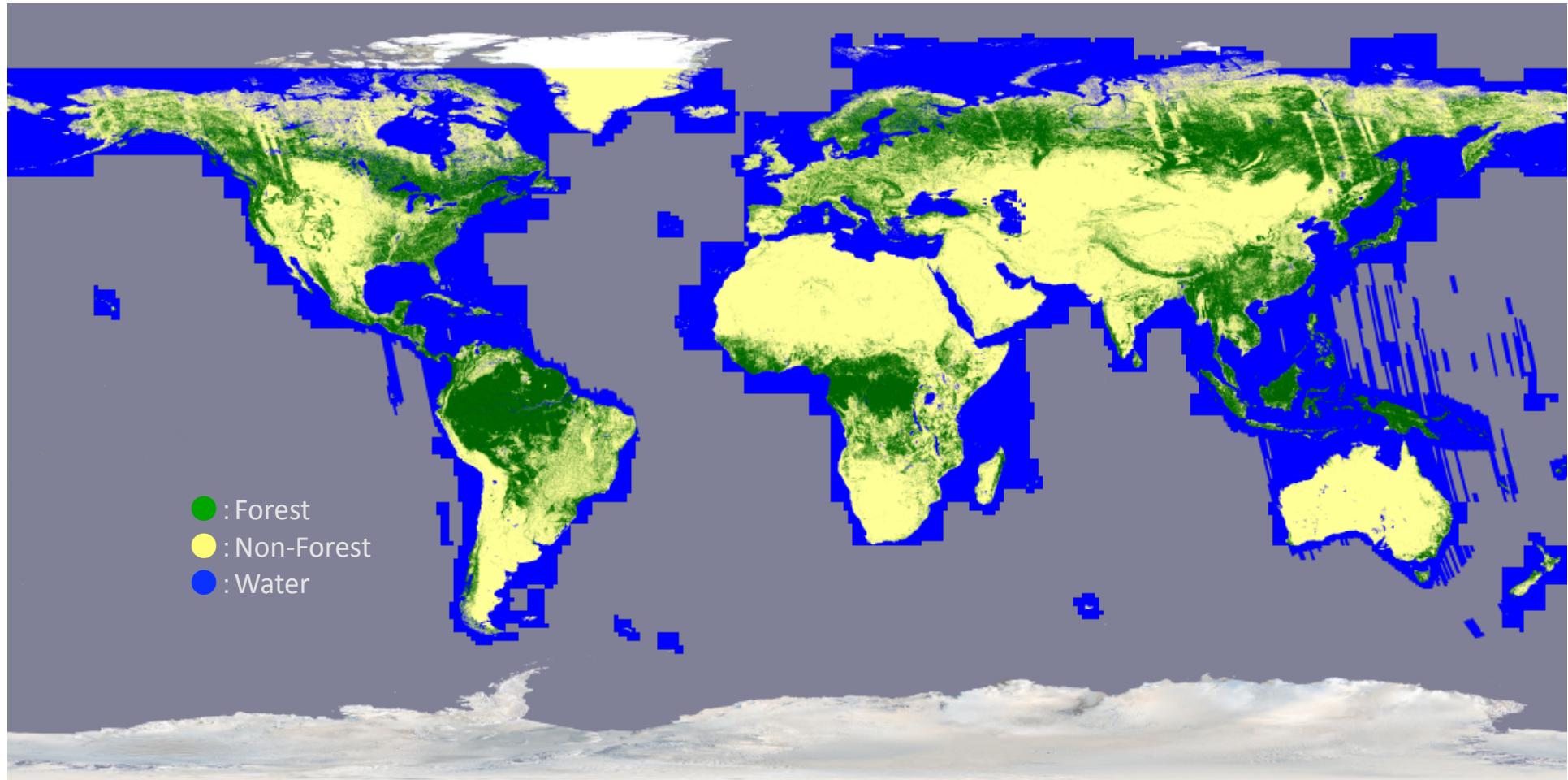


# JERS-1 SAR 10m Mosaic 1995

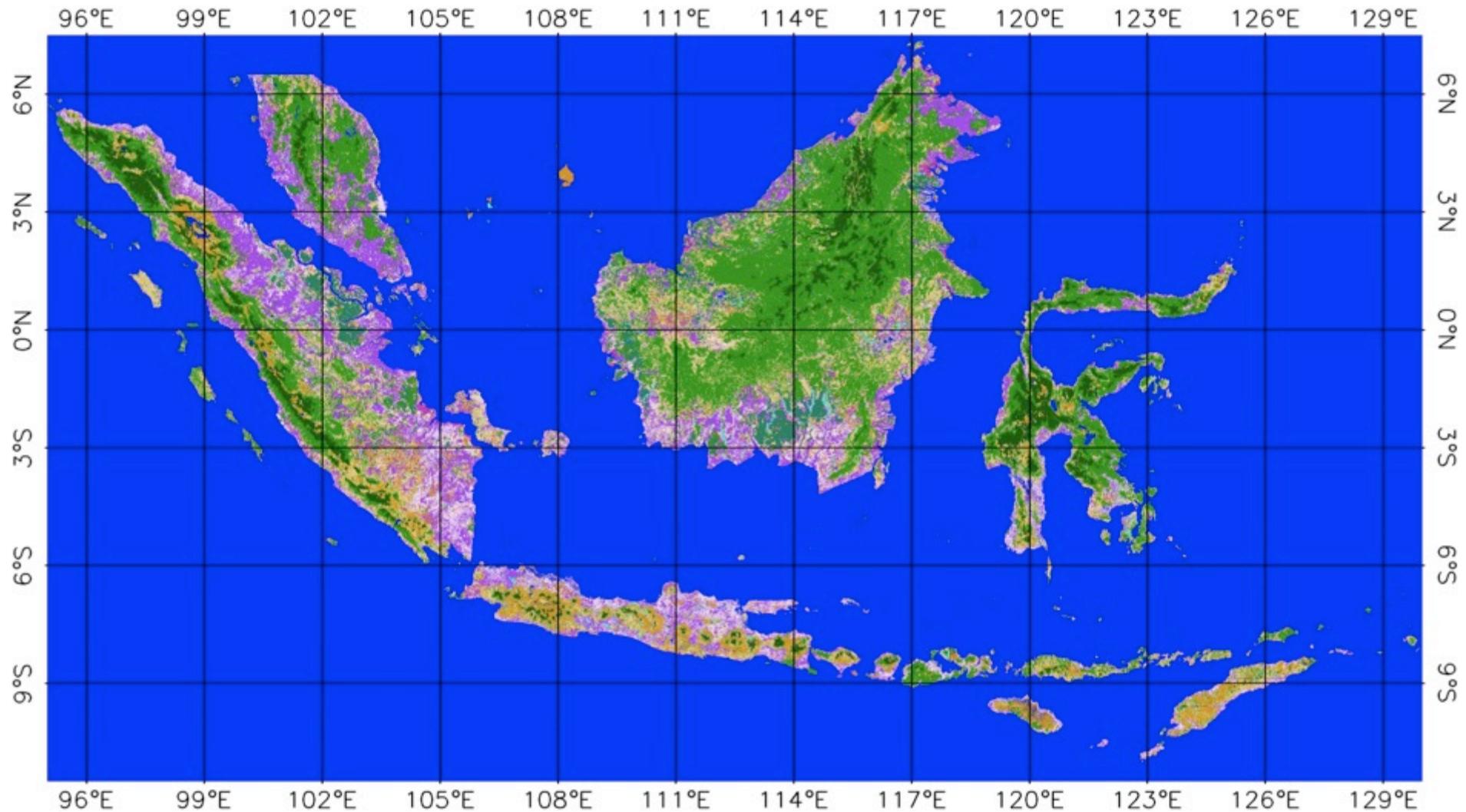
## Forest/ Non-Forest Map



# PALSAR 25m Mosaic 2010 Forest/Non-Forest Map



## ESTIMATION RESULT : All Indonesia 2009



- |                               |                          |                                |
|-------------------------------|--------------------------|--------------------------------|
| 1. Mountain forest            | 5. Shrubs/Grassland      | 9. Degraded / Secondary forest |
| 2. Lowland forest             | 6. Agriculture/Bare soil | 10. Recently Burnt / Clear cut |
| 3. Peat/Non-Peat swamp forest | 7. Plantation            | 11. Water                      |
| 4. Riverine forest            | 8. Mangrove/Nipah        | 12. Unclassified               |

# Deforestation monitoring with IBAMA

Forest monitoring from Space : 1988~

Annual deforestation at Brazil

Deforestation area:

19000km<sup>2</sup>(1996~2005)

12000km<sup>2</sup>(2007/8~2008/7)

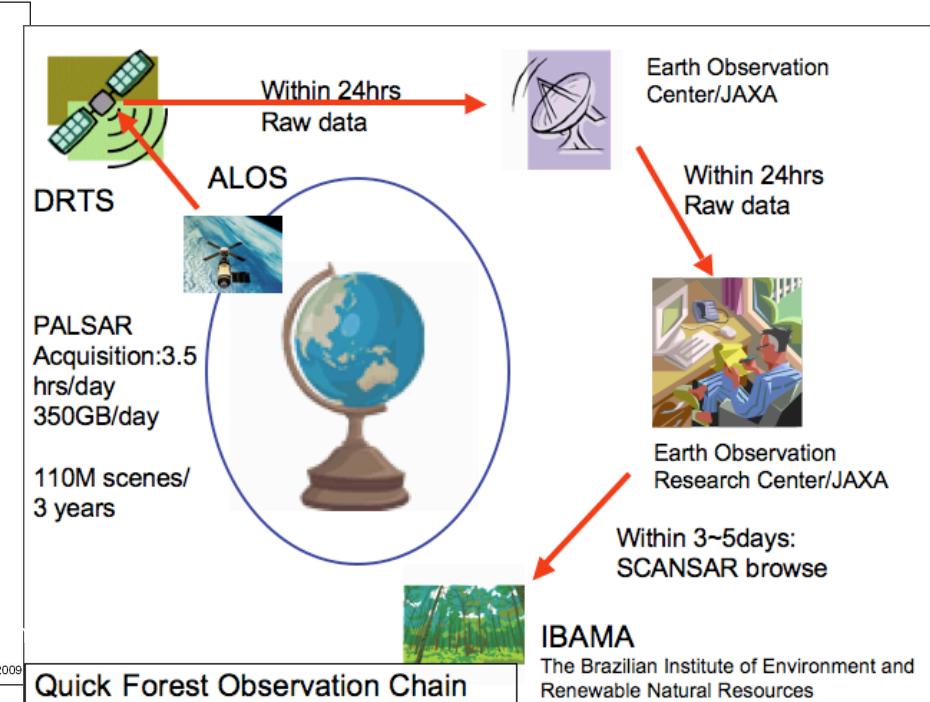
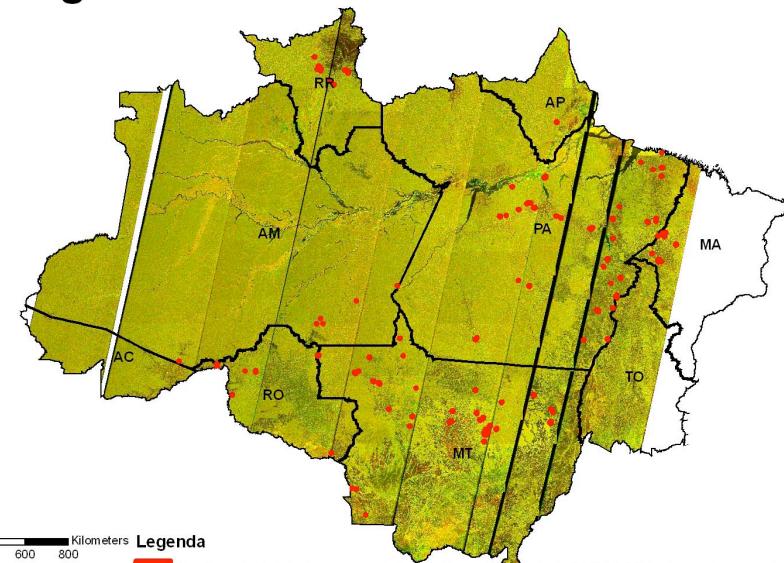
7000km<sup>2</sup>(2008/8~2009/7)

4000km<sup>2</sup>(2020 goal)

Environment Minister “Minc” said that the monitoring from space was very effective. Total deforestation of south america: 30000km<sup>2</sup>/year

Global deforestation: 70000km<sup>2</sup>/year

**INDICAR Ciclo 28 e 30**  
**Agosto 2009 a Novembro 2009**



MANAUS, 02 DE MARÇO DE 2011

# acrítica Amazônia

Notícias Manaus Amazônia Craque Buzz Vida Especiais Multimídia

PESQUISA

SITE MAP RSS

EM DESTAQUE ▶ Últimas | Conflitos | Índios | Meio Ambiente | Pesquisa | Sociodiversidade | Biodiversidade

## Ibama realiza ação contra desmatamento em período chuvoso pela primeira vez

Segundo último relatório do Ibama, os casos de apreensão serão encaminhados ao Ministério Pùblico Federal e a Polícia Federal, para providências.



### DA REDAÇÃO: SAÚDE

ENTREVISTA SEC WILSON SEC



### Você é o Repórter

Envie e transforme suas imagens e fotos em notícia



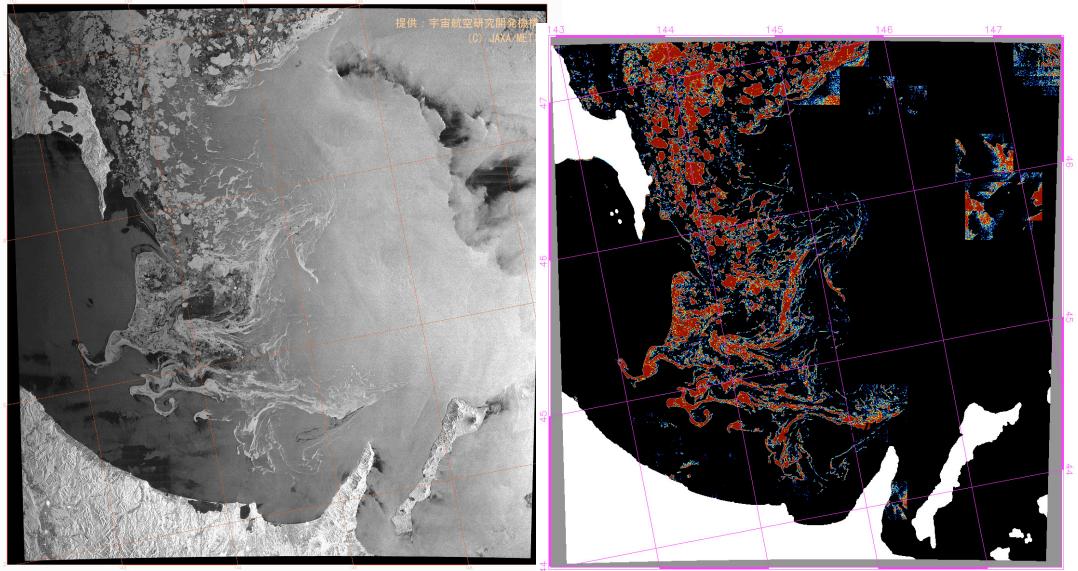
### Denúncia

**PALSAR IBAMAによる検挙ニュース**IBAMAが雨季初の取り締まりの記事です。州はアマゾナスであり、ロンドニヤに近い場所(ホットスポット)です。1月から開始されたようです。では、2011年2月

# Quasi real time data distribution and Sea Ice monitoring

10:30

ALOS/ScanSAR  
EOC receive/processing  
TKSC post processing

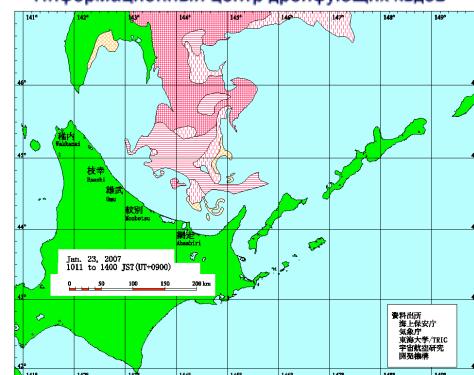


14:00

第一管区画像取得(FTP),  
海水速報図作成

流水情報センター

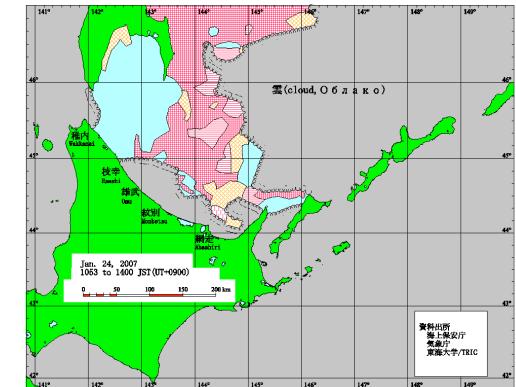
Ice information center, JAPAN  
Информационный центр дрейфующих льдов



海水速報図

17:00

Open to the public

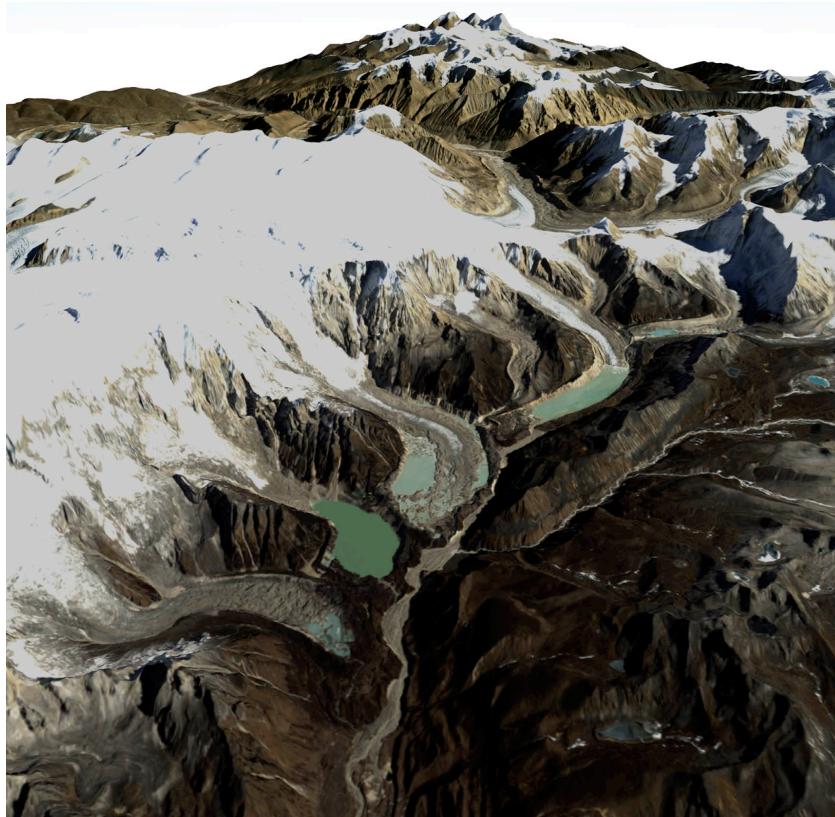


SCANSARが無い場合

## DSM generation using the PRISM

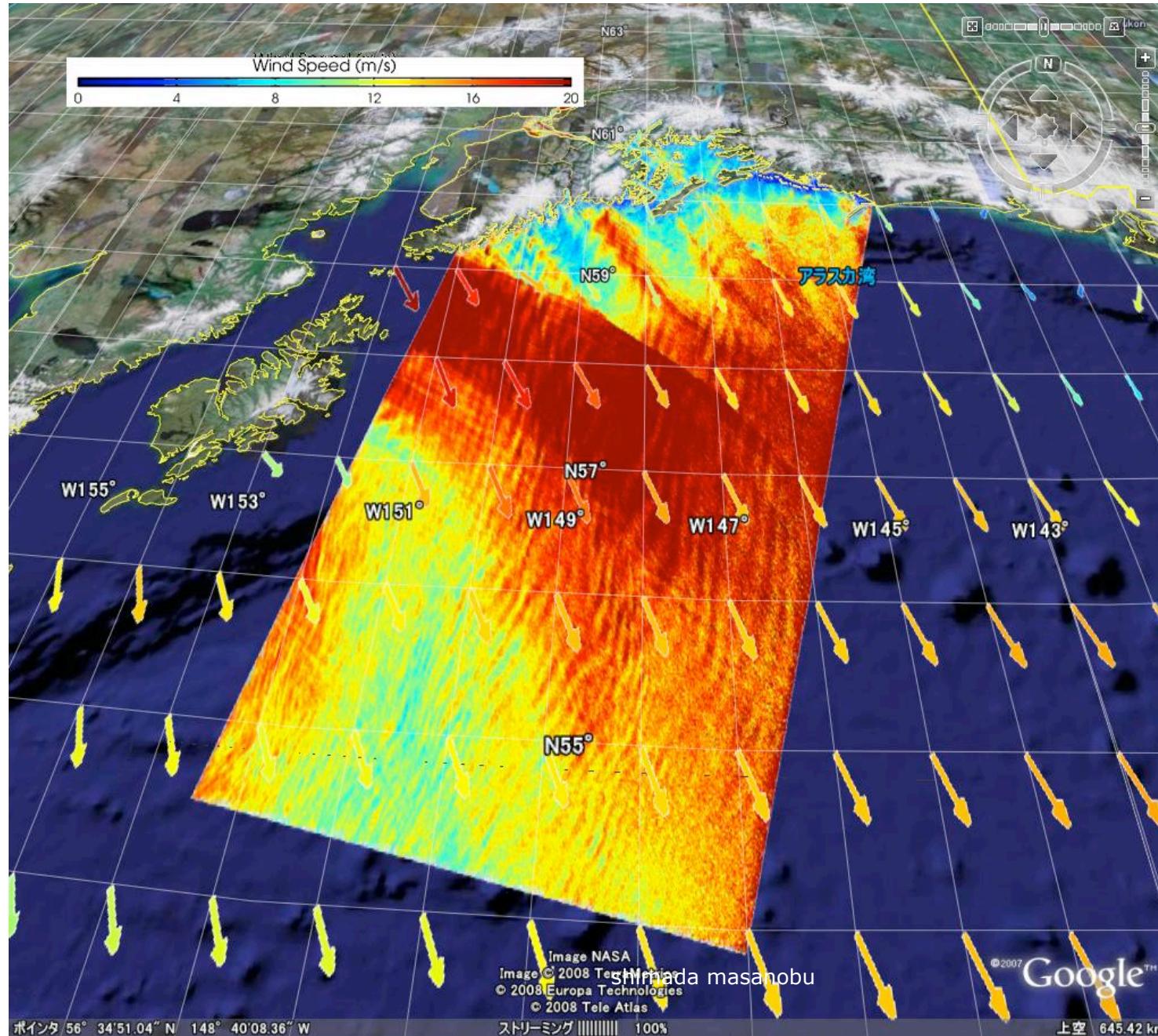


PRISMによるDSMおよびPRISMとAVNIR-2のオルソ補正画像を用いた雲仙普賢岳の鳥瞰図。PRISMは2007年10月12日、AVNIR-2は2007年5月27日にそれぞれ観測したデータを使用。



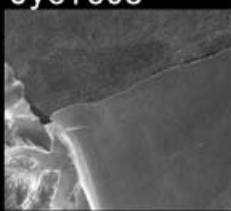
PRISMによるDSMとAVNIR-2オルソ補正画像を重ね合わせて作成したブータン付近の氷河湖の鳥瞰図。PRISMは2007年6月25日、AVNIR-2は2007年12月26日にそれぞれ観測された。

# Wind speed monitoring using the PALSAR

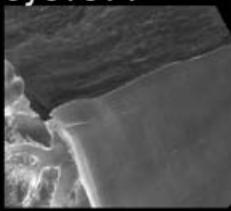


# Antarctica Browse Mosaic (Cycle08, 14, 16)

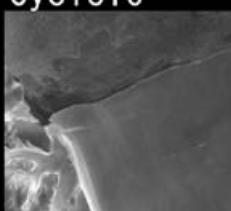
Cycle08



Cycle14



Cycle16



Cycle08



Cycle14



Cycle16

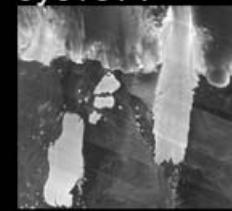


Cycle08:  
2006/12/5~2007/1/19  
Cycle14:  
2007/9/7~2007/10/22  
Cycle16:  
2007/12/8~2008/1/22

Cycle08



Cycle14

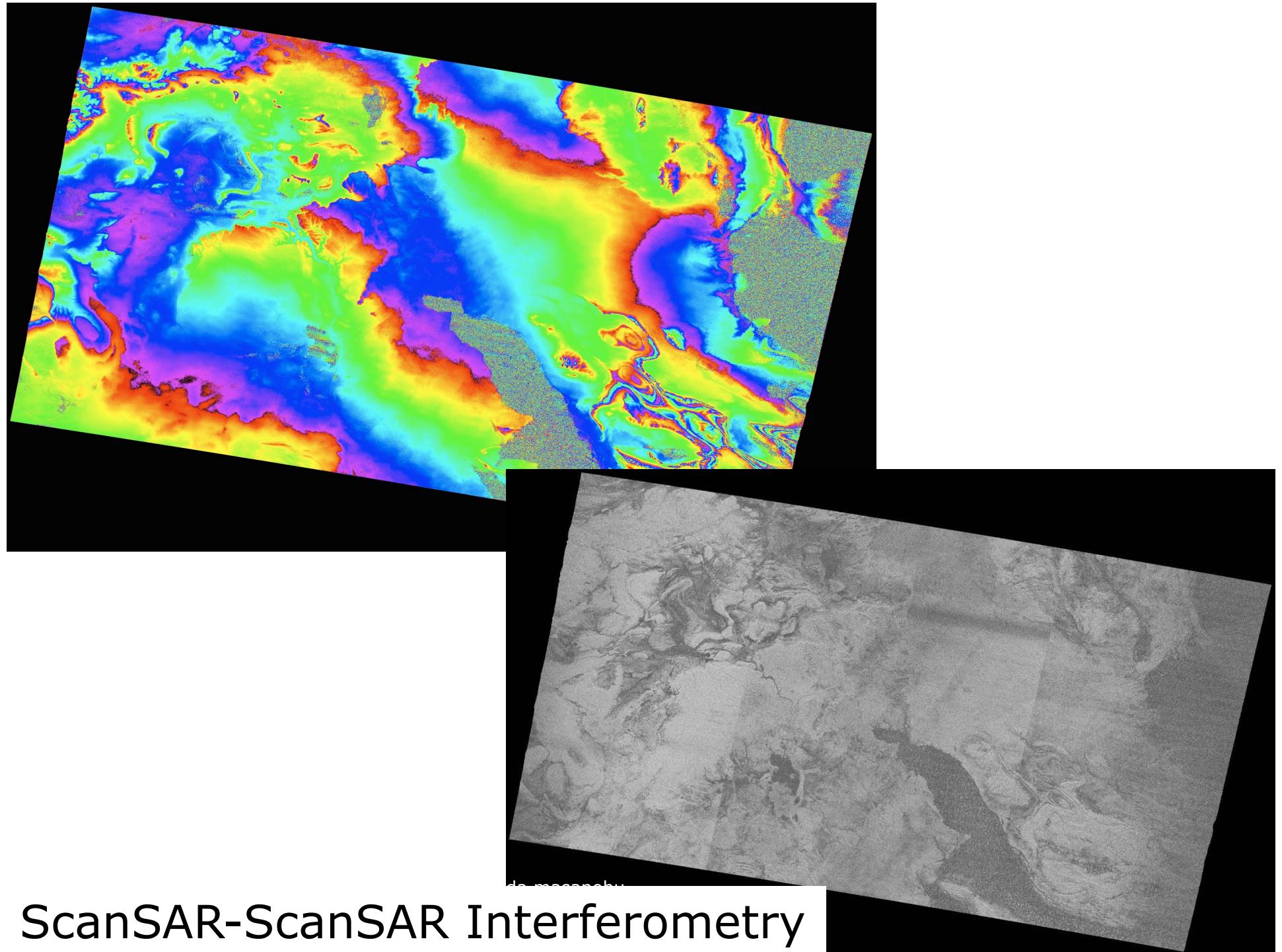


Cycle16

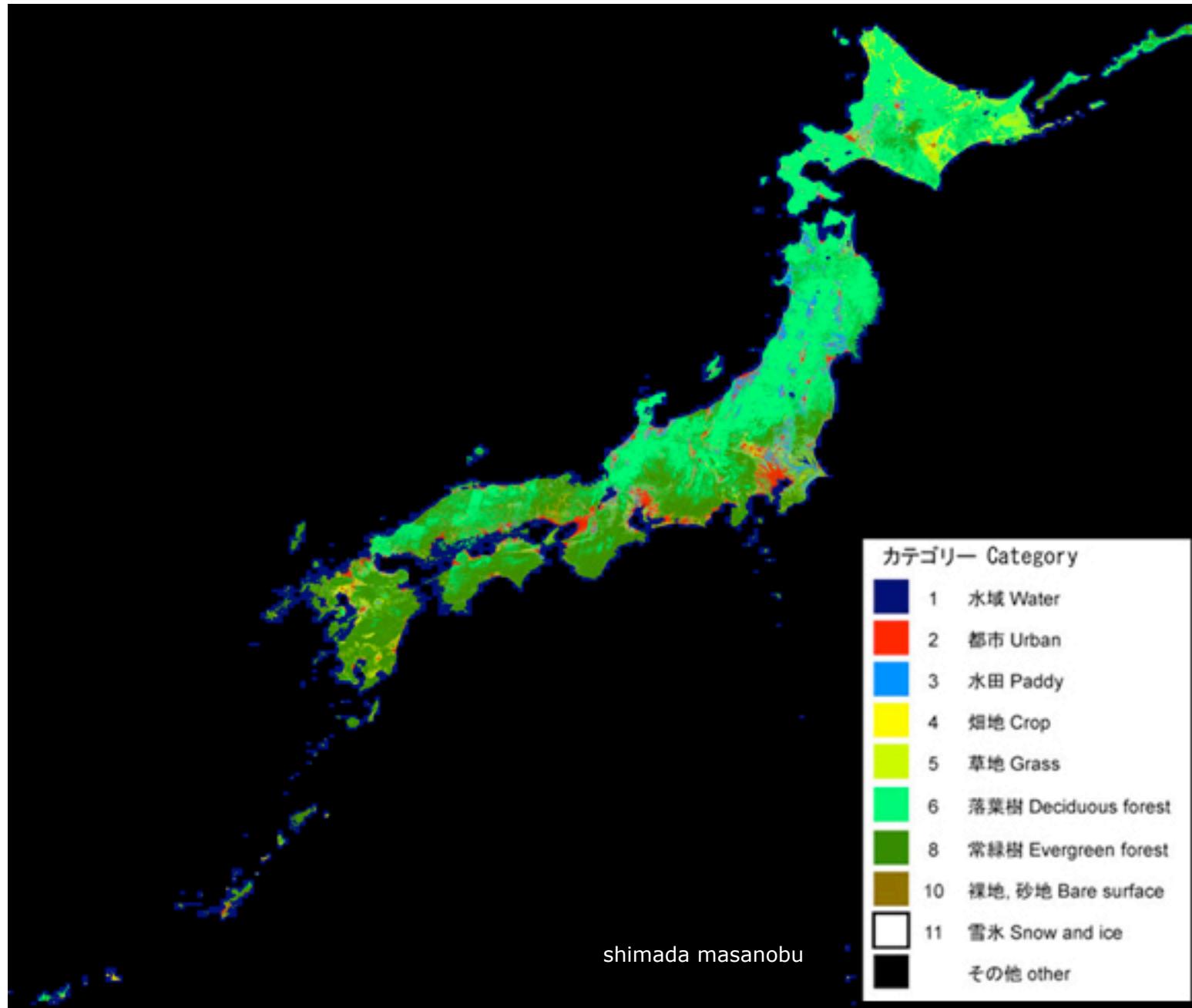


shimada masanobu

©JAXA, METI Analyzed by JAXA



# High resolution land cover using AVNIR-2 and so on



## Conclusion-1

L-band SAR high resolution slope corrected ortho global products for 1995-2007-2009 and 2010 have been generated with well geometric accuracy of 11m.

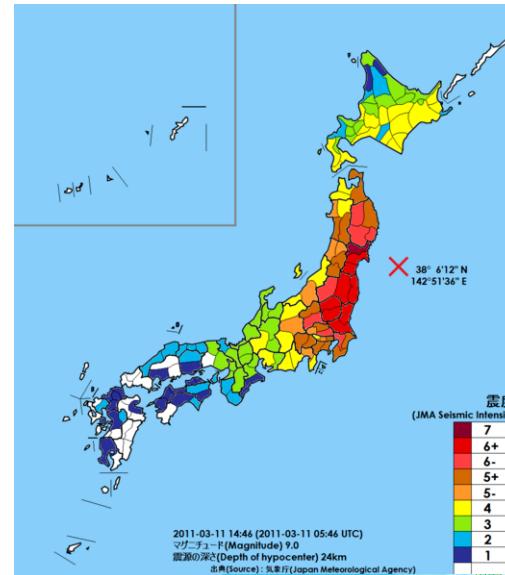
Classification processes are under going. Using the test site in Riau, SVM shows the better accuracy of 89% for forest/non-forest. Level slicing shows some over and under estimates for the forest/non-forest information while the processing speed is acceptable.

JAXA is experimentally building the MRV system using the ALOS data and the ground truth data.

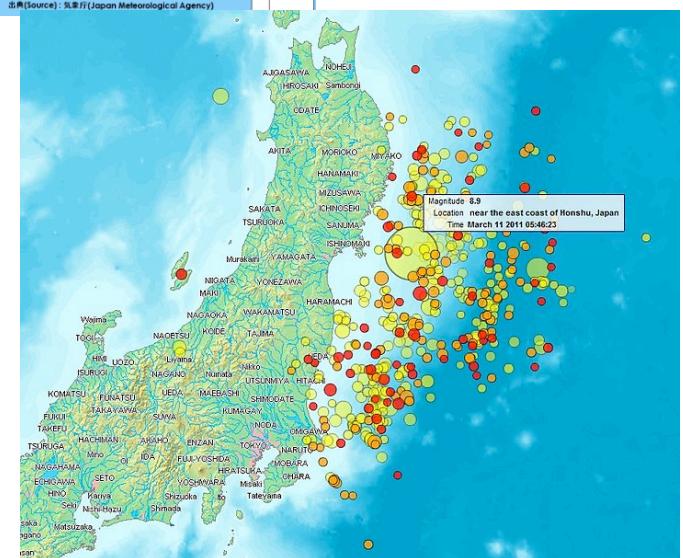
# Tohoku-Oki Earthquake 2011

Occurred at 100 km off Sendai on 2:46PM 3.11  
2011, M9.0, World 4<sup>th</sup> largest Earthquake

Dead: 15019  
Missing: 9506  
Refugee: 115522  
(May 14 2011)



Seismic  
Intensity



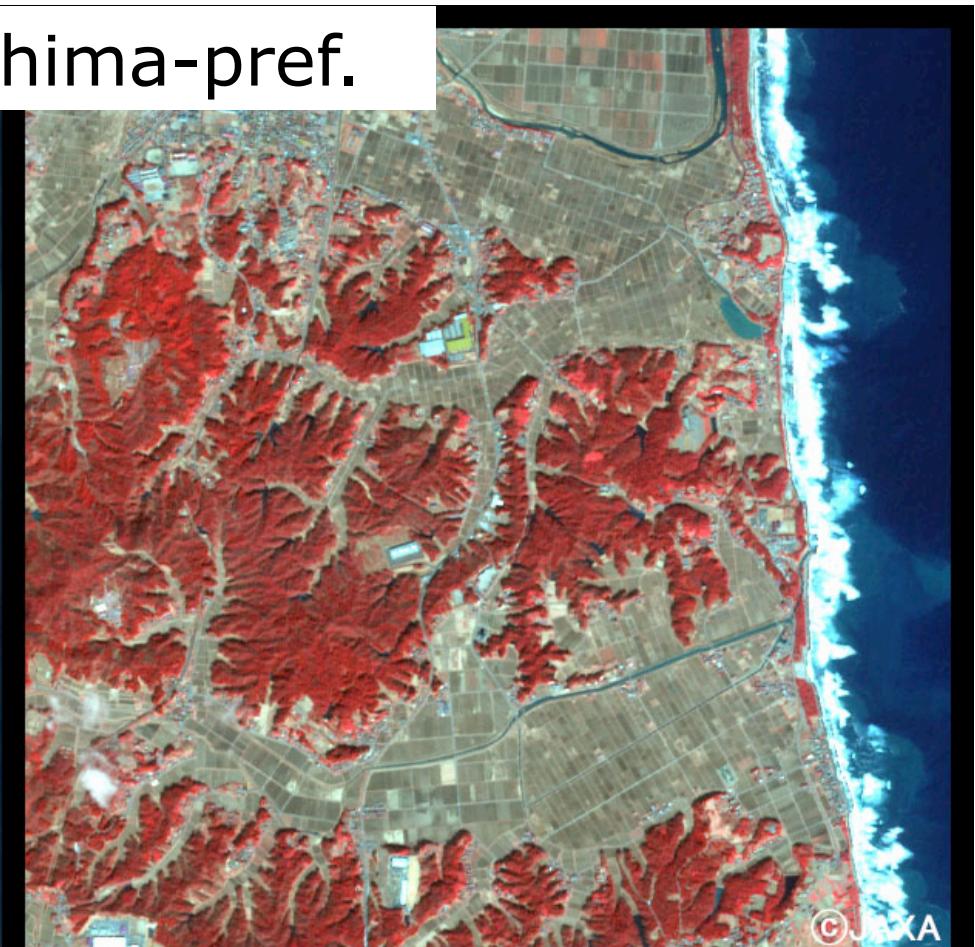
AVNIR-2 : 10m resolution.

Minami-Souma-city, Fukushima-pref.



0 1 2 3(km)

2011/3/14 (JST)



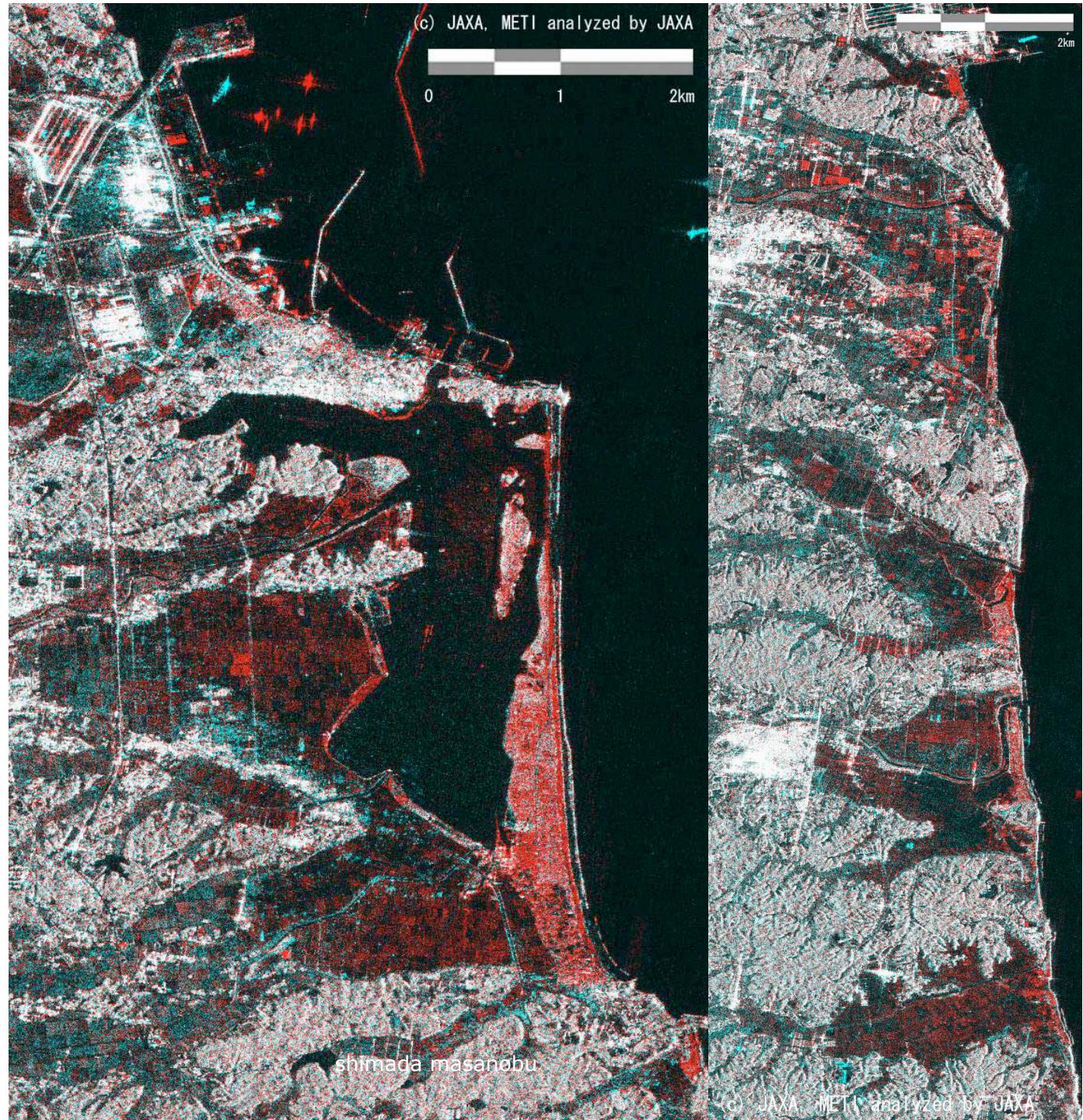
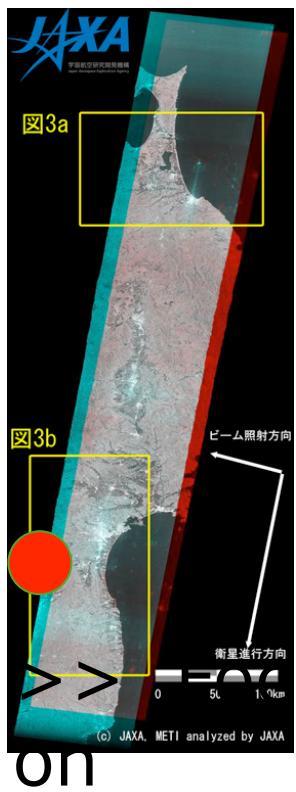
0 1 2 3(km)

shimada masanobu

2011/2/23 (JST)

# Color composite:

R:11.12.2009/off  
41.5,GB:  
3.16.2011/off43.4  
South Souma City  
area, flooded by  
the Tsunami

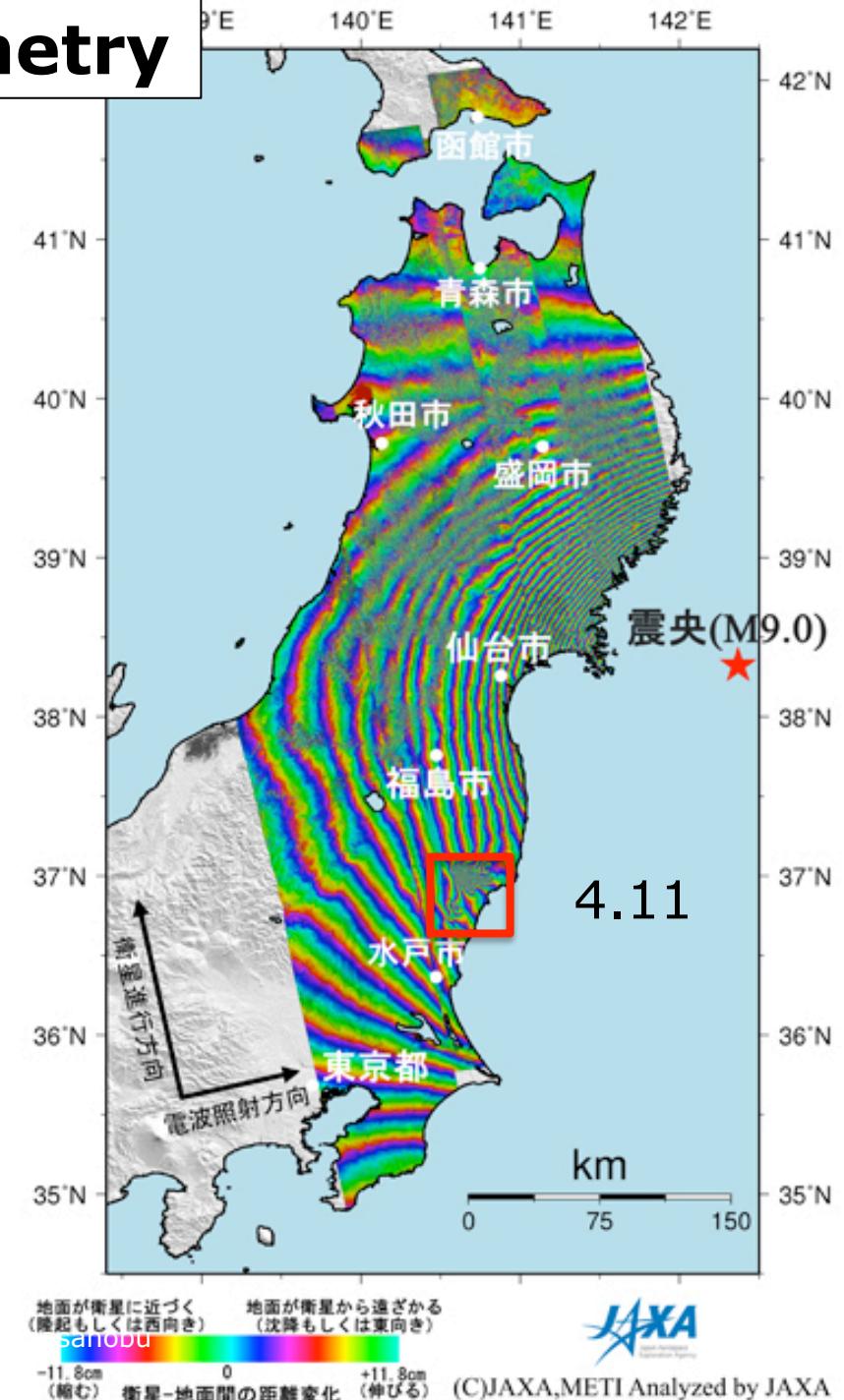
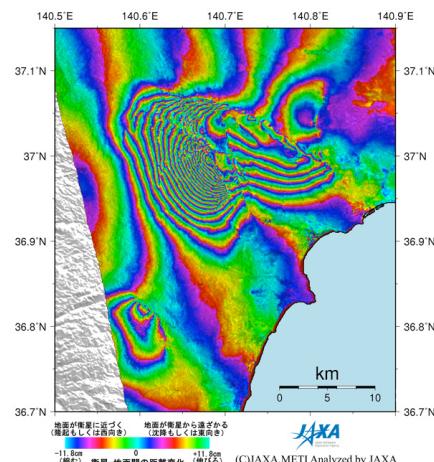


# Differential SAR interferometry

A method to detect the surface deformation by measuring the phase difference between two measurements and correcting the additional phase caused by the orbital baselines and topography.

PALSAR: FBS  
Ascending mode  
**5 strips were mosaicked.**

Earthquake of  
4.11



# ALOS - 2



Continuity of ALOS PALSAR with

- Systematic acquisition strategy (BOS)
- Improved spatial resolution
- Improved observation frequency
- dual-polarization ScanSAR

Life time: 5 years (target 7 years)

Launch: Mid-2013

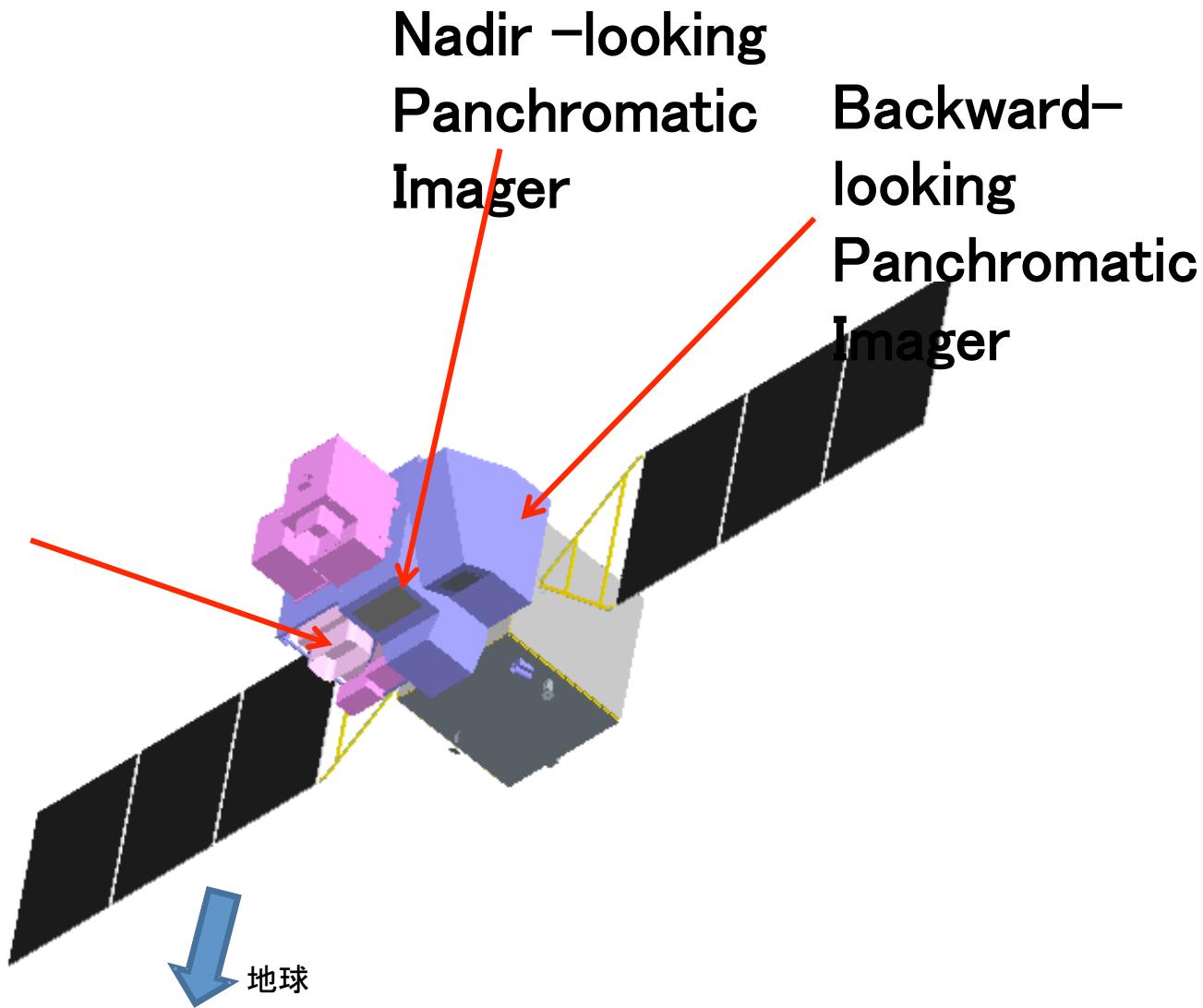


Duty cycle	xx min average/orbit
Orbit	204 orbits/cycle
Altitude (Nominal)	628 km
Inclination	97.9 degrees
Period	97.4 minutes
Orbit LST	12:00 ± 15 min
Sun-Synchronous	15-3/14 orbits/day
Repeat cycle	14 days

## Applications:

- Disaster Monitoring
- Forest Monitoring
- Information update for land and infrastructure
- Monitoring of cultivated areas

**4-band  
Multi  
spectral  
Imager**



Tentative images of ALOS-3



## Cocclusions

- **ALOS and the characteristics**
- **Environmental monitoring especially for forest monitoring**
- **2011 Tohoku Earthquake and related disaster**
- **ALOS Final moment (power anomaly)**
- **Future**