

# Remote Sensing Training & Capacity Building

Nov. 26, 2010

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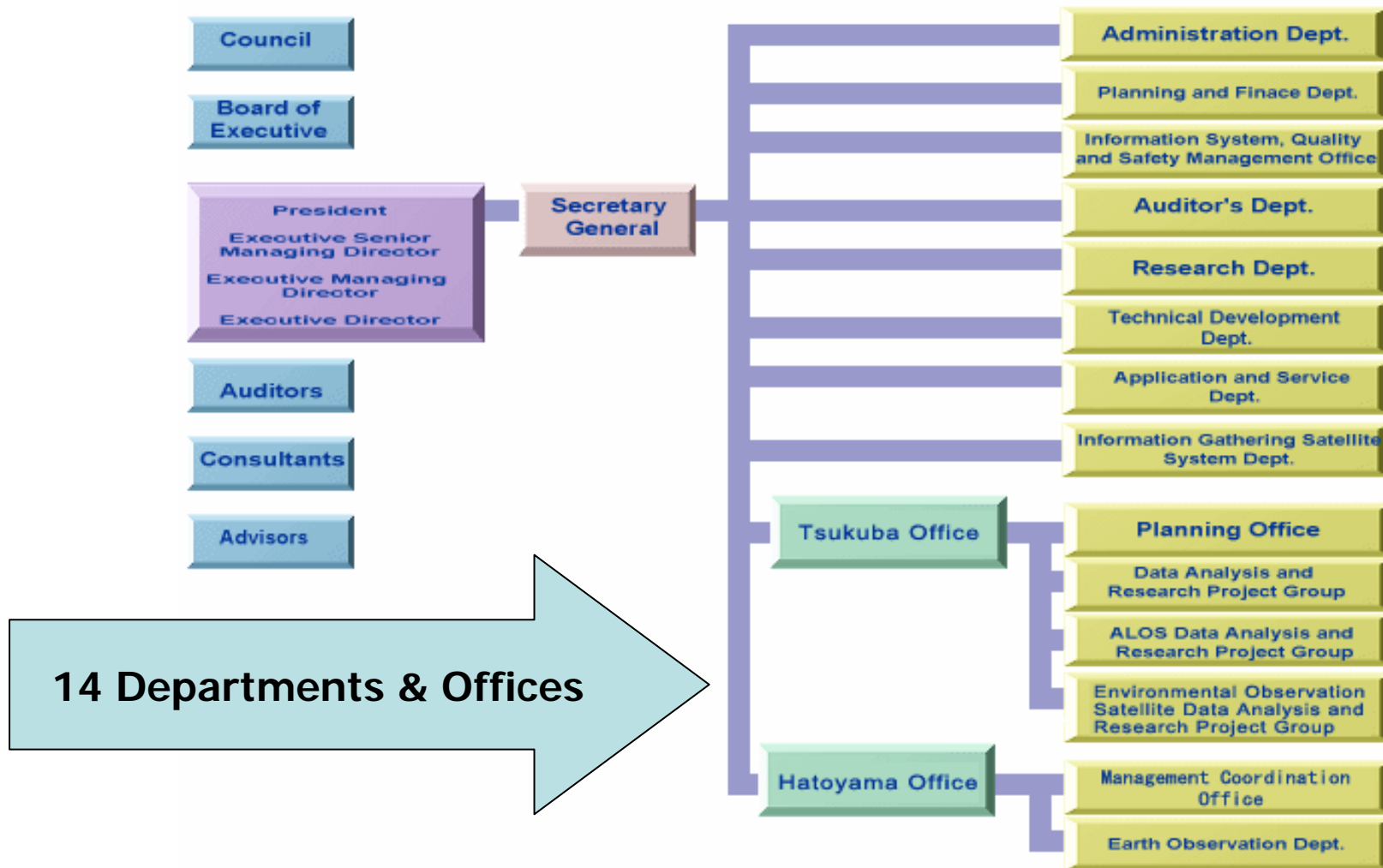
Remote Sensing Technology Center  
of Japan (RESTEC)



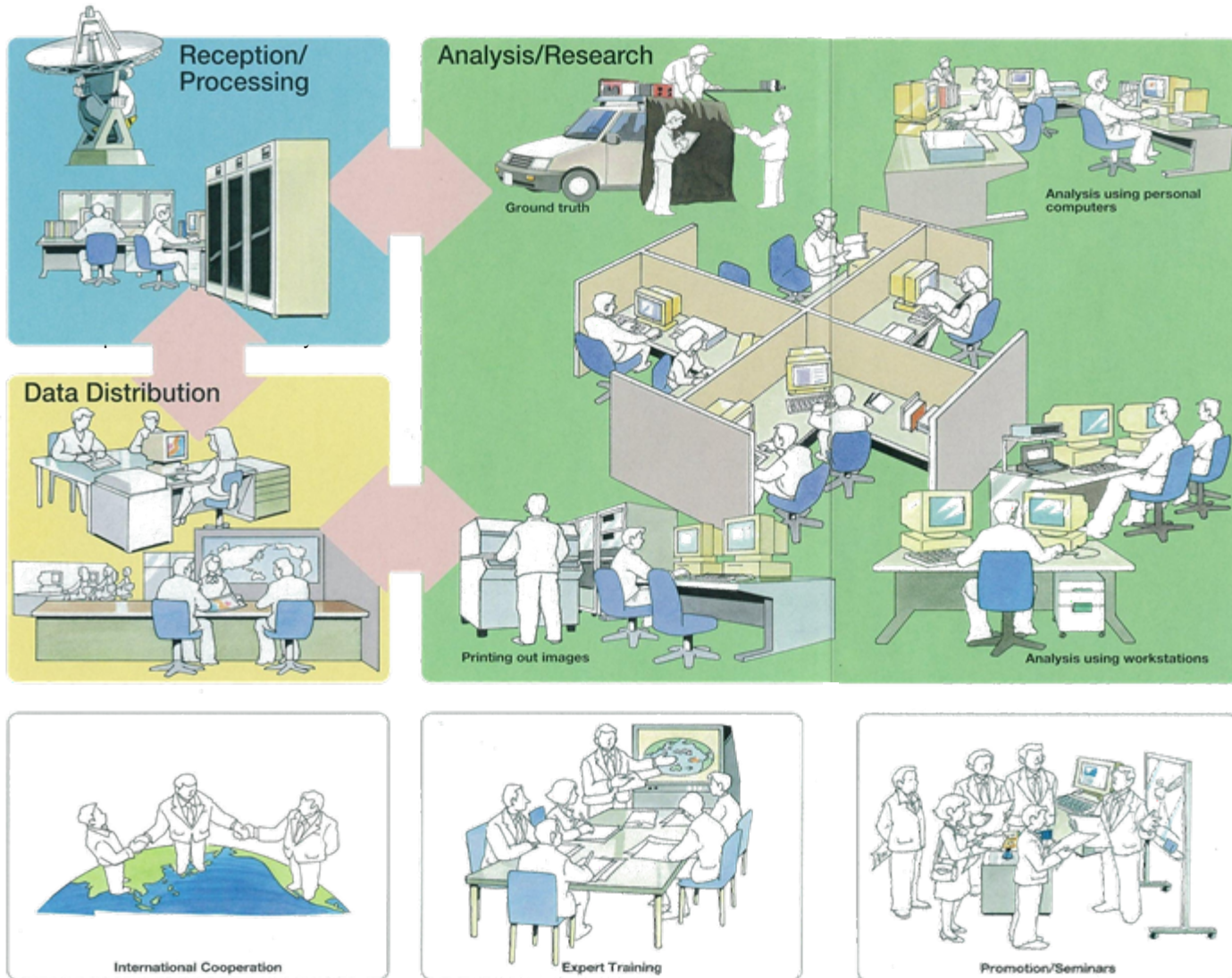
## RESTEC Overview

- Established in Aug. 1975
- Special Public-Service Promotion Foundation to conduct basic and general research and development related to satellite remote sensing.
- Number of Personnel:
  - 281 (Total: as of April 1, 2010)
  - 168 (Regular Member)
  - 113 (Support Contractor)

# RESTEC Organization



# RESTEC Activities





# Training Curriculum

## Basic Trainings

- Remote Sensing Principle
  - Sensors
  - Data Processing
  - Data Analysis
  - Date Interpretation

## Advanced Trainings

- Application Technologies and Advanced Digital Processing Technologies of Remote Sensing

### PRISM

1. Map Creation
2. DEM for Map
3. City Planning
4. Agriculture
5. Forestry
6. Coastal Management
7. Illegal Disposal Control
8. Flood Monitoring
9. Sea Traffic Monitoring

### AVNIR2

1. Large Scale Map Creation
2. Large Scale City Planning
3. Agriculture (Crop Identification etc.)
4. Forest Management
5. Coastal Management
6. Gulf Pollution Control
7. Vegetation Monitoring
8. Large Scale Flood Monitoring

### PALSAR

1. DEM Creation
2. Interferometry for Surface Deformation
3. Biomass Estimation
4. Forest Fire Monitoring
5. Forest Logging
6. Oil Spill Monitoring
7. Flood Monitoring
8. Agriculture Rice-Paddy Field Estimation
9. Ship Detection/ Identification

## Number of Participants for JICA RS Training by Countries in Asia Pacific Regions

No.	FY	'77	'78	'79	'80		6	7	8	9	10	Subtotal
3	Bangladesh	1	1	1	1							14
5	Bhutan							1	1	1	2	8
7	Brunei											2
8	Cambodia							1		1	1	4
11	China											15
15	Fiji											6
17	India	1	1	1	1							13
18	Indonesia	1	1	1	1				1	1	2	33
23	Korea	1			1							16
24	Laos											3
26	Malaysia	1	1	1					2	1	1	21
29	Mongolia											2
31	Myanmar				1			1				4
32	Nepal	1	1	1	1		1					9
37	P.N.G.											7
40	Philippines			1	1		1					21
42	Samoa							1				1
45	Singapore	1		1								4
46	Sri Lanka	1	1	1	1		1	1	1	2		18
48	Thailand	1	1	2	1						1	29
52	Vietnam											3
	<b>TOTAL</b>	<b>9</b>	<b>7</b>	<b>10</b>	<b>9</b>		<b>8</b>	<b>10</b>	<b>9</b>	<b>10</b>	<b>9</b>	<b>267</b>

## Number of Participants for AIT RS Training by Countries in Asian Region

No.	FY	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total
1	Bangladesh	1	1	5	4	28	5	5	9	22	2	82
2	Buhtan						1					1
3	Brunei					2	1					3
4	Cambodia		2	2		3	28	4		60	3	102
5	China				1	1			1		1	4
6	Fiji			3	1			1				5
7	India	3	1	1	2	2	5	2	4	1	1	22
8	Indonesia			6	30	6	5	2	36	4	31	120
9	Iran							1				1
10	Laos		2	6					27	3	4	42
11	Malaysia		2	2	1	1	1	12		3		22
12	Mongolia			4	2	2	1		3	1		13
13	Myanmar				3		33	3		2	27	68
14	Nepal	3	3	27	5	2	4		4	2	3	53
15	Pakistan			4	2	4	2		2			14
16	Philippines	2	1	24	3	1	2	4	21	2	3	63
17	Singapore					1	1	1				3
18	Sri Lanka	1	2	2	7	31	7	6	12	3	2	73
19	Thailand	8	4	9	4	3	5	7	20	6	3	69
20	Viet Nam	2	2	5	30	6	6	2	11	3	3	70
	Total	20	20	100	95	93	107	50	150	112	83	830



No.	FY	'77	'78	'79	'80		6	7	8	9	10	Subtotal
1	Afghanistan	1		1			1					3
2	Argentina								2	1		24
4	Benin											1
6	Brazil								2	2	2	29
9	Cape Verde											1
10	Chile											3
12	Colombia						1					5
13	Egypt											3
14	El Salvador							1				1
16	Ghana											2
19	Iran											4
20	Iraq				1			1				2
21	Jordan						1					3
22	Kenya											13
25	Macedonia											1
27	Maldives											2
28	Mexico											5
30	Morocco											1
33	Nicaragua						1					2
34	Oman											2
35	Pakistan		1							1		12
36	Panama											1
38	Paraguay							1				1
39	Peru											12
41	Palestinian Auth.							1				3
43	Saudi Arabia							1				12
44	Senegal											1
47	Tanzania											2
49	Tunisia											1
50	Turkey											8
51	Venezuela											6
53	Zambia						1					1
54	Zimbabwe											1
	TOTAL	1	1	1	1		8	10	9	10	9	201



## Remote Sensing Technology Basic Training using optical and SAR data

NOTE: This training employs FREE soft-wares in principal aiming at sustainable future usage after the training.

### Curriculum

Objective	Hours	Program/ Details	Purpose and Method of Guidance
Basic	2.5	Introduction to Remote Sensing	·To introduce the basic theory on remote sensing
Satellites & Sensors	2.5	High Spatial Resolution Remote Sensing	·To present an overview of sensors and data processing theories
	2.5	Basic Principles of Microwave Sensor System and Data Processing (SAR)	
	2.5	Hyper-spectral Sensor	
	2.5	Thermal Infrared Remote Sensing	
	2.5	Satellite Data Format	
	2.5	Land Surface Environment	·To explain how to apply remote sensing technology to various fields (lectured by outside experts)
	2.5	Atmosphere, Oceanography including Tropical Rainfall Measuring Mission (TRMM)	
	2.0	Earth Resources	
	2.0	Topographic Mapping	
	2.0	Agriculture	
	2.0	Forestry	
	2.0	Geology	
	2.5	GIS & Remote Sensing	
Ground Truth	5.0	Ground Truth Investigation	·To introduce methods of measuring the characteristics of substances; the spectral characteristics and radiation temperatures of typical natural substances such as grass, bare soil, trees, water, and so on
	5.0	Field Evaluation	·To provide a basic understanding of the target area for land cover analysis
Hands-on Training	35.0	Digital Image Analysis	·To introduce the techniques of digital analysis for applying remote sensing data to various fields using digital image analysis systems (personal computer and workstation)
			·Interpretation of satellite data obtained by different types of sensor
			·Geometric correction and data combination using HSI conversion
			·Land cover analysis using multi-spectral classification, change detection, and vegetation index
	20.0	Remote Sensing for Disaster Monitoring	·Remote Sensing for Disaster Monitoring
15.0	SAR Data Handling	To introduce how to access and handle SAR (Synthetic Aperture Radar) data	
	SAR and Optical Data Fusion	·To introduce how to analyze SAR and optical images together	
1.0	Satellite Data Search by Internet	·To introduce how to search satellite data by Internet	
20.0	Subject focused on Local Area	·In Hiroshima: Hazard estimation of land slide using remote sensing and GIS	
Site Visit	10.0	Earth Observation Center(EOC) or Earth Observation Research Center(EOR), Japan Aerospace Exploration Agency(JAXA) or other related organizations	·To give participants a better understanding of the training course through site visit

## Satellite Remote Sensing Data Analysis Technology for Disaster/Environmental Monitoring SAR Advanced Training using ALOS PALSAR data

NOTE: This training employs FREE soft-wares in principle aiming at sustainable future usage after the training.

### Curriculum

Objective	Program/Details	Hours
Principles and analysis method of SAR and other data	- Introduction to remote sensing	1.5
	- ALOS system -Bus, Sensor	2.5
	- Case study for disaster/environmental monitoring(SAR&Optical)	2.5
	- ALOS data product	1.0
	- ALOS data search	1.5
	- Principle of SAR	2.5
Basic and advanced processing of SAR data	- Principle of SAR data correction	2.5
	- Principle of interferometric SAR (InSAR)	2.5
	- Principle of polarimetric SAR (PolSAR)	2.5
	- SAR image interpretation	20.0
Site Visit	- Radiometric correction, Geometric correction	20.0
	- Image processing from raw data	
	- InSAR analysis	
Integration of disaster/environmental SAR and other data into geographic information	- PolSAR analysis	20.0
	- Earth Observation Center (EOC) or Earth Observation Research Center (EORC), Japan Aerospace Exploration Agency (JAXA)	
Integration of disaster/environmental SAR and other data into geographic information	- Analysis of SAR and optical data for disaster & environment monitoring	20.0
	- Integrated use of the analysis result and map information	
	- Applied analysis of SAR and other data for disaster & environmental monitoring (Flood, Landslide, Earthquake, Volcano, Forestry)	
Integration of disaster/environmental SAR and other data into geographic information	- Integrated use of the analysis result and map information	20.0

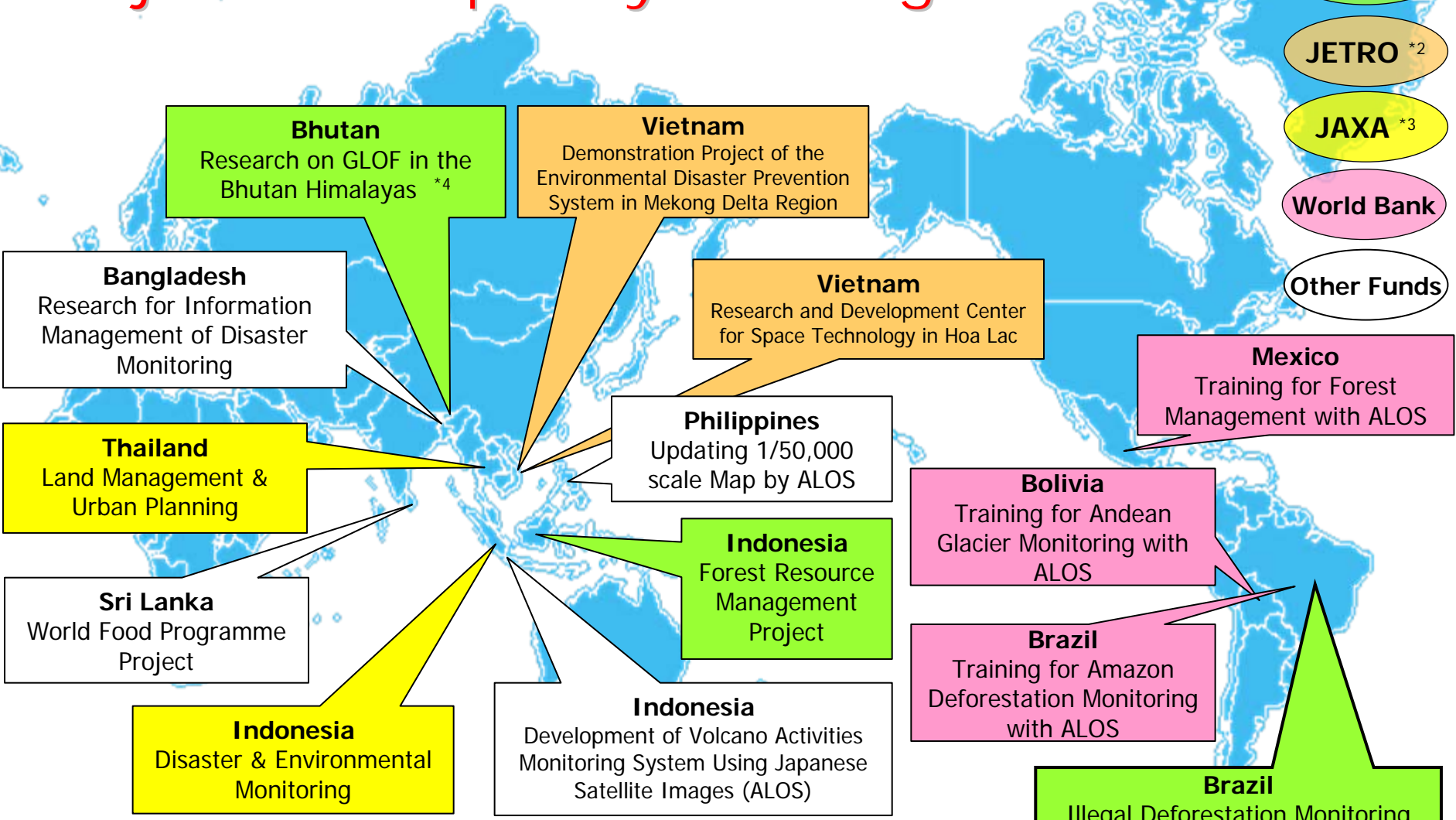
## 2008 Volcano Activities Monitoring System Using Japanese Satellite Images (ALOS) Training Schedule in Japan

Date	TIME	SUBJECT	SOFTWARE	LECTURER	PLACE
10/17	Fri	Move to Japan			
18	Sat				
19	Sun				
20	Mon	10:00~11:00		Mr. Masaharu Takamatsu Mr. Kyoichi Ito	RESTEC
		11:10~12:30	Satellite data in the world ALOS Data Search by Internet (CROSS)	Mr. Kyoichi Ito	RESTEC
21	Tue	10:00-12:30		Dr. Tsutomu Yamanokuchi RESTEC	RESTEC
		13:30-16:00	Proc-Basic Handling of ALOS data	RESTEC Software Multispec	
22	Wed	10:00-16:00	Proc-Land Classification using ALOS AVNIR-2	Multispec Dr. Aya Yamamoto & Others RESTEC	RESTEC
23	Thu	10:00-16:00	Proc-DEM Generation using ALOS PRISM data	RESTEC Software	Mr. Makoto Ono RESTEC
24	Fri				
25	Sat	Tour to Tokyo			Tokyo
26	Sun				
27	Mon	10:00-16:00	Proc-SAR Processing	RESTEC Software	Mr. Nobuhiro Tomiyama & Others RESTEC
28	Tue	10:00-16:00	Proc-Interferometric SAR	RESTEC Software	Mr. Makoto Ono & Others RESTEC
29	Wed				
30	Thu	10:00-16:00	Proc-Polarimetric SAR	Polsar Pro	Mr. Nobuhiro Tomiyama & Others RESTEC
31	Fri	10:00-16:00	Tour to Tsukuba		Tsukuba
		10:30-	Agriculture, Forestry and Fisheries Research Council Secretariat		
		14:00~	Geographical Survey Institute		
		15:30~	Forestry and Forest Products Research Institute		
11/1	Sat				
2	Sun				
3	Mon	Tour to Nikko			Nikko
4	Tue	10:00-16:00	Proc-Application for Disaster Management		Mr. Makoto Ono & Others RESTEC
5	Wed	10:00-16:00	Output Presentation, Closing Ceremony,		RESTEC
		17:30~	Farewell Party		Toranomon Pastoral
6	Thu	Move to Jakarta			



# Projects & Capacity Building

- JICA \*1
- JETRO \*2
- JAXA \*3
- World Bank
- Other Funds



\*1 JICA (Japan International Cooperation Agency)

\*3 JAXA (Japan Aerospace Exploration Agency)

\*2 JETRO (Japan External Trade Organization)

\*4 Project of JICA and JST (Japan Science and Technology Agency)



# ALOS-THEOS Application & Verification Project in Thailand

JAXA and GISTDA made an agreement on ALOS-THEOS Application and Verification Project in 2010 after the successful completion of ALOS Pilot Project.



**GISTDA**

- Dept of National Park Wildlife and Plant Conservation (DNP)
- Kasetsart University
- Chulalongkorn University (CU)
- Dept of Mineral Resources (DMR)
- Electricity General Authority of Thailand (EGAT)
- Royal Thai Survey Dept (RTSD)
- Dept of Public Works and Town and Country Planning (DPT)

**WG1:**  
Forest Biomass Estimation

**WG2:**  
Land Subsidence Study

**WG3:**  
PALSAR DEM Generation



# ALOS Application & Verification Project in Indonesia

JAXA and LAPAN made an agreement on ALOS Application and Verification Project in 2009 after the successful completion of ALOS Pilot Project.



**LAPAN**

- Agency for Technology Assessment and Implementations (BPPT)
- National Coordinating Agency for Survey and Mapping (BAKOSURTANAL)
- State Ministry for the Environment (KLH)
- Ministry for Marine Affairs and Fisheries (DKP)
- Ministry of Energy and Mineral Resources (KESDM)
- Ministry of Forestry (DEPHUT)
- Ministry of Agriculture (DEPTAN)
- Ministry of Public Works (DEP. PU)
- Ministry of Public Housings (MENPERA)
- Indonesian Maritime Security Coordinating Board (BAKORKAMLA)
- Bogor Agricultural University (IPB)
- Bandung Institute of Technology (ITB)
- Syiah Kuala University (UNSYIAH)
- University of Indonesia (UI)
- Diponegoro University (UNDIP)
- Gadjah Mada University (UGM)
- CReSOS – Udayana University

**WG1: Change detection of vegetation cover**

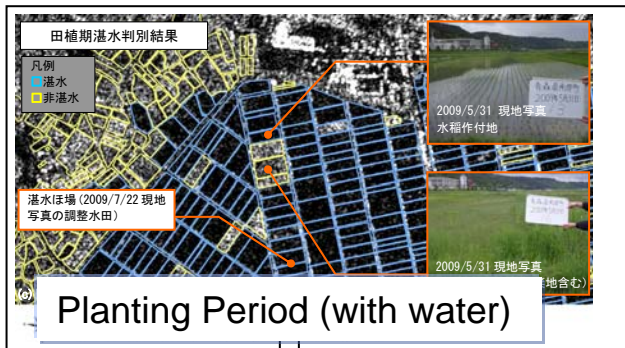
**WG2: Change detection of coastal areas & small islands**

**WG3: Monitoring of Volcanoes and Earthquake**

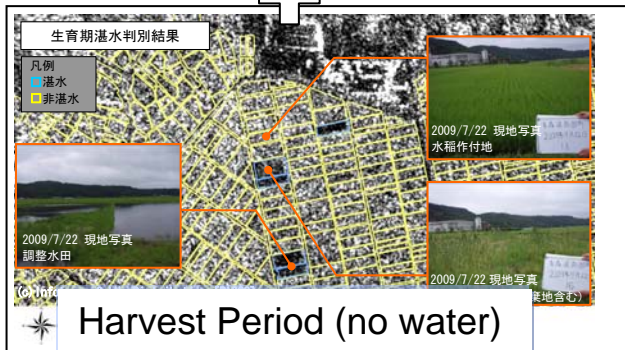
**WG4: Production and Updating of Maps**



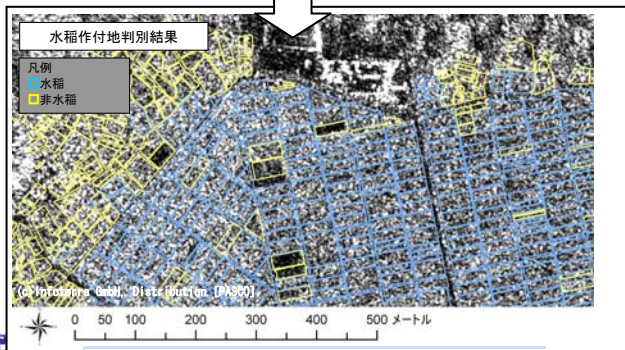
# AGRICULTURE: Detection of Paddy Fields



Planting Period (with water)



Harvest Period (no water)



Detection of Paddy Fields

By Using combination of SAR Data (ALOS/PALSAR, TerraSAR-X, Radarsat-2) and GIS data (farm field polygon, paddy fields and its area size can be detected with high accuracy.

Paddy fields in Japan are filled with water during planting and growing period. By comparing its planting period and harvest period, paddy fields can be classified. Note that SAR backscatter is very low from water surfaces because of specular reflection,



Classification Result  
 Green - Paddy Field  
 Pink - Non Paddy Field

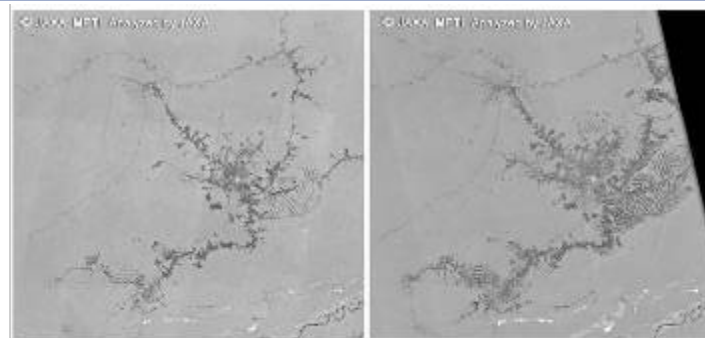
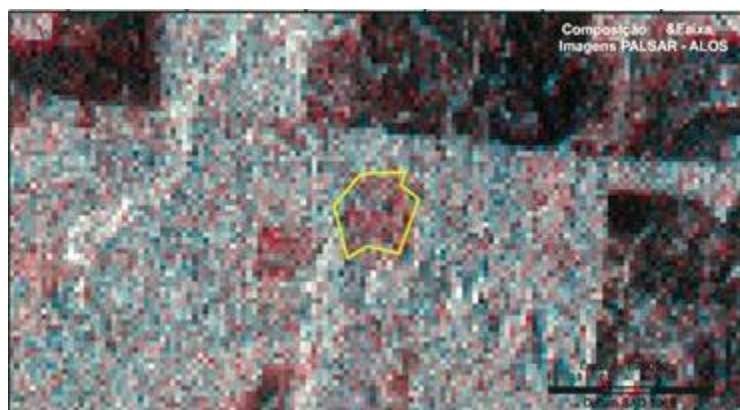
Accuracy  
 SAR Data Only  
 -Classification: 87%-98%  
 -Area Size: 89%-99%

SAR + Optical Data  
 -Classification: 89%-99%  
 -Area Size: 92%-99%

Background Images: TerraSAR-X image (c) Infoterra GmbH.Distribution[PASCO]

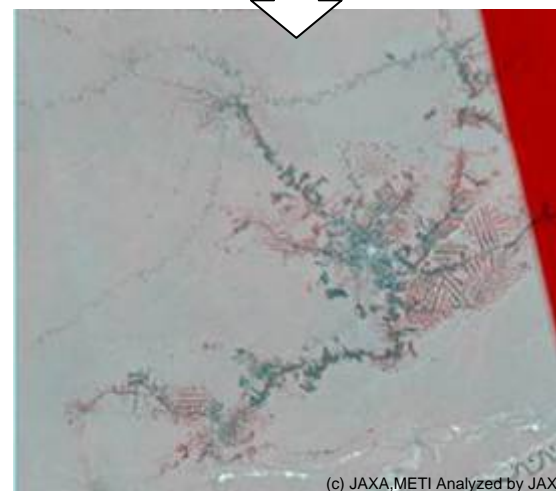
# FOREST: Detection of Illegal Logging in Brazil

Brazil had developed Real-time Detection of Deforestation (DETER) system, but [cloud cover is always big problem](#). Brazil required Japan International Cooperation Agency (JICA) to provide capacity building for handling SAR data to detect the area of illegal logging and technology to assemble SAR capability to the existing system. JICA initiated the project in cooperation with RESTEC in 2008.



JERS-1 (1995)

ALOS/PALSAR (2006)



Japan has a big amount of archive data of JERS-1 satellite (1992-1998). Combination with this archive data, total logging area for 11 years was detected.

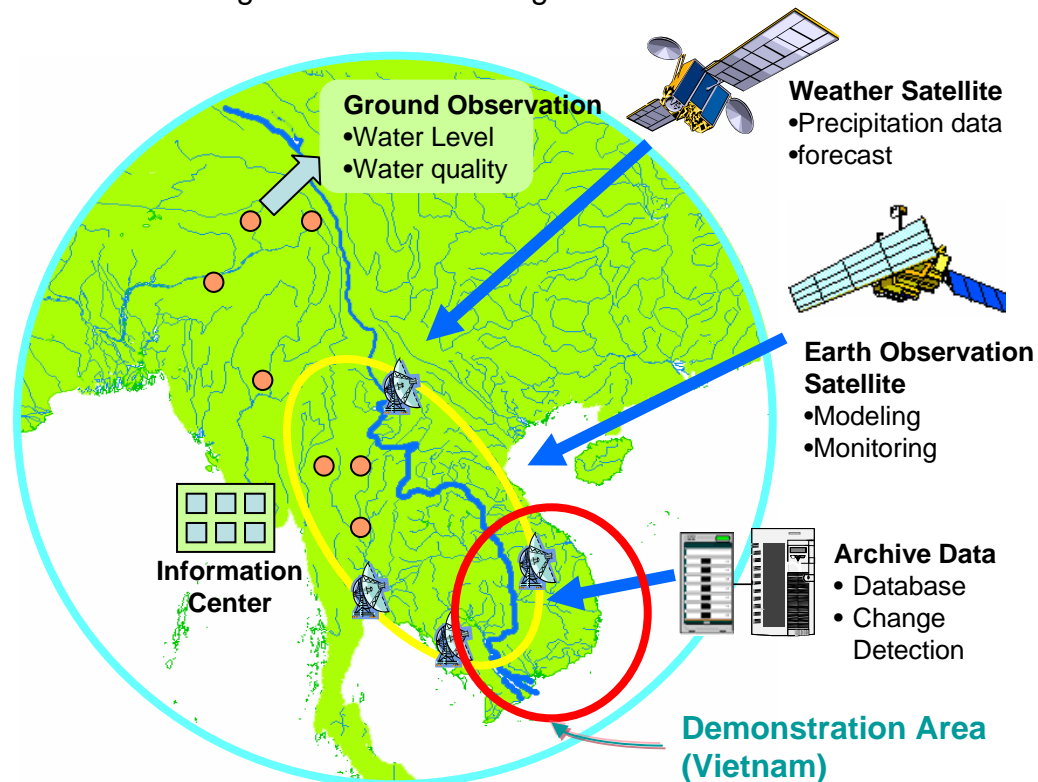
(c) JAXA, METI Analyzed by JAXA



# Disaster: Management of Mekong River

Mekong River runs through Asian countries and provides them with not only fullness but also damages by floods and environment pollution.

By using information from Earth Observation Satellites and Weather Satellites with terrain model, basin model, weather forecast information, thematic maps and the other various information, floods can be forecasted and the government can give an alarm. Environment, agriculture and forestry around the Mekong Delta can be managed with the information from this system.

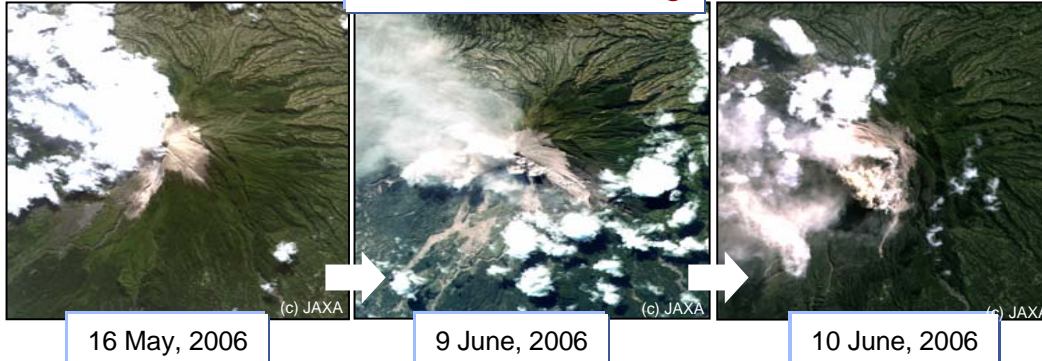


Concept Image of the Future Plan



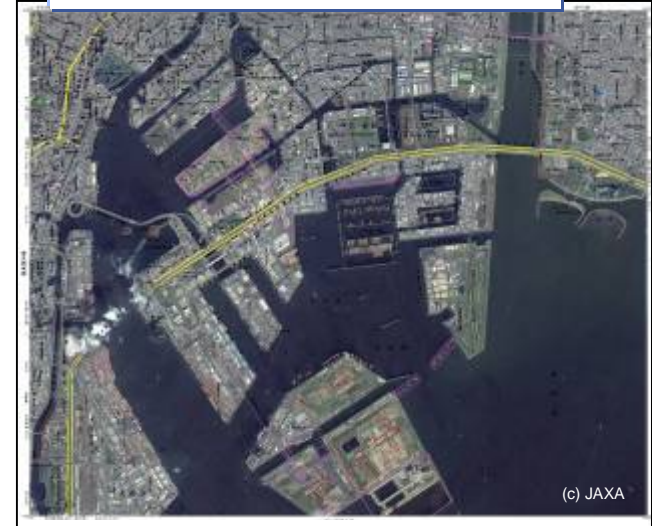
# Disaster: Emergency Observation

## Volcano Monitoring



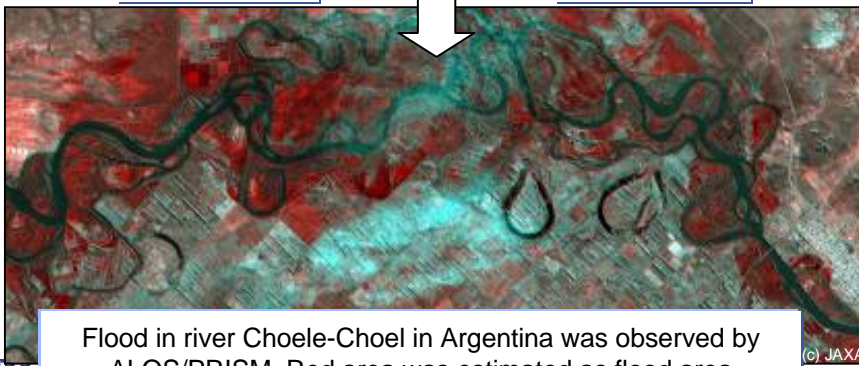
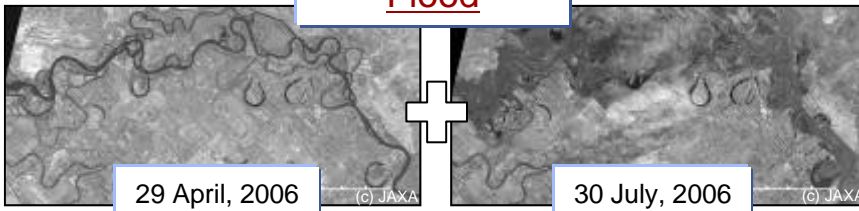
Eruption of Mt. Merapi was frequently monitored by ALOS/AVNIR-2

## Disaster Prevention Map



Disaster Management Map is utilized for emergency drill, base map for emergency activities and so on.

## Flood



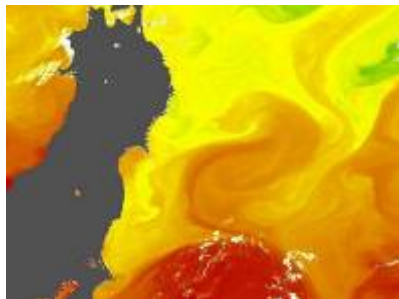
Flood in river Choele-Choel in Argentina was observed by ALOS/PRISM. Red area was estimated as flood area.

## Land Slide

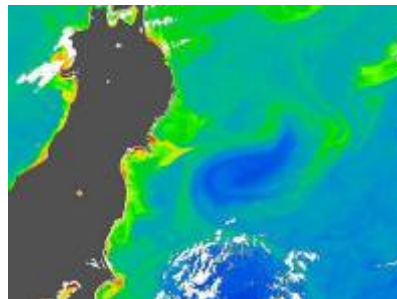


Avalanche of mud (dark brown area) from the top to bottom of Mt. Mayon in Philippine was observed by ALOS/AVNIR-2 (5 Dec, 2006)

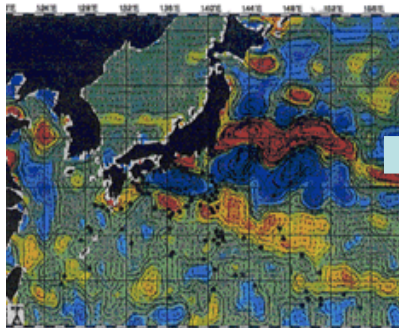
# Coastal: Fishery



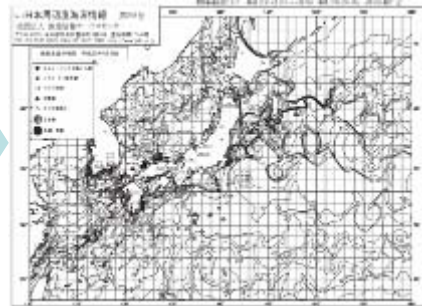
Sea Surface Temperature



Chlorophyll

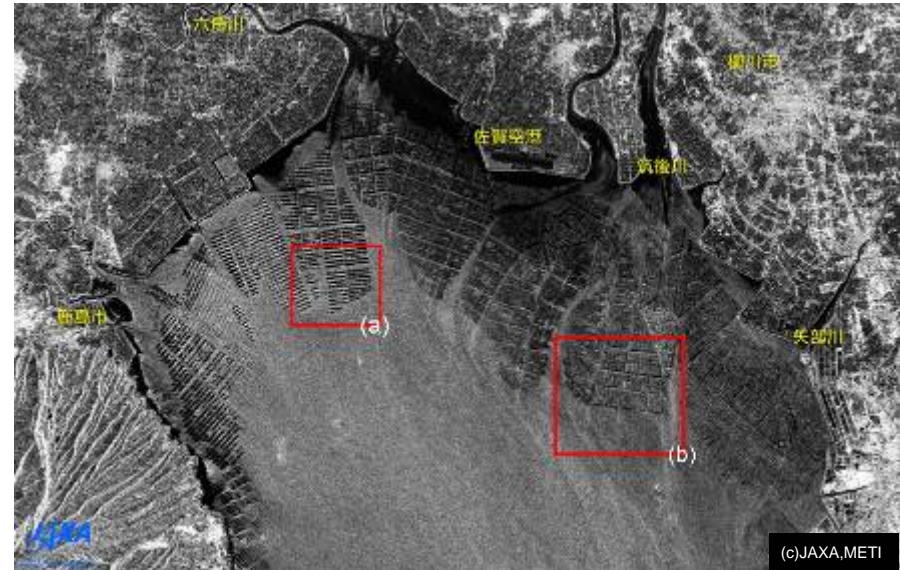


Altimeter



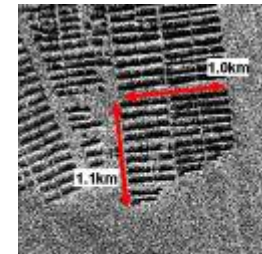
Fish Ground Forecast

Japan Fishery Information Service Center forecasts fish ground near Japan using various information including Sea Surface Temperature, Chlorophyll and Altimeter from satellites.

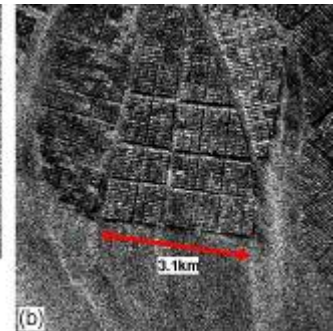


(c) JAXA, METI

Seaweed aquaculture fields were detected by ALOS/PALSAR. A number of fields and approximate size can be estimated from these images.

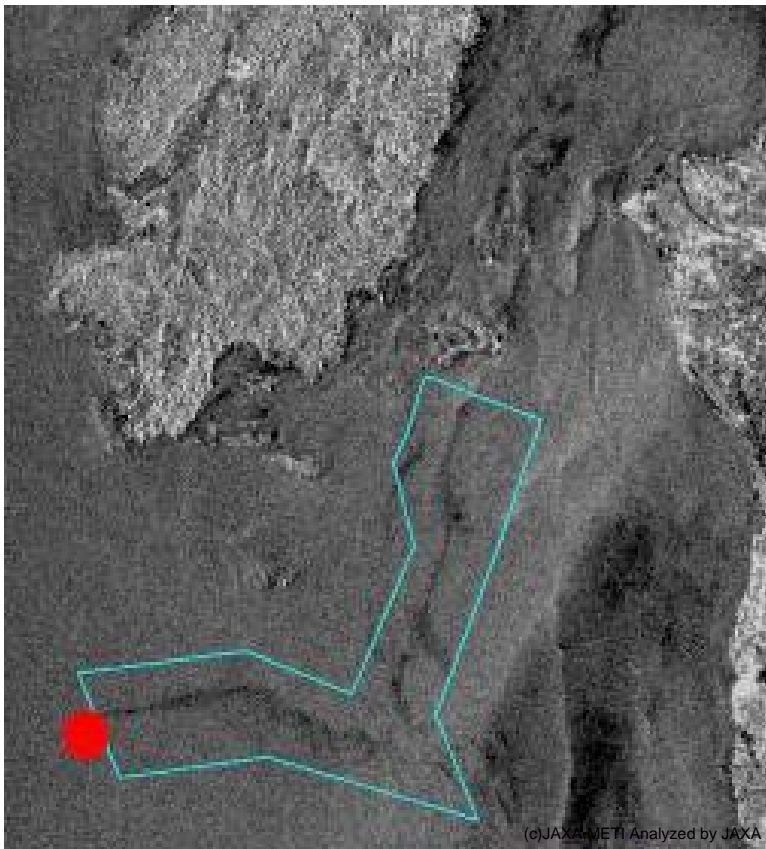


(a)

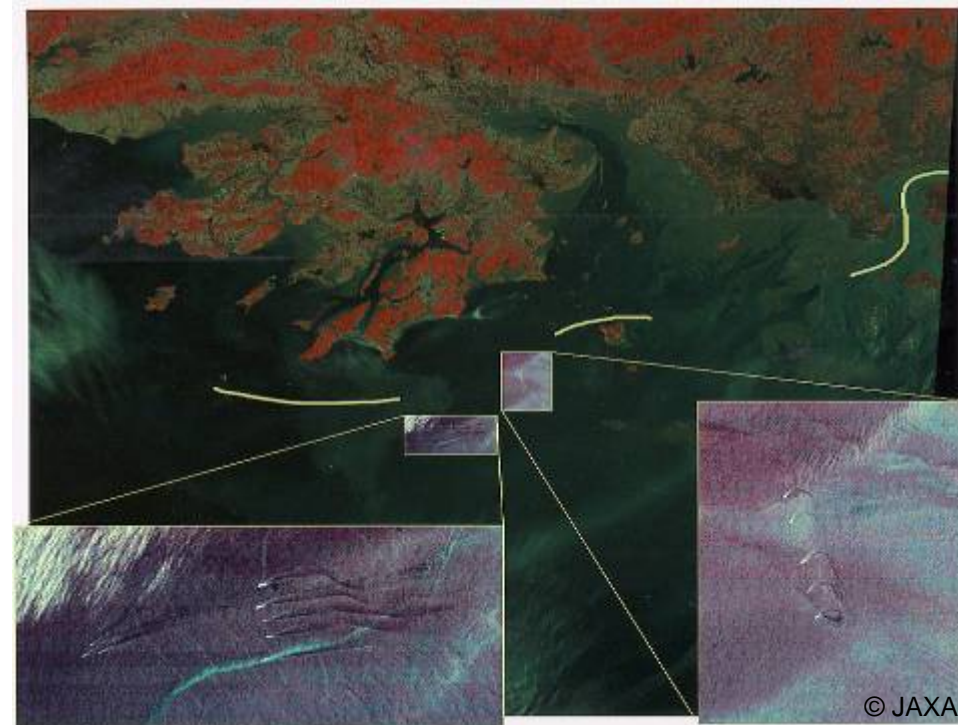


(b)

## Coastal: Oil Spill and Illegal Ships



An oil tanker leaked much oil by an accident in Philippines. This image was observed by ALOS/PALSAR on 25 August 2006. A red circle shows its accident point and dark line surrounded by blue line shows oil from the tanker.



Illegal ships were shot by Landsat. Korean Coast Guard chased the illegal ships because they violated their territorial sea.

## Urban Planning: Case Study in China



Nantong City (Jiangsu Province, China) uses GIS with ALOS pansharpened image for their urban planning. ALOS pansharpened image which is 2.5m resolution color image is made from ALOS/AVNIR-2 data (10m resolution / color image) and ALOS/PRISM data (2.5m resolution / black & white image).



2.5m resolution color image can tell individual buildings, roads, bridges and so on.



Vector data and the other various information can be overlaid on satellite images by GIS.



Thank you!