



**The 4th Joint Project Team Meeting
for Sentinel Asia STEP 3 (JPTM2017)
7th to 9th March 2017
at VAST, Hanoi, Vietnam**

Status of Space Technology

Application for DRR in Lao PDR

**Virany SENGTIANTHR
Remote Sensing Center (RSC)
Natural Resources and Environment Institute (NREI)
Ministry of Natural Resources and Environment (MoNRE)**

Outline

1. Introduce to RSC;
2. The status of Space Technology
Application for DRR & Sentinel Asia
activities;
3. Suggestions /Discussion and
4. Future work plan of RSC 2014-2020.

Introduce to RSC

- **Remote Sensing Center (RSC)**, Natural Resources and Environment Institute (NREI), under the Ministry of Natural Resources and Environment (MONRE).
- One of the main duties of RSC **is to be the main coordinator and** manager of the Space Technology Applications, focusing on the RS and GIS at the national level.

Vision

To be a center of the national focal point on the applications of Remote Sensing and GIS in natural resources and environment as well as natural disaster research.

Type of disaster in Laos

▪ Natural Disaster:

- **Flood** (river flood and flash flood)
- **Drought**
- Local Storm ,
- Hail
- Tropical Cyclone,
Southwest Monsoon,
- Landslide
- Earthquake

❖ Man-made

- UXO
- Fire

The main hazards in Lao PDR are flood and drought Both are dependent on the amount of rainfall.

Disaster Statistics from 1999-2015

No	Year	Types of Damage	Damage Cost/(USD)	Place of Damage
1	1999	Flood	7,450,000	Central
2	2000	Flood	12,500,000	Central and southern
3	2001	Flash flood	8,000,000	Central and southern
4	2002	Large flood, flash flood and landslide	24,454,546	Northern, Central and southern
5	2003	Drought	16,500,000	Northern and Central
6	2004	Flood	20,750,000	Southern
7	2005	Flash flood and landslide	218,304,000	Central and southern
8	2006	Flood and strong wind	3,207,968	Northern, central and southern
9	2007	Flood and drought	997,960	Central
10	2008	Large flood	485,902,186	Northern and Central
11	2009	Flash flood and Typhoon	58 million	Southern
12	2011	Flood / Tropical storms <u>Haima</u> , (June) and <u>Nok-Ten</u> , (August)	12 million, (<u>Xavaboury</u> province) or 174 million in Laos	Northern, Central and southern
13	2013	Large flood	280 million	Southern
14	2015	Winter storm		<u>Hatxayphong</u> district, Vientiane capital city (18/02/2015)
15	2015	Flood		<u>Bolikhamsay</u> province, 2-6 August 2015

The status of Space Technology Application for DRR & Sentinel Asia activities



Sentinel Asia in Lao PDR

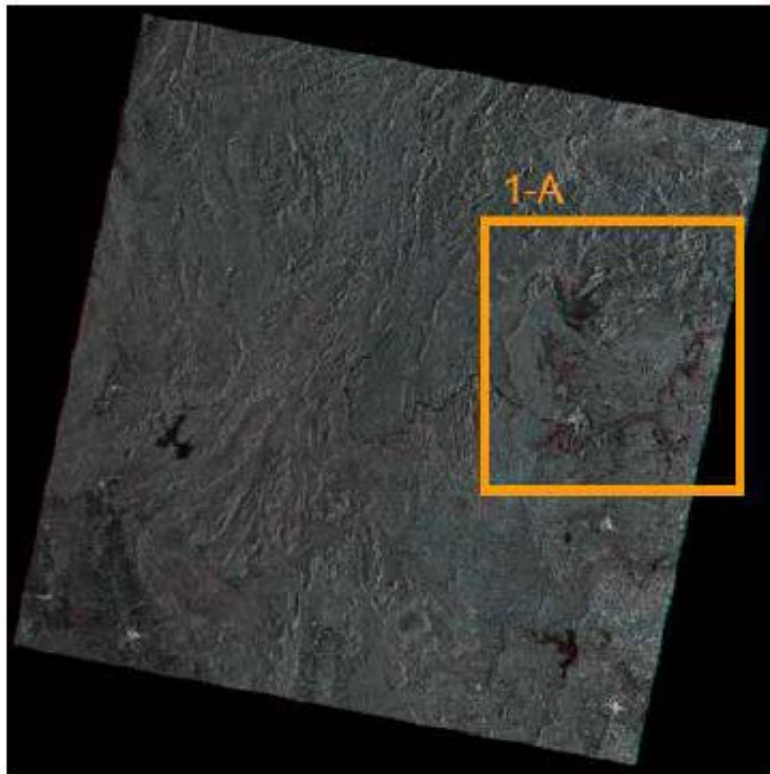
Emergency Request:

SENTINEL ASIA EMERGENCY OBSERVATION REQUEST (EOR) FORM		
Your name and organization		
Your name		
Your organization	Membership <input type="checkbox"/> JPT member <input type="checkbox"/> ADRC member	
Your phone		
Your cellular phone		
Your fax		
Your E-mail		
Other E-mail(s) for notification		
Disaster type		
<input type="checkbox"/> Flood	<input type="checkbox"/> Landslide	<input type="checkbox"/> Storm
<input type="checkbox"/> Volcano	<input type="checkbox"/> Earthquake	<input type="checkbox"/> Ice hazard
<input type="checkbox"/> Other :		<input type="checkbox"/> Tsunami
Place of occurrence		
Country		
Date and time (UTC)		
Date of occurrence		
Request area		
Name of a place		
Please select one	<input type="checkbox"/> Circular zone	Coordinates of center point Latitude : <input type="text"/> N Longitude : <input type="text"/> E Radius : <input type="text"/> km
	<input type="checkbox"/> Rectangular zone	Coordinates of corners Lat. : <input type="text"/> N Lon. : <input type="text"/> E Lat. : <input type="text"/> N Lon. : <input type="text"/> E
Details, news source		
Based upon request from requesting organization (RO), this Emergency Observation Request (EOR) may escalate to International Charter for Space and Major Disasters (ICD) when secretariat confirms its appropriateness. If RO wishes to escalate to ICD, please check the box right.		
Please fill the form and send it to ADRC		
+81-78-267-5246 (Fax) or sasrequest@sentinelaia.com (E-mail)	Request ID (Requested by name)	

1. The observation request User Name (UN) and Password (PW), by Sentinel Asia website and submit EOR completed form as well as request to the ADRC/JAXA;
2. Sharing information between line agency and research node such as AIT, JAXA, ADRC, etc;
3. Report to the Ministry of Natural Resources and Environment-MoNRE.

Request Sentinel Asia in case emergency: Coordinate, Pictures, sharing data information...

Flooded area detected from ALOS PALSAR ScanSAR



RGB color composite image of PALSAR ScansAR
R:G:B=2007/08/18:2008/08/20:2008/08/20
(R:G:B=pre-post-post-disaster)



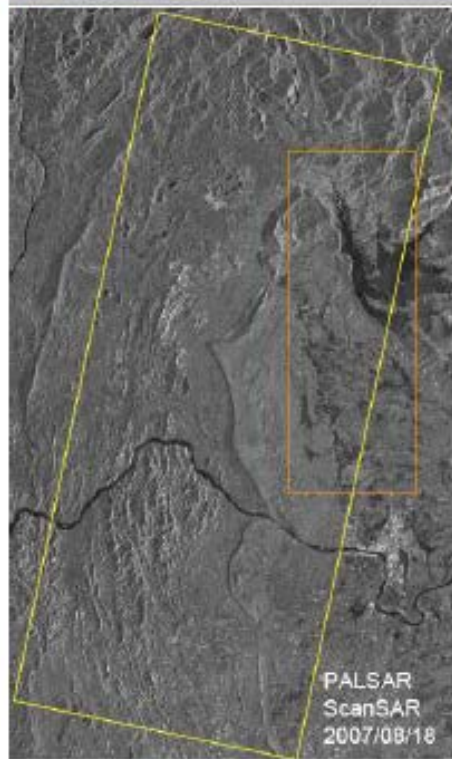
Enlarged view of area 1-A
Flooded area can be estimated as red colored area.

RSC/JAXA/ADRC: Field survey on flood area in Vientiane Capital City and Vientiane Province

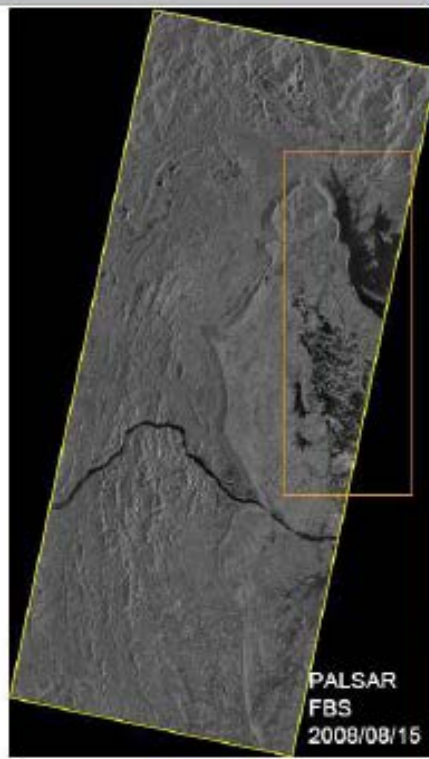


Nov 13, 2008

Field survey :
ADRC/JAXA/RSC



PALSAR
ScanSAR
2007/08/18





PALSAR
FBS
2008/08/15





Capacity building


JAXA/AIT/Mini-project/Research, Result, 2009-2010

Flood Hazard Mapping 2009-2010

Potential Use of ALOS/ PALSAR in Flood Hazard mapping



Study Area
The study area is parts of Viengkham district in Vientiane province in Lao PDR. It is within the map extent of 17° 52' 29.26" Lat to 17° 53' 53.29" Lat and 102° 36' 47.88" Long to 102° 37' 10.23" Long. This district is bordering Thailand with the Mekong river flowing through them. In Vientiane Capital, Viengkham District has the largest agricultural land but it often experiences serious impacts from the floods which are caused by the Mekong River in many seasons each year. In 2008, approximately 5-125 hectares of paddy fields in the District were damaged.

Data Used
The data used in this study were: ALOS PALSAR dry date (June), 2008) - HH and HV polarization; ALOS PALSAR wet date (September), 2008) - HH and HV polarization; ALOS AVNIR2 (December 29, 2008) - RGB; GIS data including: District Boundary of Vientiane Province; DEM of the study area.

The main objective of this study is:-
Flood extent mapping in the year 2008 using ALOS PALSAR images of the study area.

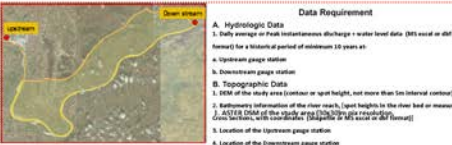
The sub-objective is:-
To see change of BS from dry to wet season in the area.

Study Area
The study area is parts of Viengkham district in Vientiane province in Lao PDR. It is within the map extent of 18° 22' 55.1" Lat to 18° 21' 56.38" Lat and 102° 32' 14.8" Long to 102° 32' 56.17" Long. This district is bordering Keo-Oudom in the north, Phongsavan in the west, Doukkhaden in the south in Vientiane province. Viengkham District has the largest agricultural land but it often experiences serious impacts from the floods which are caused by the Namgram River in many seasons each year. In 2008, approximately 285 hectares of agricultural in the District were damaged.

The peak flood was recorded at August 17, available PALSAR image of wet season is of September 1, 2008.
The same date PALSAR image does not fully cover the whole of the Viengkham District.

ONE SOLUTION ?
Sentinel Asia
The Asia-Pacific region is the world's most rapidly growing and most dynamic. It is also the most diverse and most resilient. The region's growth is driven by a combination of factors, including a young and growing population, a strong and growing middle class, and a rapidly growing service sector. The region's growth is also driven by a combination of factors, including a young and growing population, a strong and growing middle class, and a rapidly growing service sector.

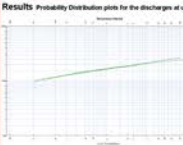
Flood Hazard mapping Using Hec-Ras



Data Requirement

- Hydrologic Data
 - Daily average or Peak instantaneous discharge + water level data (300 series or data) needed for a historical period of minimum 10 years as:-
 - Upstream gauge station
 - Downstream gauge station
- Topographic Data
 - DEM of the study area (contour or spot height, not more than 1m interval contour)
 - Boundary information of the river reach, Cross section at 4 km interval starting from downstream, without coordinates (Source: MIC, Vientiane)
 - ASTER DEM of the study area (30m interval resolution) with coordinates (Source: MIC, Vientiane)
- GIS Data
 - Watershed Boundary Map
 - River boundary
 - Location of bridge and other obstructions with height information
 - Location of storage reservoirs
 - Height of levees and roads
 - Building footprints with height information
 - Landuse Map
- Satellite Image
 - Optical Satellite image covering the study area (Medium to High Resolution)


Results Probability Distribution plots for the discharges at upstream



Available Data

- Hydrologic Data
 - Daily average discharge data for a historical period of (1953-2003) is the upstream station (Source: MIC, Vientiane)
 - Topographic Data
 - DEM of the study area (contour or spot height, not more than 1m interval contour)
 - Boundary information of the river reach, Cross section at 4 km interval starting from downstream, without coordinates (Source: MIC, Vientiane)
 - Location of the Upstream gauge station

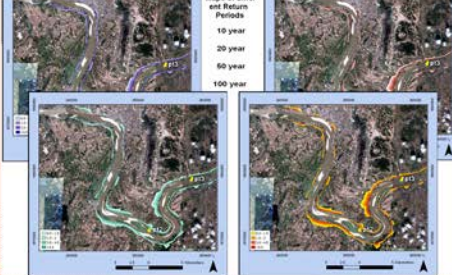
Results 10% Generated from ASTER DEM



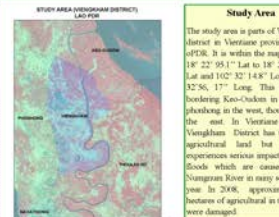
Available Data

- Hydrologic Data
 - Daily average discharge data for a historical period of (1953-2003) is the upstream station (Source: MIC, Vientiane)
 - Topographic Data
 - DEM of the study area (contour or spot height, not more than 1m interval contour)
 - Boundary information of the river reach, Cross section at 4 km interval starting from downstream, without coordinates (Source: MIC, Vientiane)
 - Location of the Upstream gauge station

Flood Hazard Maps of different Return Periods



Potential Use of ALOS/ PALSAR in Flood Hazard mapping A Case study- Viengkham District, LaoPDR



Study Area
The study area is parts of Viengkham district in Vientiane province in Lao PDR. It is within the map extent of 18° 22' 55.1" Lat to 18° 21' 56.38" Lat and 102° 32' 14.8" Long to 102° 32' 56.17" Long. This district is bordering Keo-Oudom in the north, Phongsavan in the west, Doukkhaden in the south in Vientiane province. Viengkham District has the largest agricultural land but it often experiences serious impacts from the floods which are caused by the Namgram River in many seasons each year. In 2008, approximately 285 hectares of agricultural in the District were damaged.


Field Visit and Discussion.

No. of areas	Area	Area	Area	Area	Area	Area	Area	Area	Area
1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100


Range of BS per Landuse type

Landuse	BS (m)	BS (m)	BS (m)	BS (m)	BS (m)	BS (m)	BS (m)	BS (m)	BS (m)
1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

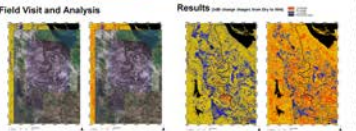
Methodology:




Field Visit and Analysis



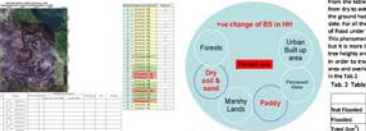
Results (with change of BS in HH)




Field Visit and Analysis



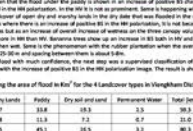
Results (with change of BS in HH)



Field Visit and Analysis



Results (with change of BS in HH)



Field Visit and Discussion.

For Forests, change of BS is most likely by the increase of overall wetness of the canopy wetness during wet condition. Flood under the canopy - not suitable.

For Marshy lands, decrease of BS is wet condition. Both in HV and HH. Possibly due to more area under water due to flood. Flood - not suitable.


Over dry soil and sand, HH pair is more sensitive to change than HV. Change in 7dB and 2 dB in HH and HV respectively. Flood - not suitable.

In paddy, the change in 3 dB and 1 dB in HV and HH high change in HV is due to multiple interaction of the reflected wave with the sides of the paddy water under. HH gives a better estimation of the flood under paddy as it is more prone to detect surface wetting. Flood - not suitable.


Over permanent water, HH maps the surface roughness. The change is most likely because of change of wind speed over it.

In urban areas, ROIS are not homogeneous, or range from 0.83 to 1.32. Change of BS most likely because of the overall increase of moisture in the wet condition and corner effect. Flood - not suitable.

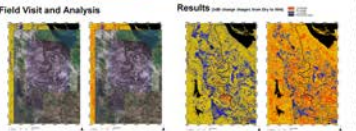
Methodology:




Field Visit and Analysis



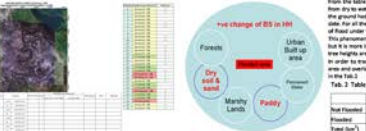
Results (with change of BS in HH)




Field Visit and Analysis



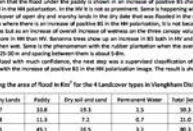
Results (with change of BS in HH)



Field Visit and Analysis



Results (with change of BS in HH)

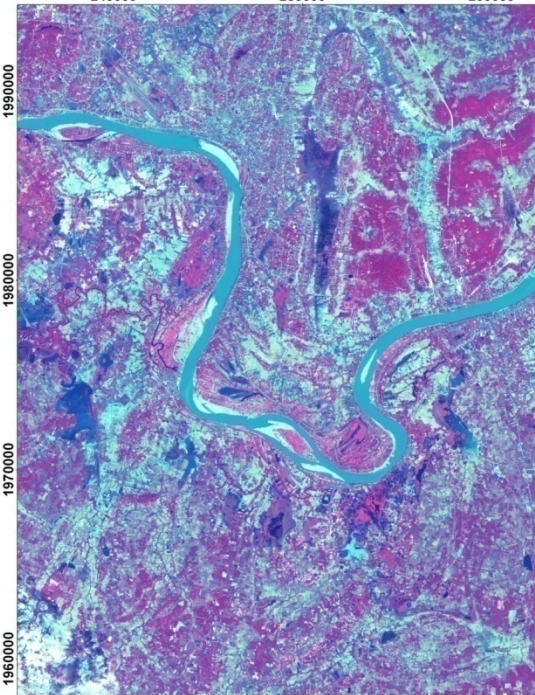


Lao PDR/GIC-AIT: Flood Hazard Mapping using ALOS/ PALSAR, 2009.



ALOS AVNIR2 (Dry Date, Dec 29, 2009)
Parts of Haxaphone District, LaoPDR
RGB:432

240000 250000 260000



0 1.25 2.5 5 7.5 10 Kilometers

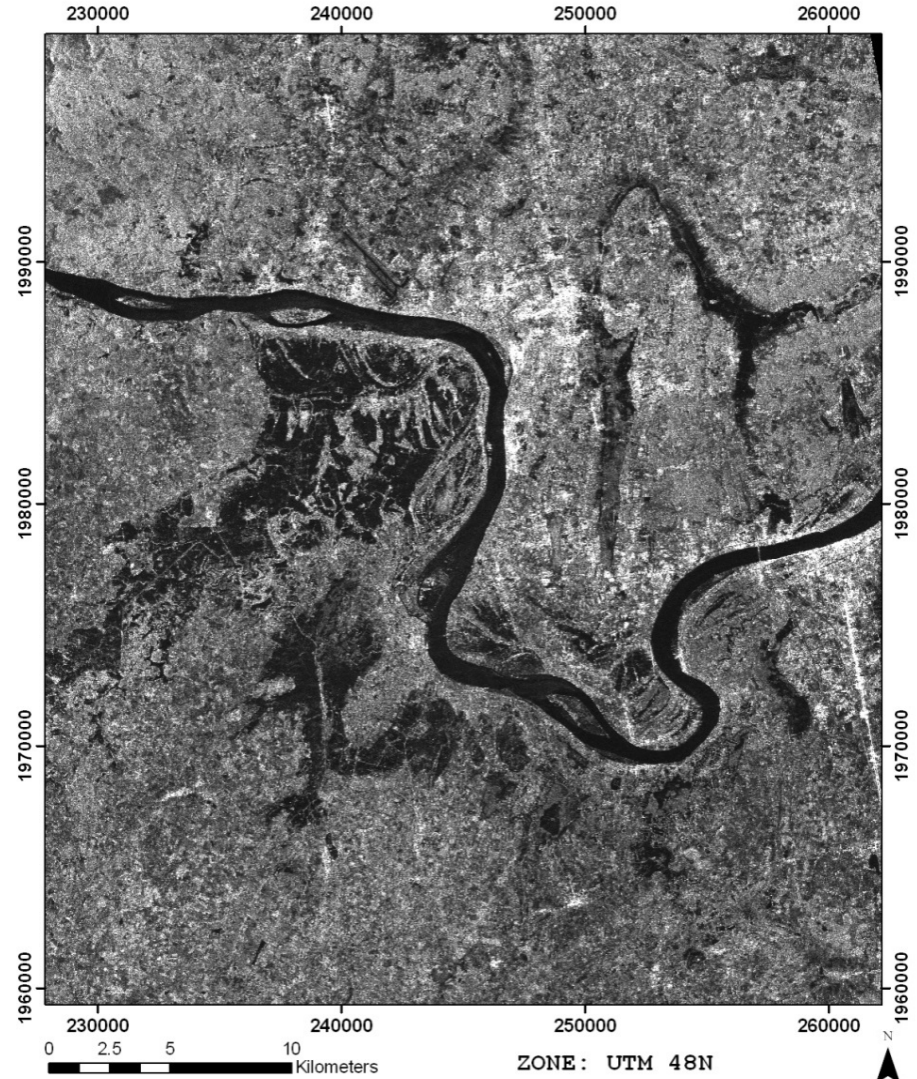
UTM 48 N

Hatsayphong
District, Vientiane
11-15 August 2008

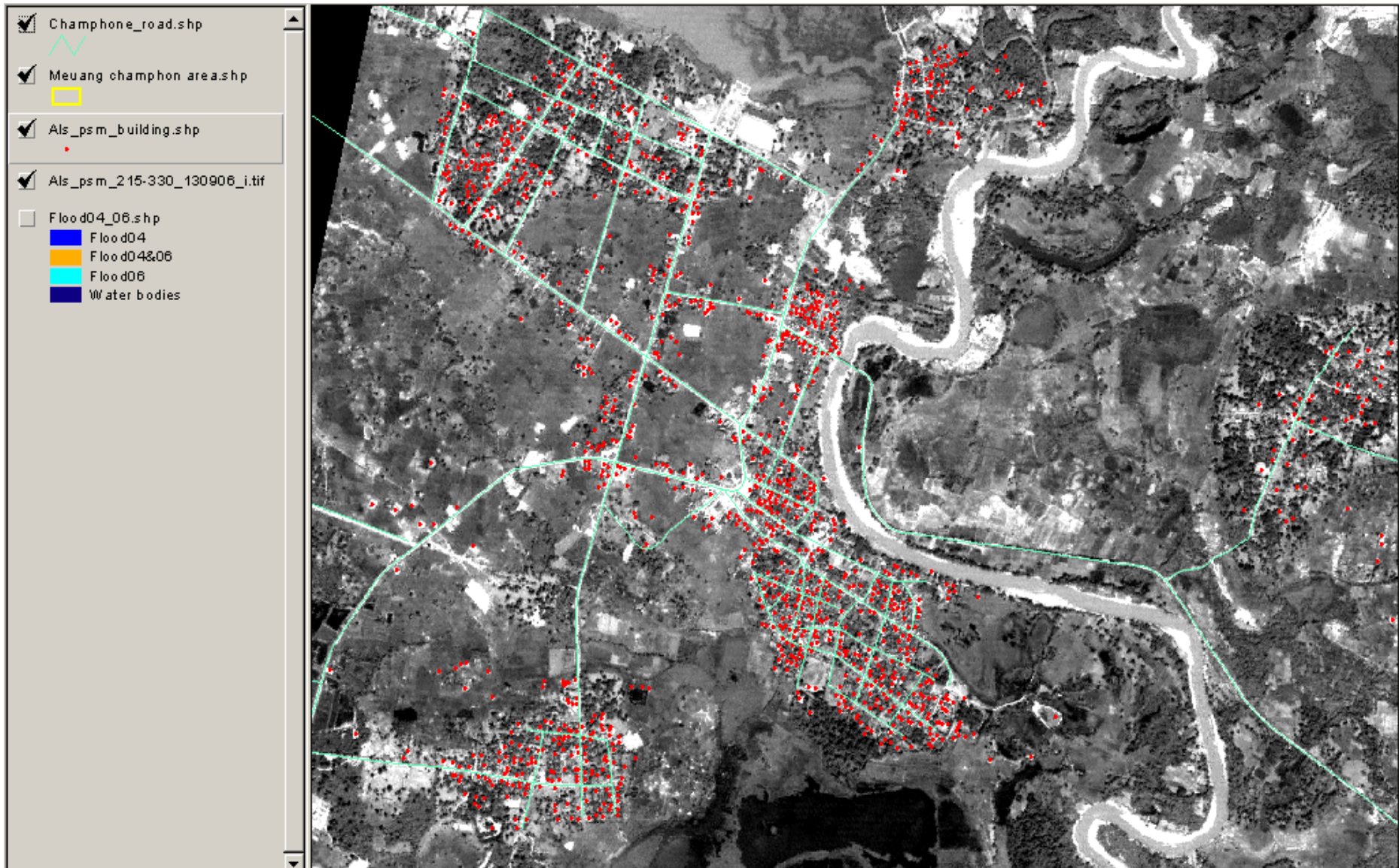
ALOS PALSAR (Wet Date, Sept 3, 2008)
Parts of Hatsayphong District, Lao PDR
Polarization: HH



ALOS PALSAR (Wet Date, Sept 3, 2008)
Parts of Hatsayphong District, Lao PDR
Polarization: HV



Building map and Road map from ALOS/ PRISM



Sentinel Asia STEP 2



The 4th Sentinel Asia System Operation Training was held on 10-12 February 2009 in Vientiane

- Sponsor by JAXA
- Organized by RSC/WERI/WREA
- attended by 13 Asia Pacific countries including 6 ASEAN Member States namely Indonesia, Lao PDR, Malaysia, Philippines, Thailand and Viet Nam.



The 5th Sentinel Asia System Operation Training was held in Colombo, Sri Lanka in 22 – 26 February 2010.

The 6th SAS Operation Training was held in July, 2010, Bangkok, Thailand..

Lao PDR would like to participate the next SA training.

Field Survey on Ketsana Tropical Storm-Flooded in Attapu Province, Lao PDR , September 30, 2009.



City of Samakkheesay
Attapu province



07 June 2010





Flood depth 1.5 metre



Flood in Bolikhamxay

2-6 August 2015

Vientiane times newspaper :

-Hadkhay village in Thaphabath district, Borikhamxay province, has shut down its activities after the road into the village was flooded when the Mang River overflowed.

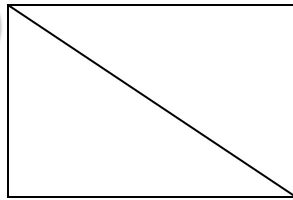
-More than 1,400 families and 4,200 hectares of rice fields have been affected by flooding in the districts of Thaphabath, Borikhan, Pakxan and Pakkading.



Flood in Saravanh Province Lao PDR, 2013.

Lat: 18° 24"

Long:103° 40"



Lat: 18° 23"

Long:103° 42"

The heavy rain in Saravan province during 18-24 September, 2013 caused flood in to three district such as Vapi district, Khongsedone district and Saravan district around Xedone basin area.

About 187 villages and 10,683 household affected by flooded.
(Vientiane May newspaper dated 06 November 2013)

Suggestions

1. Lack of national policy and regulation of the application of space technology (especially Remote Sensing technology). The Assistance from the international organization is required .
2. Enhancement of National staffs capacity building.
3. Joint Project Research between SA Members/JAXA/ADRC/AIT: Flood, drought, wildfire monitoring and climate change by using satellite data;

RSC/NREI/MONRE: Future Work Plan 2014-2020 On Natural Resources and Disaster Monitoring using the Space Data.

1. Emergency Request by using ER form;
2. Flood Risk Mapping Bolikhamxay province, Lao PDR;
3. Drought Risk Mapping using Remote Sensing and GIS in Savannakhet Province, Lao PDR.
4. Research/Training/: (RS/GIS/GPS), on soil erosion in Saravan province and Luangnumtha province.
5. Fire Monitoring in Lao PDR.
6. Land slide monitoring in Khammouane Province.
7. RSC, NREI, MoNRE would like to continue support Sentinel Asia STEP3 and promotion related to the utilization on space for disaster reduction.

A photograph of a blue canoe with three people on a river. The person in the front is wearing a pink shirt and is rowing. Two other people are seated behind them. In the background, there is a two-story house with a red roof and a balcony. The water is brownish and reflects the surrounding greenery and the house. The text "Thank you very much For your kind attention !" is overlaid in blue on a semi-transparent grey background in the center of the image.

Thank you very much
For your kind attention !