

# ACHIEVEMENTS OF THE SENTINEL ASIA SUCCESS STORY IN THE PHILIPPINES

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# SENTINEL ASIA SUCCESS STORY IN THE PHILIPPINES

## Summary of Activities : 2009-2013

### STEP 1

Training on Remote Sensing for disaster application (Multi-spectral and RADAR)

- Local Case Studies
  - Flood, Landslide, Volcano-LAHAR
- Sentinel Asia EOR Training and succeeding actual operations

### STEP 2

Training on InSAR Processing and Satellite-based Rainfall (GSMAP)

- Local Case Studies
  - Ground subsidence in Metro Manila
  - Ground deformation monitoring of active volcano
  - Landslide warning system using RBN Network

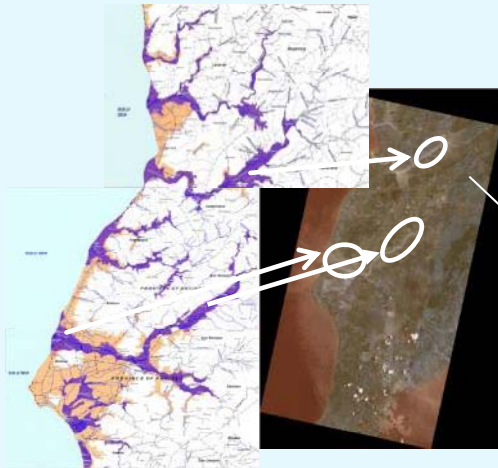
# STEP 1 2009 CAPACITY BUILDING ON IMAGE PROCESSING (OPTICAL AND RADAR)



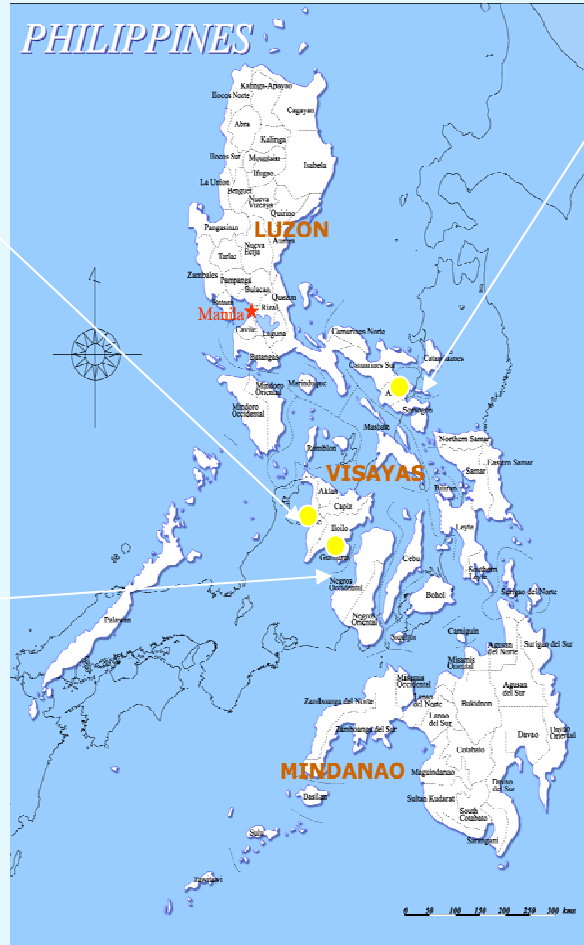
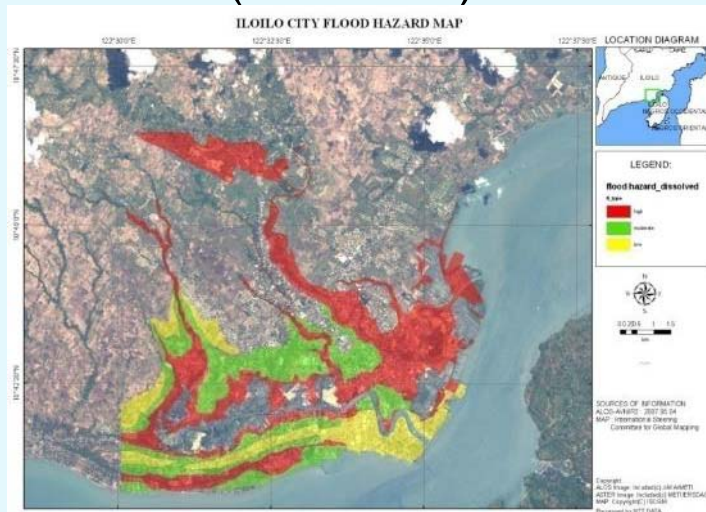
Sentinel Asia Success Story in the Philippines:  
Technical Training on Multi-Spectral and RADAR Image Processing  
Club Morocco Beach Resort, Subic, Zambales  
24-28 August 2009

# STEP 1 Product: Created/Revised Hazard Maps with the use of ALOS Satellite Data (2010)

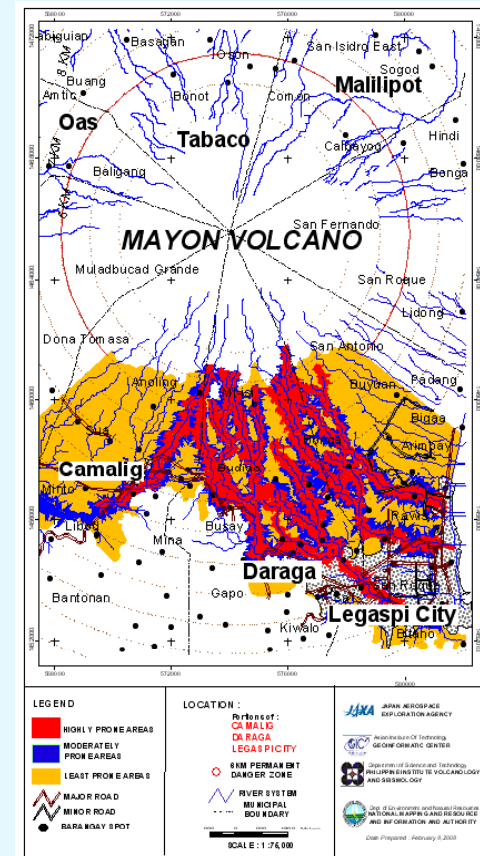
## Flood - Antique Province (MGB)



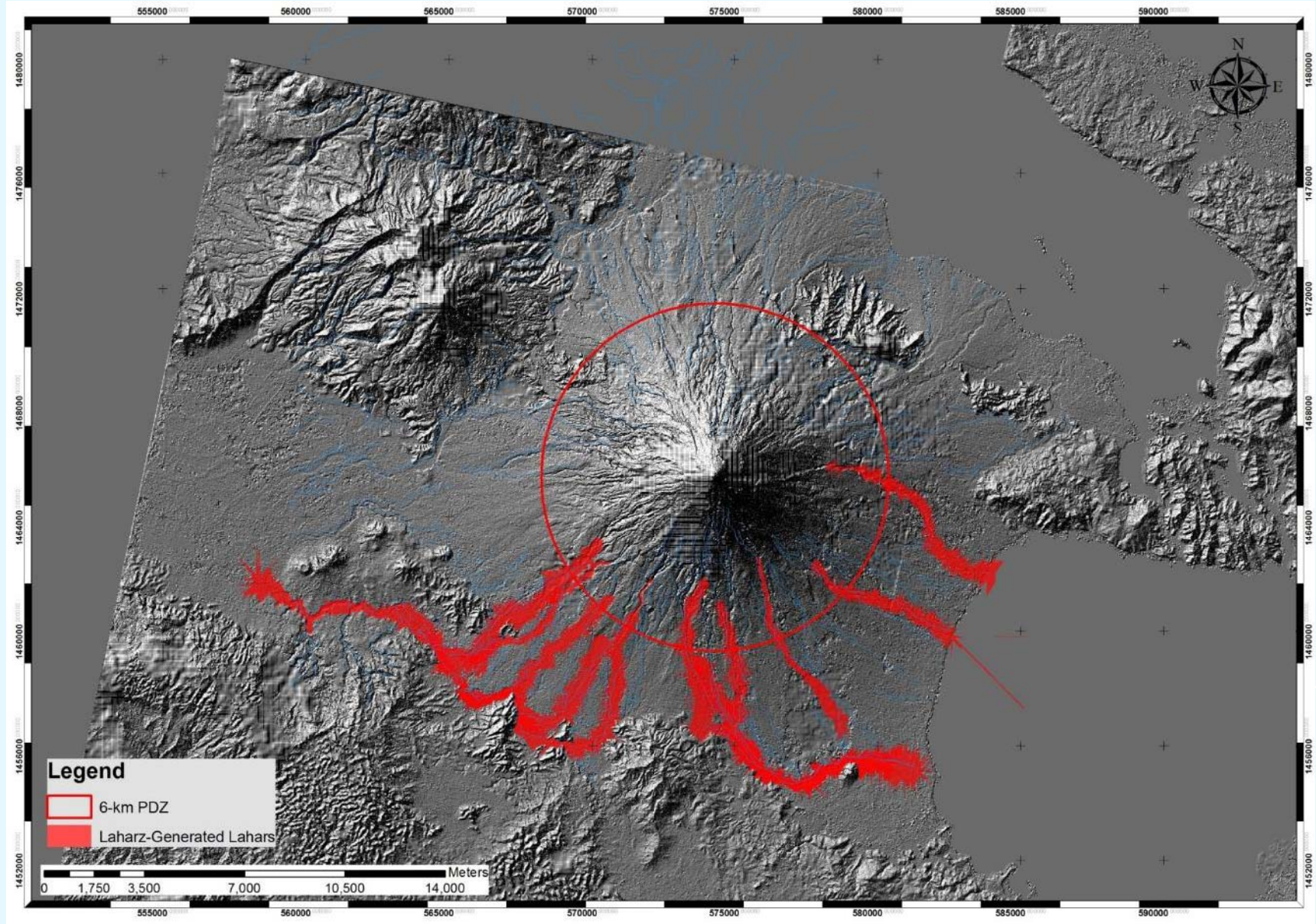
## Flood - Iloilo City (PAGASA)



## Lahar – Mayon Volcano (PHIVOLCS)



# STEP 1 LAHARZ Modeling Results Using ALOS DEM



# STEP 1: Capacity Building on Emergency Observation Request

**Sentinel Asia**  
Disaster Management Support System in the Asia-Pacific Region

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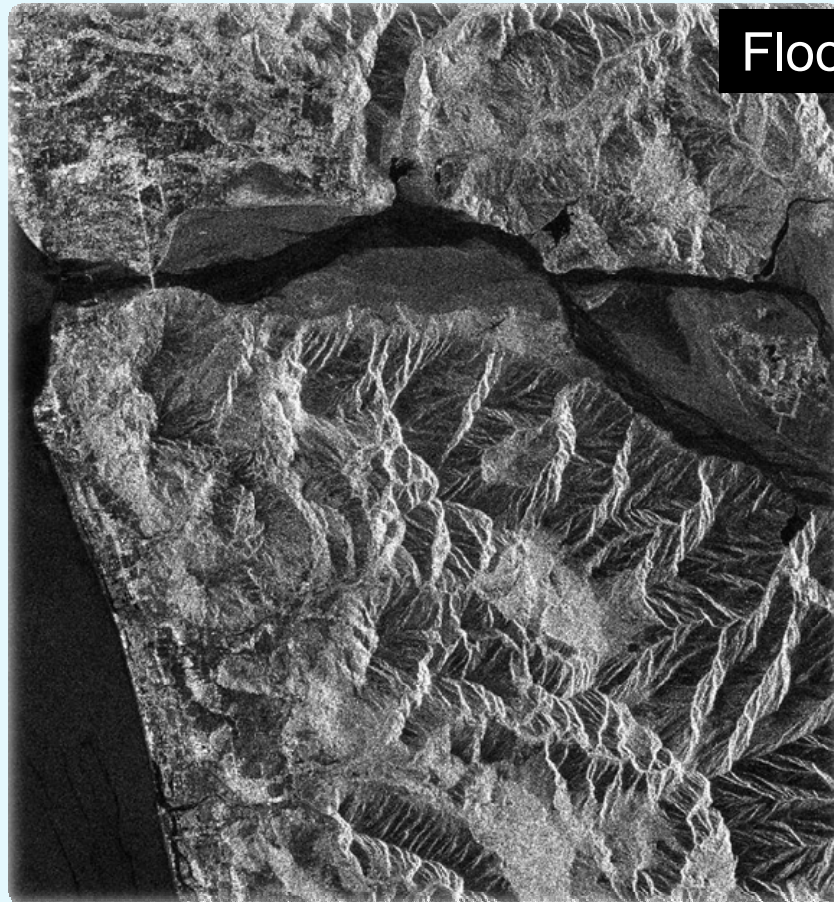
**Emergency Observation**

Date	Country	Event	Image	Product	GIS	GoogleEarth	Photo	Disaster Information
2009/11/02	Vietnam	Flood						ADRC
2009/10/06	Nepal	Flood						ADRC
2009/10/04	Philippines	Flood						ADRC
2009/09/30	Indonesia	Earthquake		CRISP1 <a href="#">Link</a>				ADRC
2009/09/26	Philippines	Flood		CRISP1 <a href="#">Link</a>				ADRC
2009/09/26	Vietnam	Flood		AIT1 THEOS1 (PSP) THEOS2 (MS) THEOS3 (PAN) THEOS4 (PSP) THEOS5 (PSP)				ADRC
2009/09/02	Indonesia	Earthquake		CRISP1 <a href="#">Link</a> THEOS1 (MS) THEOS2 (MS) THEOS3 (MS)				ADRC
2009/08/18	Nepal	Flood						ADRC
2009/08/08	Philippines	Typhoon		JAXVASPC1				ADRC
2009/07/05	Viet Nam	Flood		AIT1				ADRC
2009/03/27	Indonesia	Flash Flood		CRISP1 <a href="#">Link</a>				ADRC
2009/03/11	Australia	Oil Spill						ADRC
2009/02/19	Australia	Flood		JAXVASPC1				ADRC

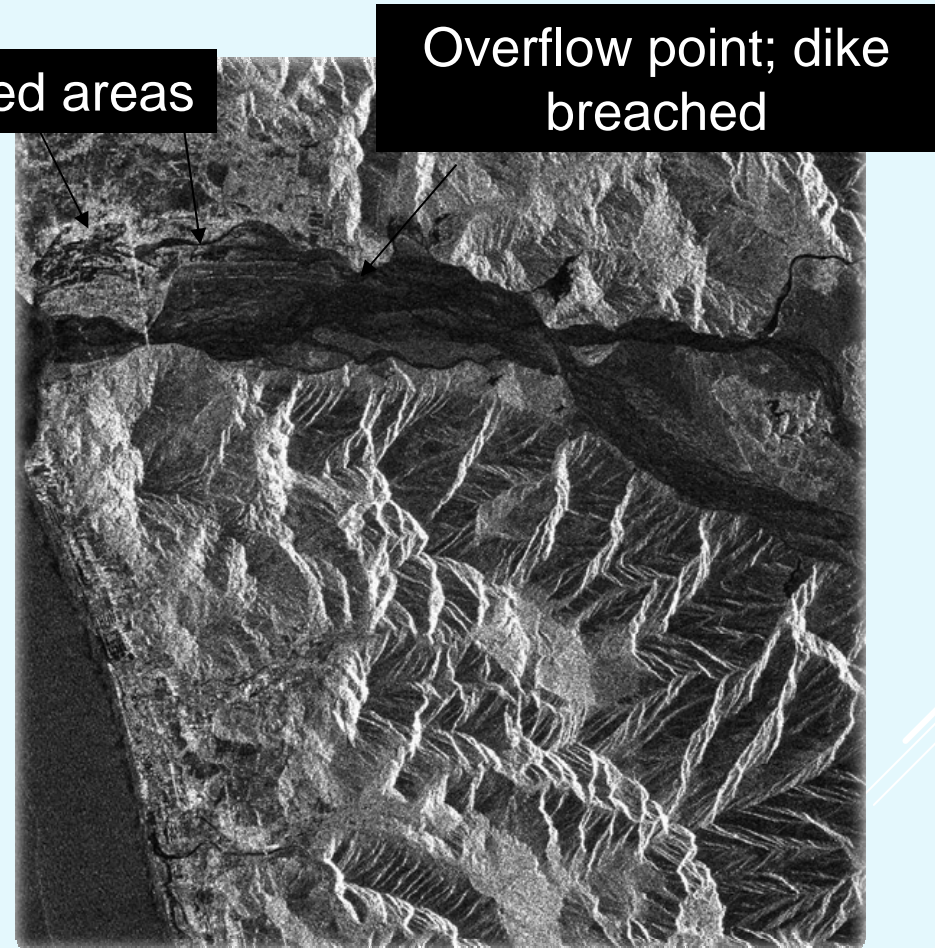
This page is updated on: 11/04/2009 14:14:24

When disaster happens, **Sentinel Asia can accept Emergency Observation Request (EOR) from users**, and Space Agency observes disaster afflicted area by Satellite. Then **satellite imagery are provided to users.**

# STEP 1 EOR: Flooding related to SW monsoon rains in Botolan, Zambales, Luzon Island, August 8, 2009



January 27, 2009



August 11, 2009

# STEP 1 EOR: Typhoon Ketsana Flooding

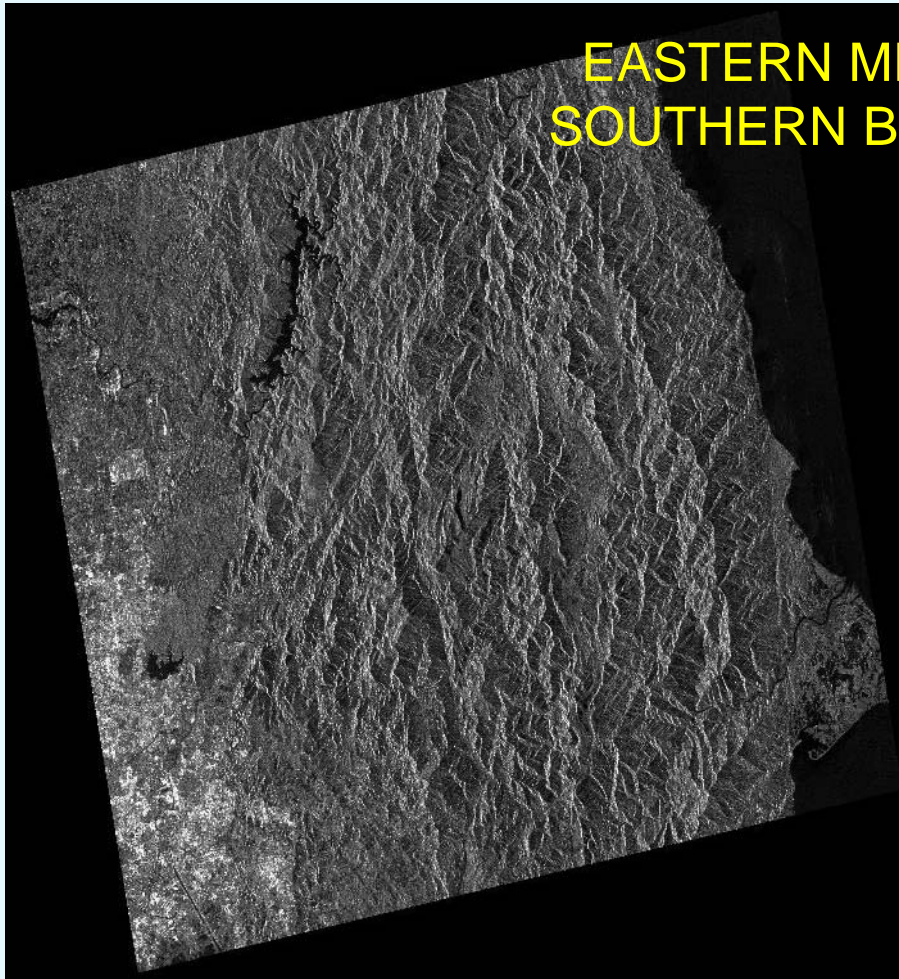


Source: [pinoymoneytalk.com](http://pinoymoneytalk.com)

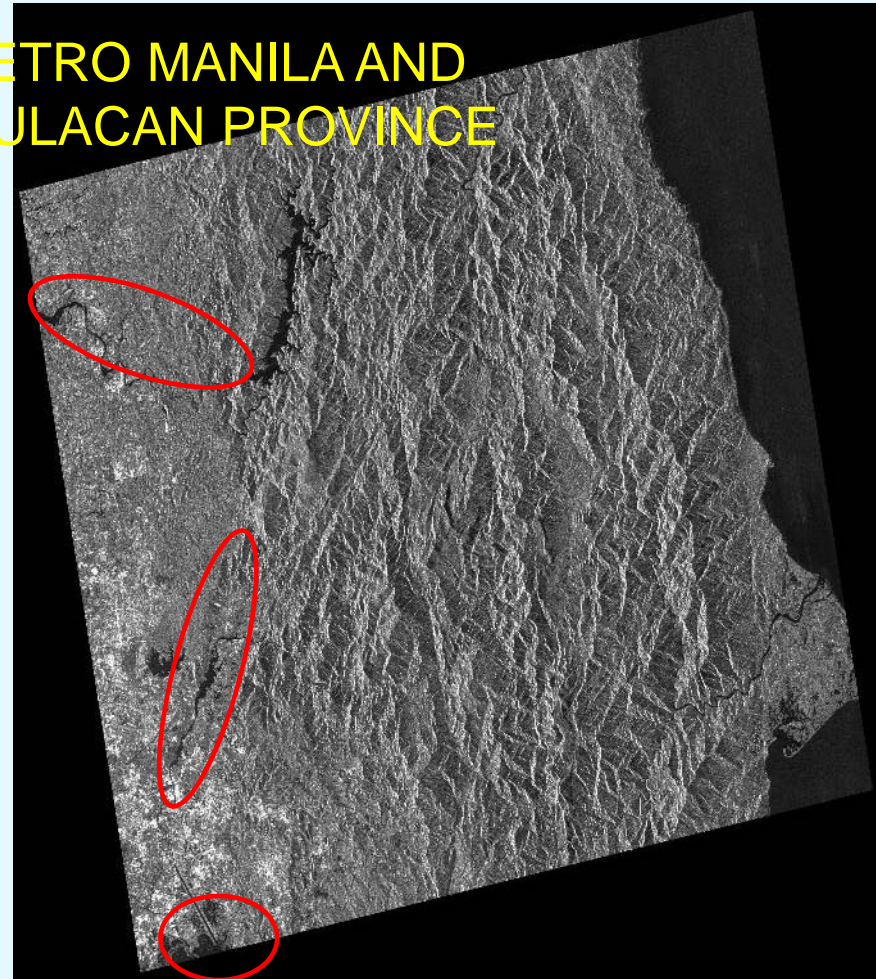


# STEP 1 EOR: Flooding related to Tropical Cyclones Ondoy (KETSANA), September 2009

EASTERN METRO MANILA AND  
SOUTHERN BULACAN PROVINCE

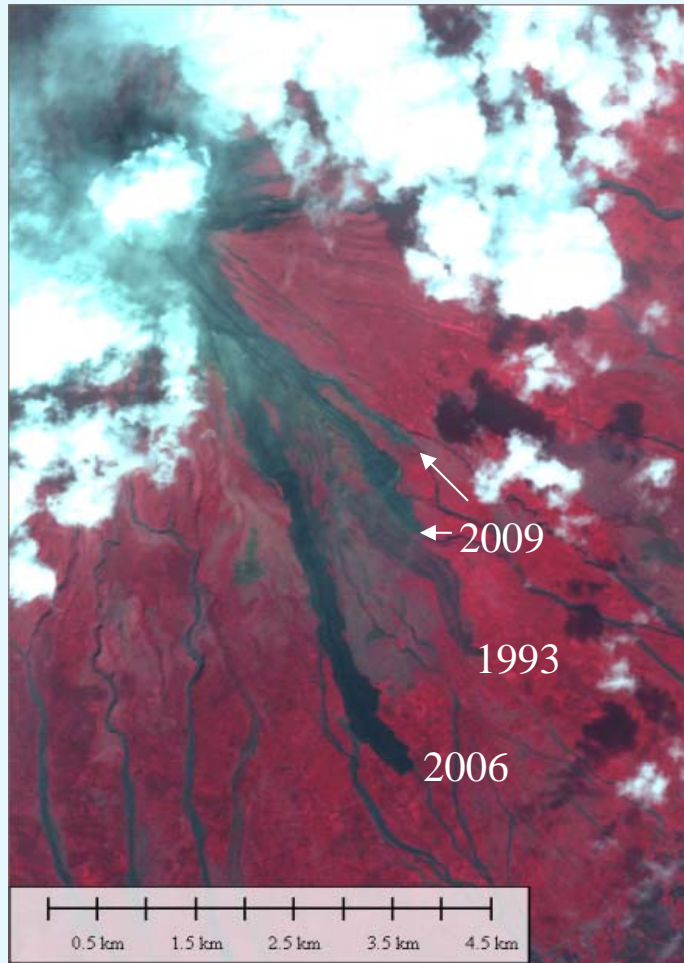


June 26, 2009  
Before Ketsana



September 26, 2009  
During Passage of Ketsana

# STEP 1 EOR: MAYON VOLCANO DECEMBER 2009 ERUPTION LAVA FLOW MONITORING



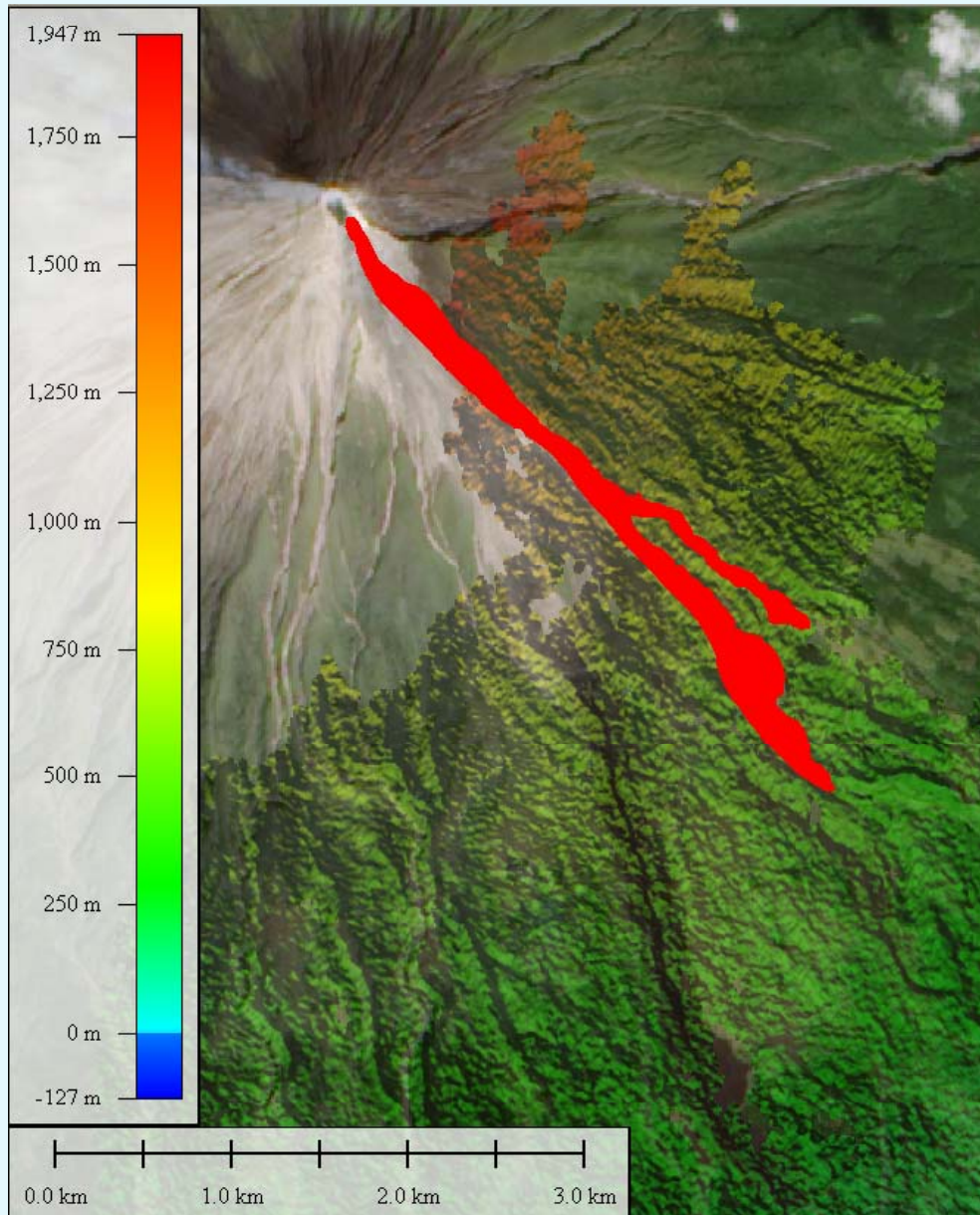
ALOS Dec 25, 2009  
Lava Flow: 4.4km

- hazard monitoring
- monitoring of volume of erupted materials for volcanic activity assessment



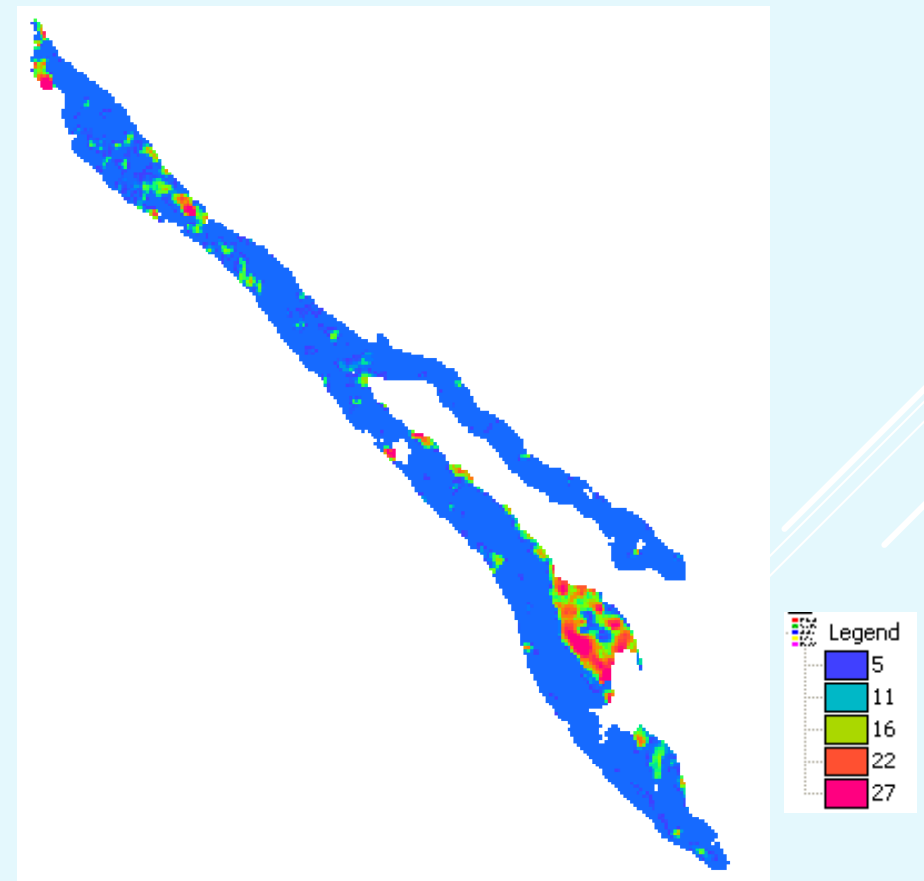
Helicopter, Jan 6, 2009  
Lava Flow: 4.7 km

# ALOS DEM LAVA VOLUME ESTIMATION FROM OCT 2009 AND DEC 25, 2009



## ALOS PRE- and POST LAVA FLOW DEM

Lava flow (Dec 25, 2009)  
Length = 4.3km from Summit  
Area = 849,000 m<sup>2</sup>  
Volume = 6,209,200



# STEP 1 EOR: Typhoon Bhopa

Dec 16-17, 2011  
TY Sendong


BARANGAY  
MACANDASIG, A  
POINT BAR  
DEPOSIT, WAS  
DEVELOPED FOR  
HOUSING. POST-  
DISASTER IMAGE  
FROM THEOS  
SHOWING THE  
COMPLETELY  
DEVASTATED  
POINT BAR AREA

Ground photos  
of Barangay  
Macandasig,  
Cagayan de  
Oro City.  
Flashflood  
completely  
swept the  
village and  
flood water  
depth is more  
than 3 meters.

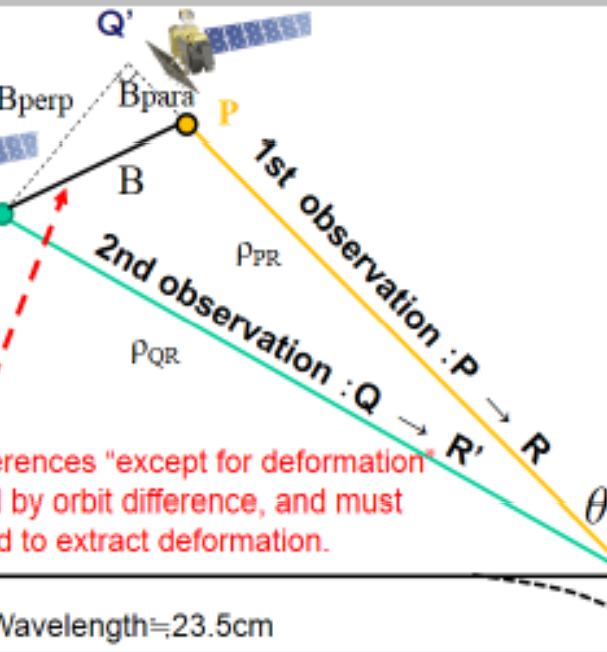


# STEP 2 (2010 – 2012)

## Training on InSAR Processing and Satellite-based Rainfall (GSMAP)

**Methodology of Differential Interferometry (2/3)** 

**Phase difference ( $\Phi$ )**  
 = (1) **deformation** + (2) **orbital fringe** + (3) **topographic fringe** + noise



$$\Phi = \frac{4\pi}{\lambda} B_{para} + \frac{4\pi}{\lambda \rho} B_{perp}$$

**Remove of (2) and (3) from  $\Phi$**

(2)  $\frac{\Delta\Phi_{orbit}}{\Delta X} = \frac{4\pi B_{perp} \cos \theta}{\lambda \rho}$

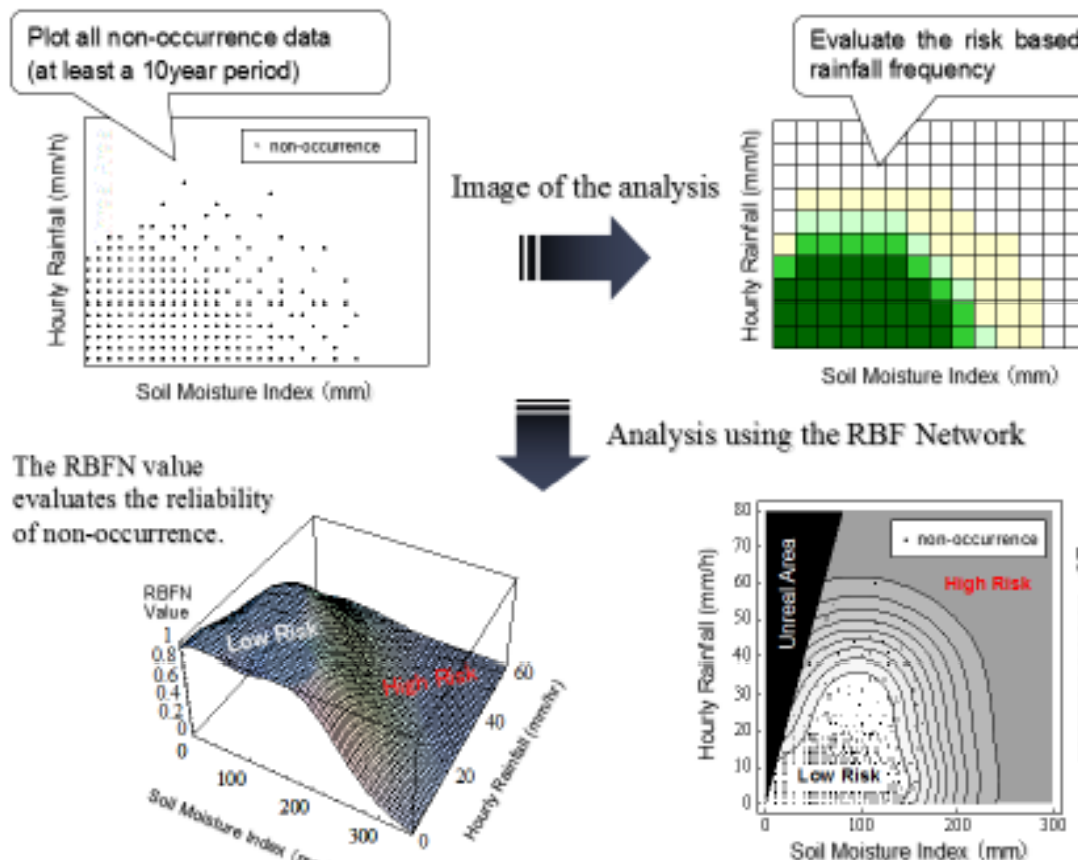
(3)  $\frac{\Delta\Phi_{topo}}{\Delta H} = \frac{4\pi B_{perp}}{\lambda \rho \sin \theta}$

Interferograms "except for deformation" are affected by orbit difference, and must be corrected to extract deformation.

Wavelength = 23.5cm

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### The Methodology for Defining the CL Using the RBF Network



Plot all non-occurrence data (at least a 10 year period)

Hourly Rainfall (mm/h)

Soil Moisture Index (mm)

Image of the analysis

Hourly Rainfall (mm/h)

Soil Moisture Index (mm)

Evaluate the risk based on rainfall frequency

Analysis using the RBF Network

The RBFN value evaluates the reliability of non-occurrence.

RBFN Value

Low Risk

High Risk

Hourly Rainfall (mm/h)

Soil Moisture Index (mm)

Hourly Rainfall (mm/h)

Soil Moisture Index (mm)

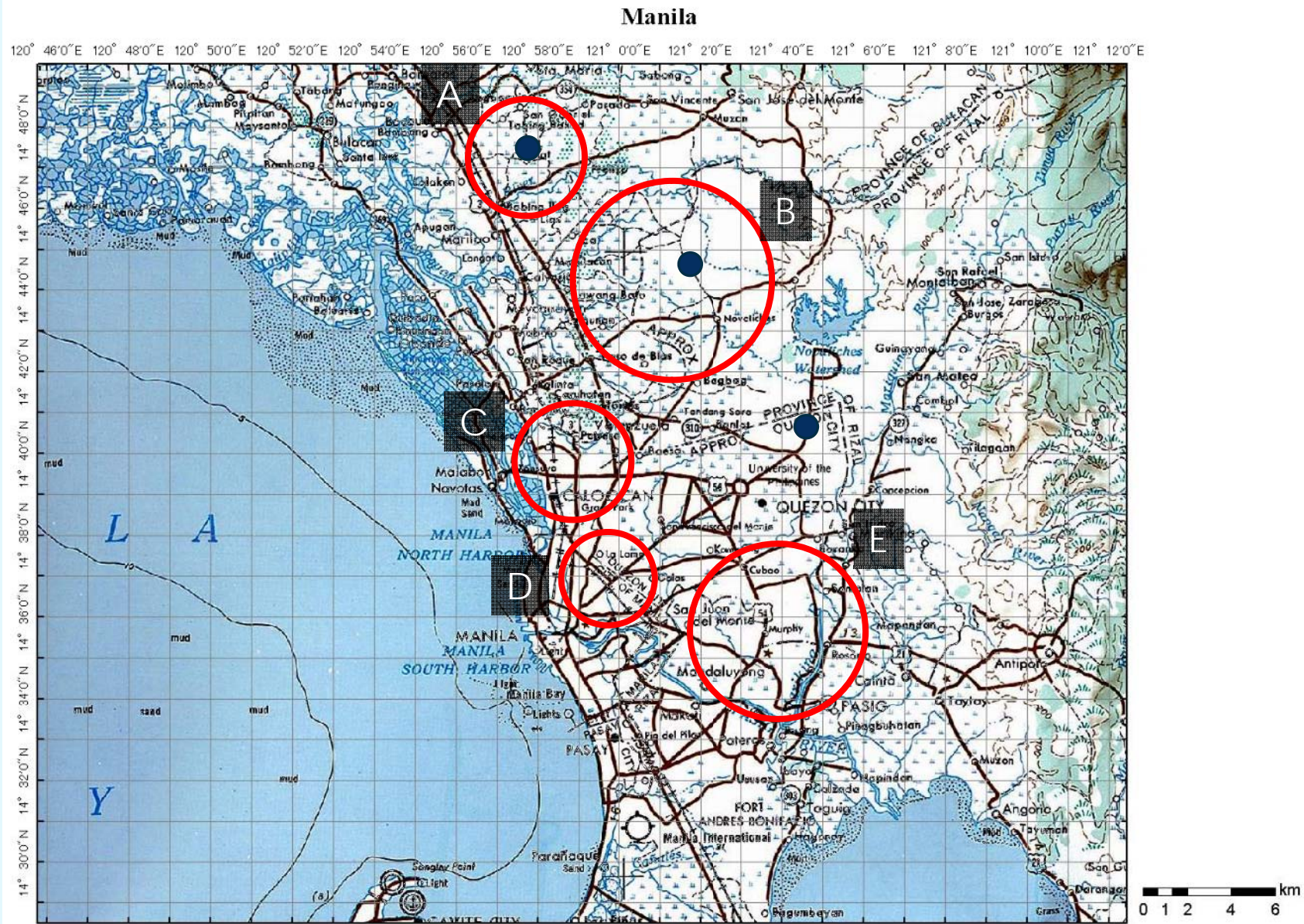
Unreal Area

Low Risk

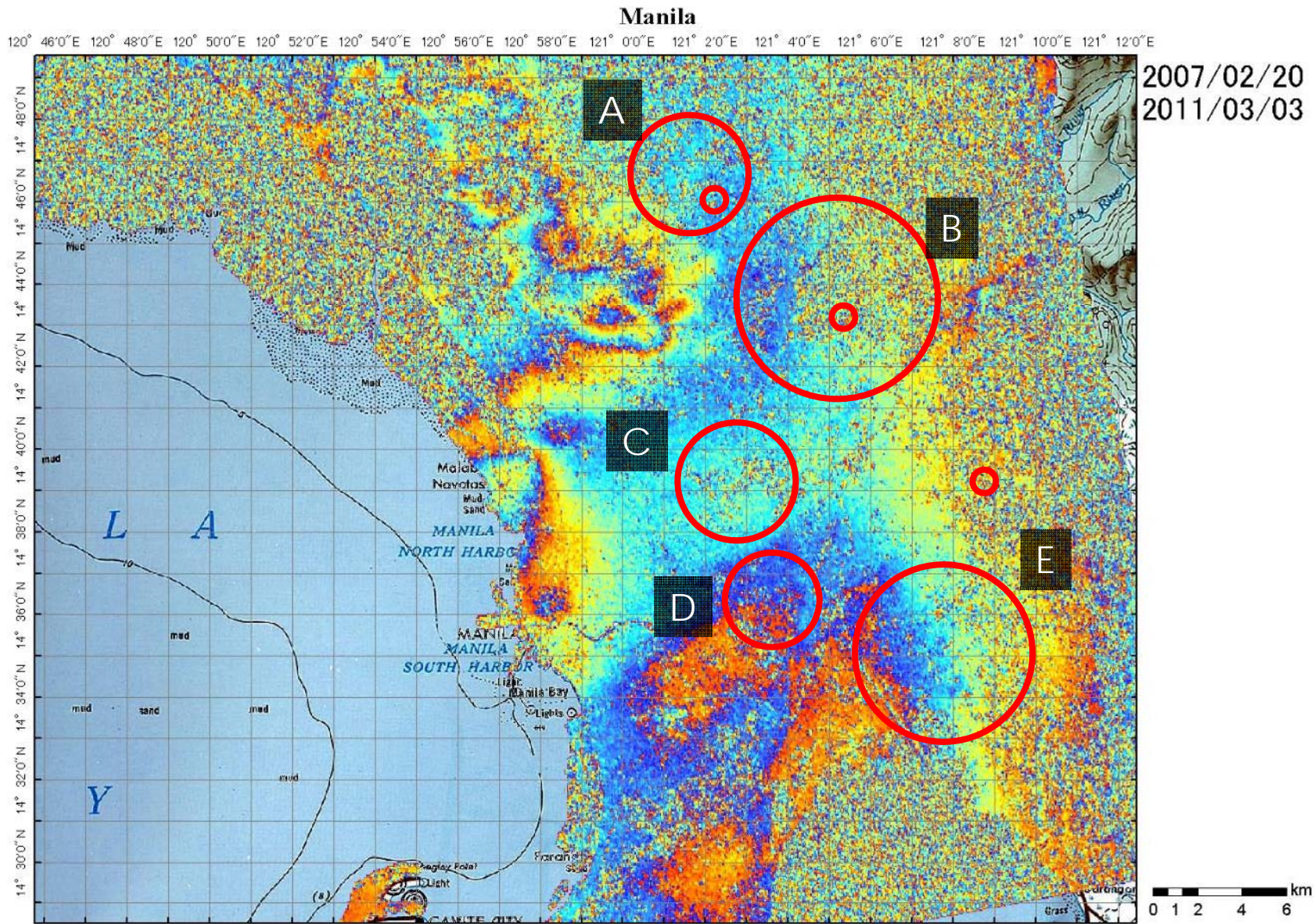
High Risk

2012 Sentinel Asia success story in the Philippines

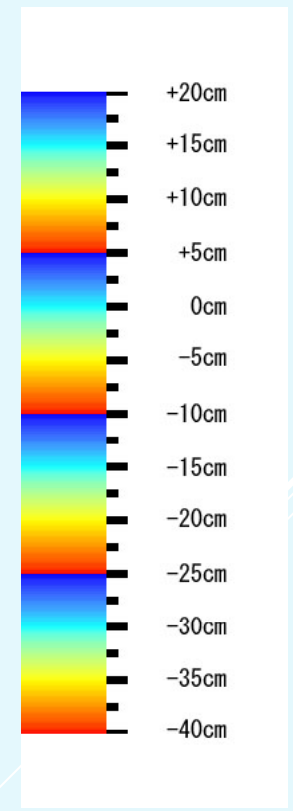
# STEP 2 Subsidence: Metro Manila



# STEP 2 Subsidence: Metro Manila



2011 - Feb. 2007 (1472 Days)



# EP 2 Subsidence: Metro Manila Four years from 2007-2010 with Supplemental GPS Data

Original

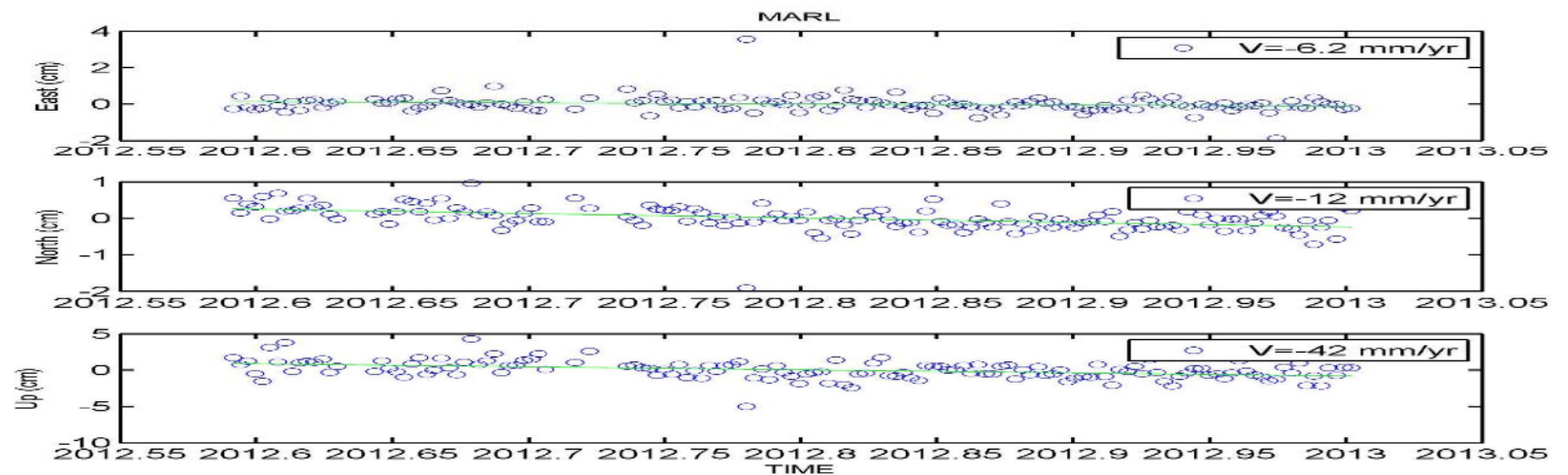
				A	B	C	D	E
1	2010/11/1	2007/2/3	1380	-	-30	-	-	12
4								
13	2011/3/3	2007/2/20	1472	-40	-27	-20	-12	7.5

Conversion

1	2010/11/1	2007/2/3	1460	-	-32	-	-	13
4								
13	2011/3/3	2007/2/20	1460	-40	-27	-20	-12	7

Average

4 years	-39.7	-29.3	-19.8	-11.9	10.1
1 year	-9.9	-7.3	-5.0	-3.0	2.5





# STEP 2 INSAR: STUDY AREA: MAYON VOLCANO



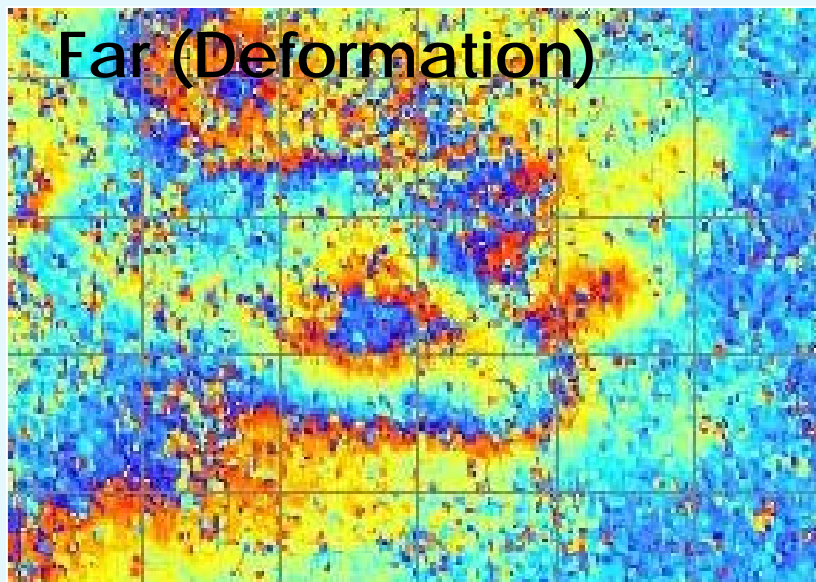
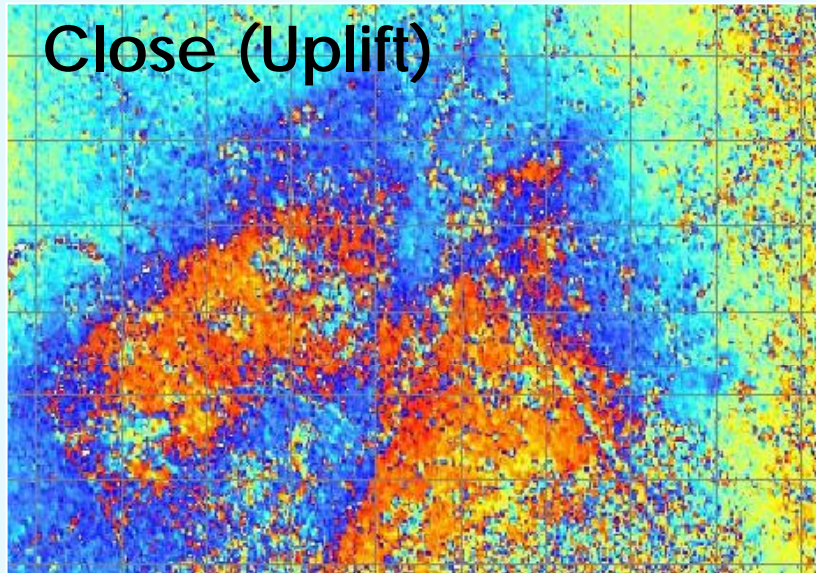
Location: Province of Albay, Bicol

Elevation: 2.46 km a.s.l.

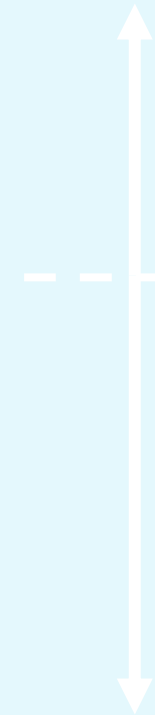
Base Diameter: ~20 km

Volcano Type: Stratovolcano

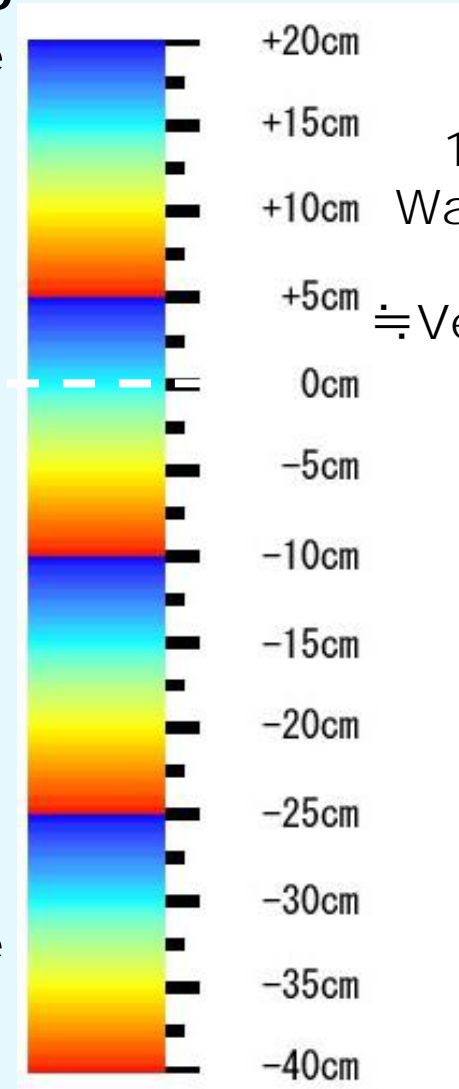
# STEP 2: Ground Deformation on Volcano



Close to  
Satellite



Far from  
Satellite



+20cm

+15cm

+10cm

+5cm

0cm

-5cm

-10cm

-15cm

-20cm

-25cm

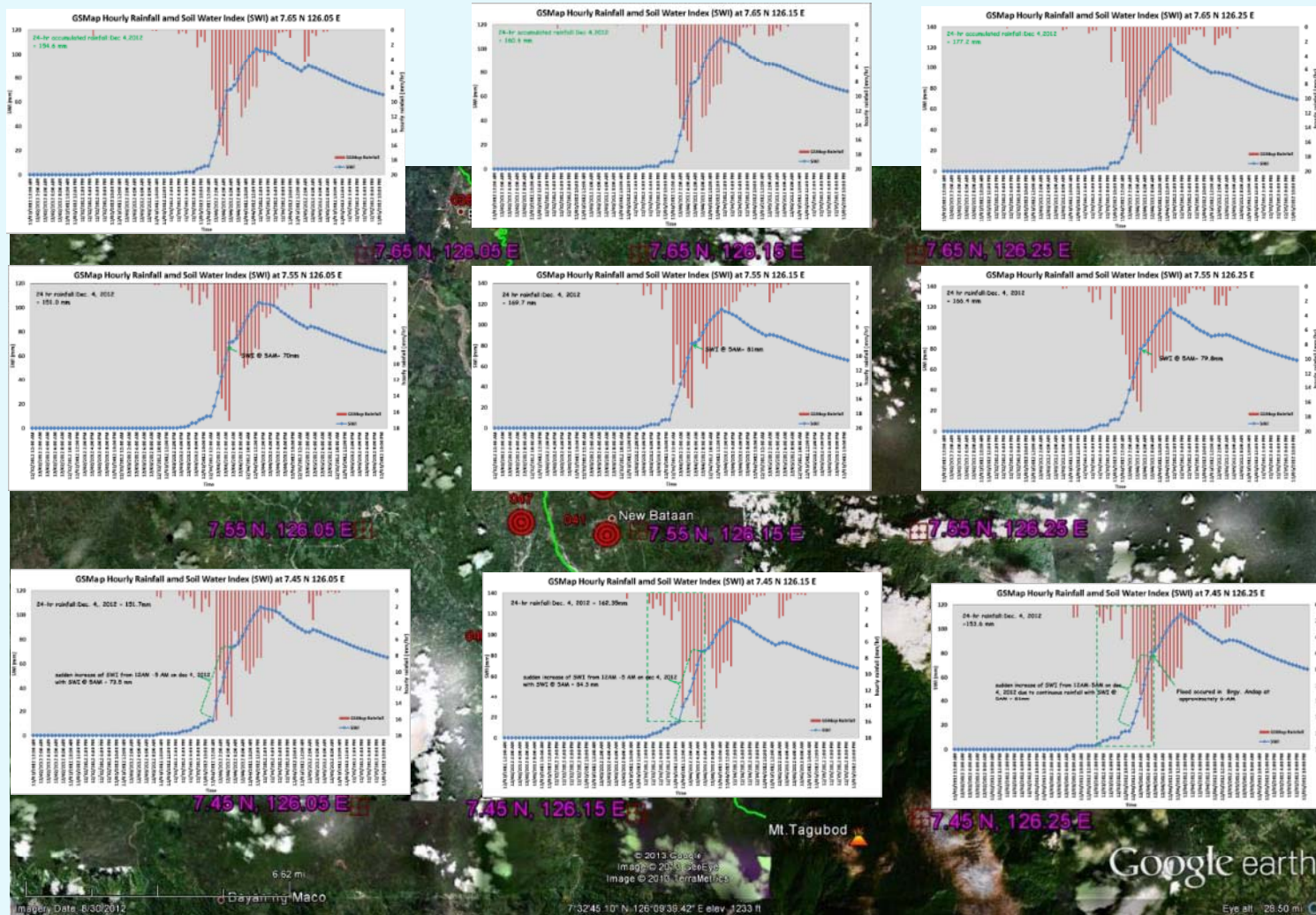
-30cm

-35cm

-40cm

1 Cycle =  
Wavelength/2  
(11.8cm)  
≐ Vertical 15cm

# STEP 2: Use of GSMAP in rainfall Monitoring for Flood and Landslide



# What is the Landslide Early Warning Prototype System

When we get a warning message, we should do assessment of landslide warning.



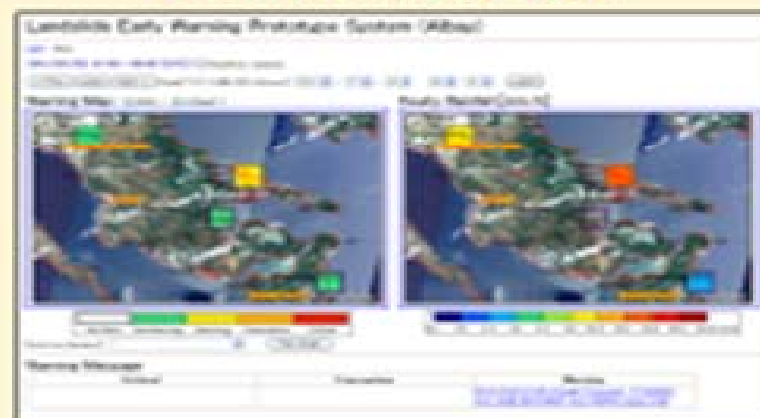
Access

Philippines Team  
& Japan Team

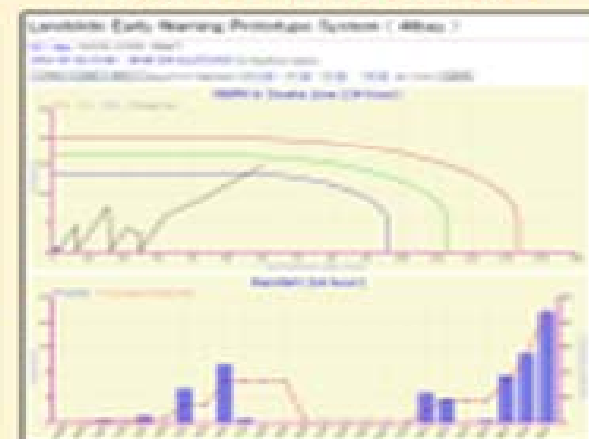
## Landslide Early Warning Prototype System

The system has web interface. We can access to the system by web browser (like a Internet Explorer).

### Web Interface (Map)

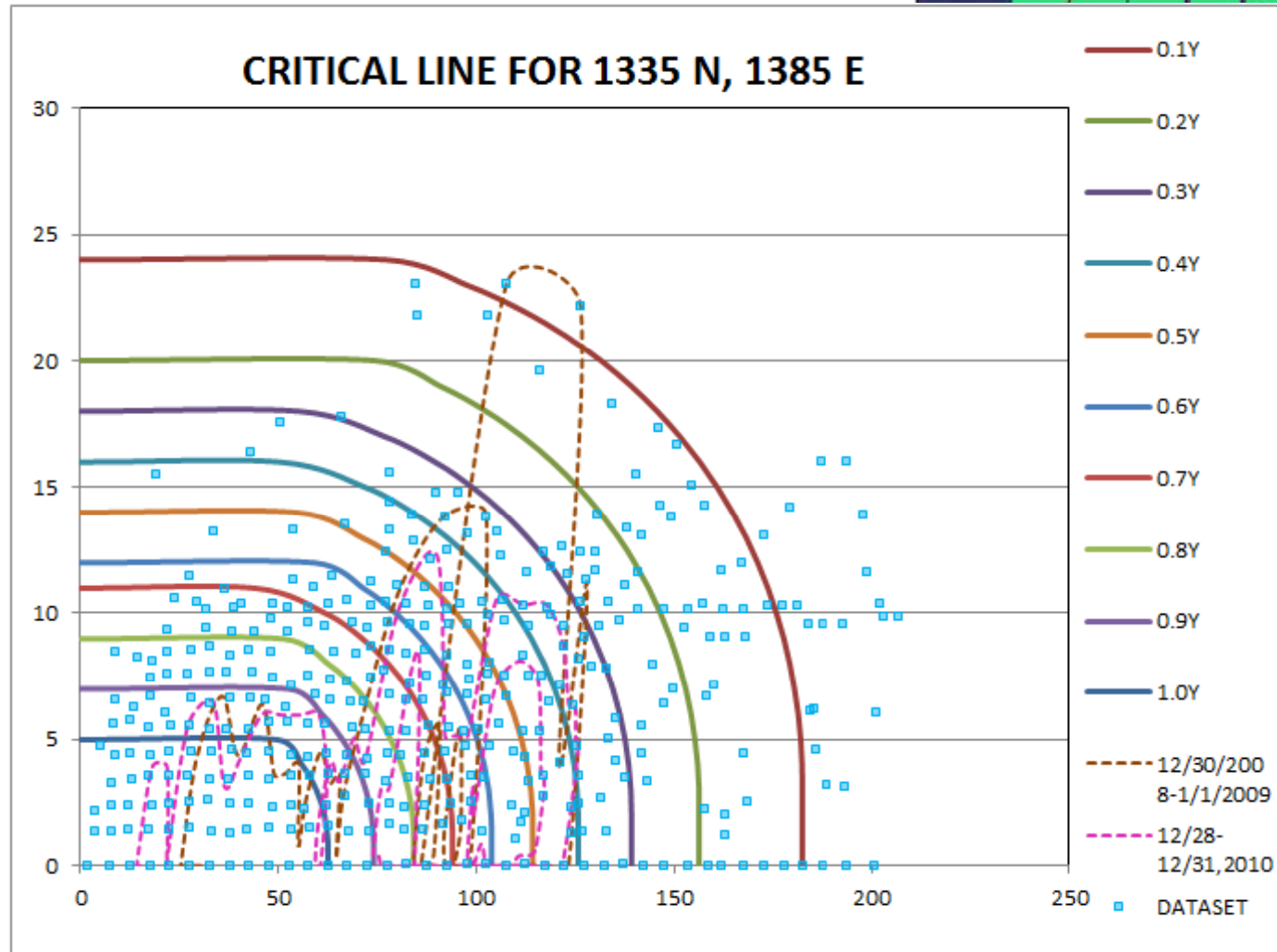
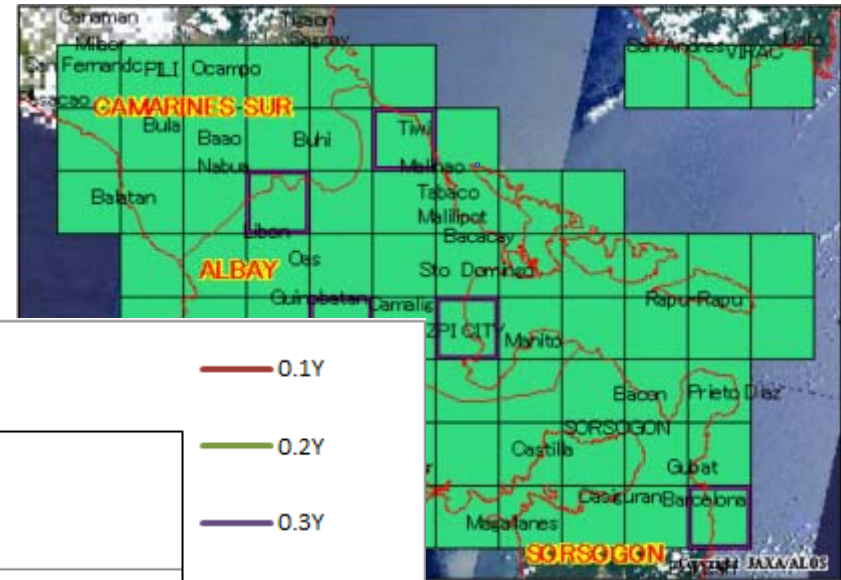


### Web Interface (Graph)



The system has two types of interface. Map graphically shows warning information and rainfall information at observation area. Graph shows RBFN and Snake Line and rainfall.

# STEP 2: Use of GSMAP in rainfall Monitoring for Flood and Landslide

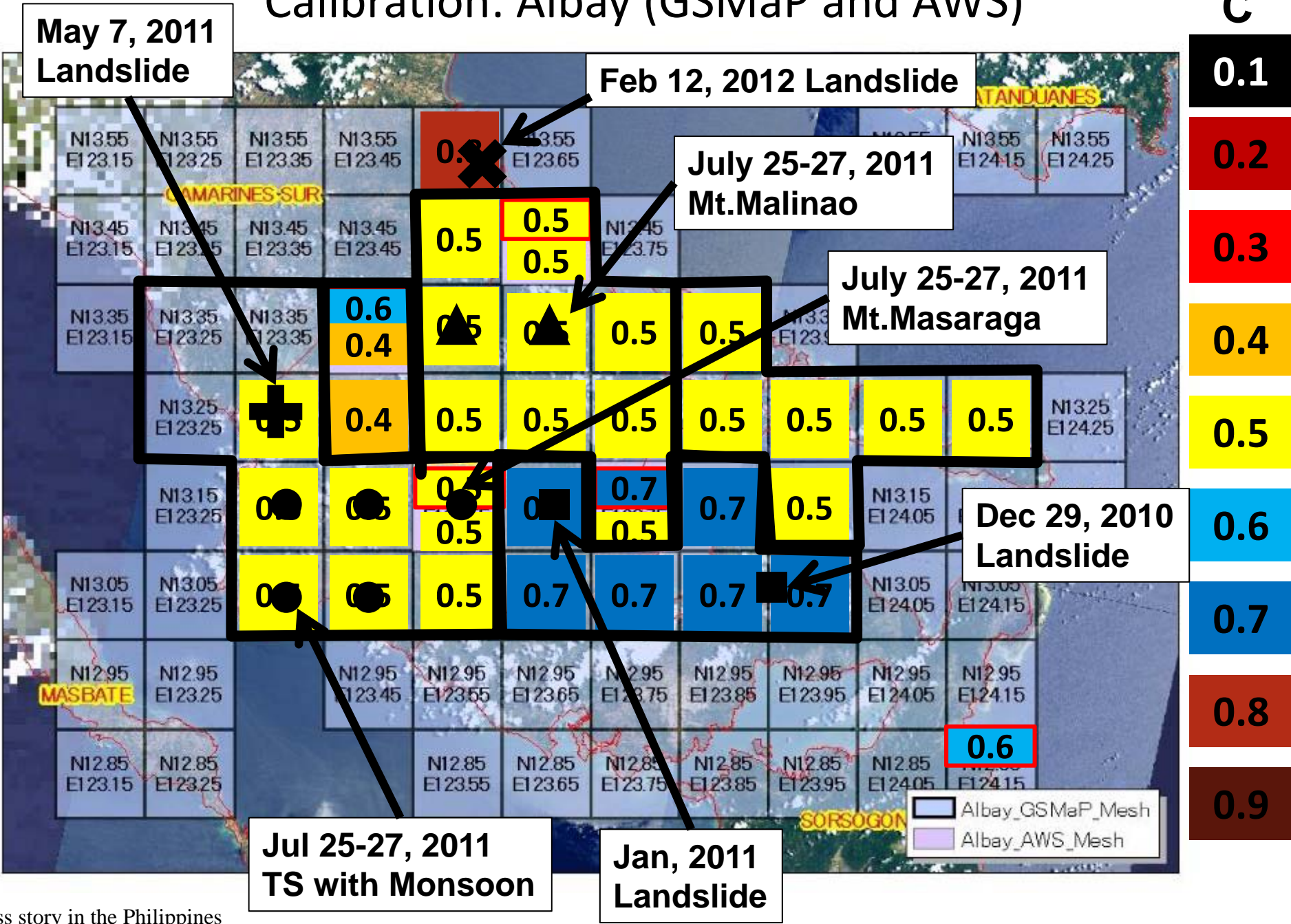


MaP

**CL : 0.5Y**  
Scattered data.

# Calibration: Albay (GSMaP and AWS)

**C**



# STEP 2: Operational Landslide Warning

Established Landslide Warning server at NTT Data  
Tokyo Office Website

<http://60.36.183.126/lsWarning/>

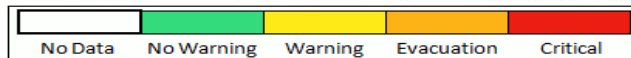
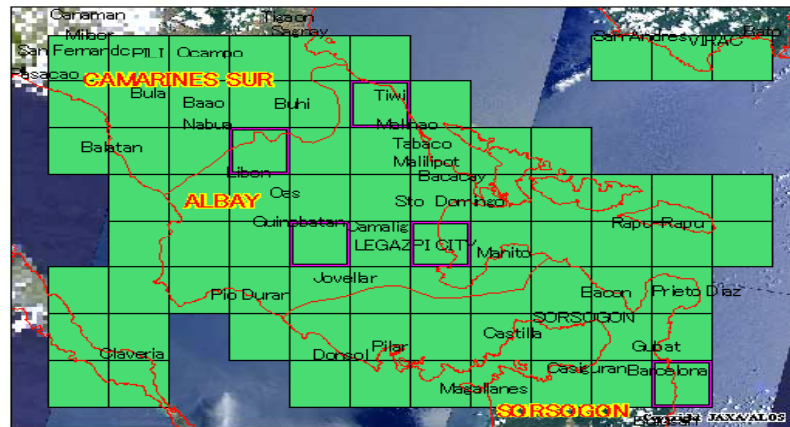
## Landslide Early Warning Prototype System (Albay)

[TOP](#) > Albay

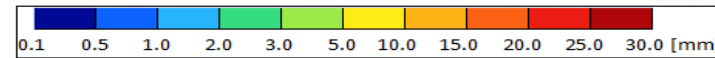
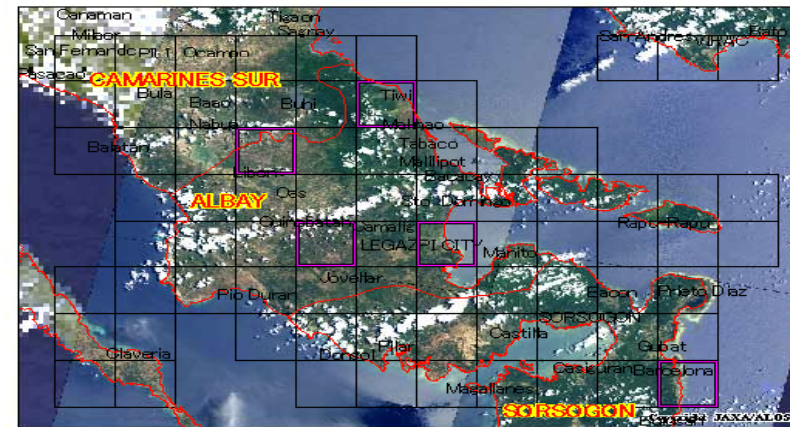
2013/02/12 11:45- 12:00 (UTC)  Realtime Update

<< Prev Latest Next >> Date(YYYY-MM-DD HH:mm): 2013 - 02 - 12 12 : 00 submit

Warning Map (AWS/GSMaP)



Hourly Rainfall [mm/h]



[Lat, Lon, Name, Sensor]: - View Graph

## Warning Message

Critical	Evacuation	Warning

THANK YOU

The image features a light blue background with a white border at the top and bottom. In the bottom right corner, there are several thin, white, parallel lines that appear to be part of a decorative graphic element, possibly representing a stylized 'L' or a corner design.