

# Emergency Observation Request (EOR) Kumamoto Earthquake, April 2016

Yamaguchi University

Center for Research and Application for Satellite Remote Sensing

Deputy Director, Dr. Masahiko Nagai

## Kumamoto hit again; dozens die in M-7.3 quake

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9:59 am, April 17, 2016

### The Japan News

A powerful quake with an estimated magnitude of 7.3 struck Kumamoto Prefecture at about 1:25 a.m. Saturday, following the magnitude-6.5 quake on Thursday night.

According to the Kumamoto prefectural government and other sources, 32 people were killed in the quake, which had its focus in the prefecture. The combined death toll from the quakes reached 41.

On Saturday, powerful aftershocks, measuring as strong as upper 6 on the Japanese seismic intensity scale of 7, have continued intermittently. The focus of at least one of the aftershocks was in neighboring Oita Prefecture.

At about 8:30 a.m., a small eruption was confirmed at Mt. Aso in Kumamoto Prefecture, but there has been no significant change in its volcanic activity, according to the Japan Meteorological Agency.

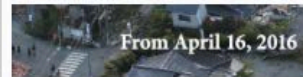
The Yomiuri Shinbun

An aerial view at 6:20 a.m. Saturday of the area that collapsed near the Aso Ohashi bridge in Minami-Aso, Kumamoto Prefecture

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Latest news from Sophia University

### Kumamoto Earthquake Photos



# The M6.5 and M7.3 Kumamoto Earthquakes on April 14 and 16, 2016

Table 1 Human Casualties (persons)

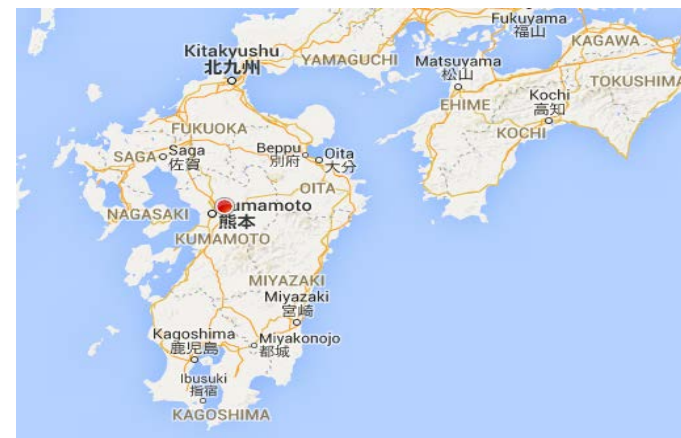
Pref.	Deaths	Severely Injured	Slightly Injured
Fukuoka	0	1	17
Saga	0	4	9
Kumamoto	49	360	1,258
Oita	0	4	23
Miyazaki	0	3	5
Total	49	372	1,312

Source: Emergency Disaster Response Headquarters

Note: Another 20 deaths are considered to be quake-related, and 58 injured persons in Kumamoto are have not yet been classified.



Asian Disaster Reduction Center



# Charter Call 562

PM: Dr. Masahiko Nagai, the University of Tokyo

End Users: 

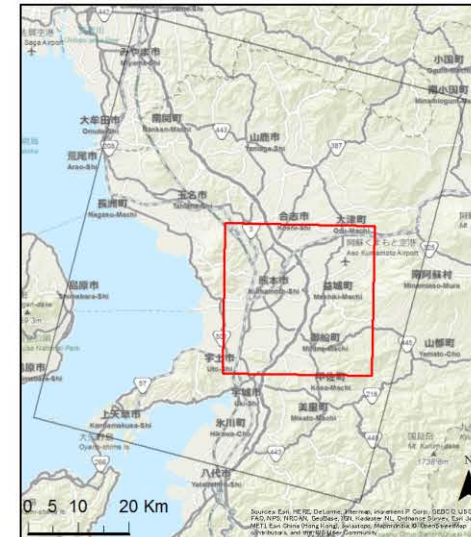
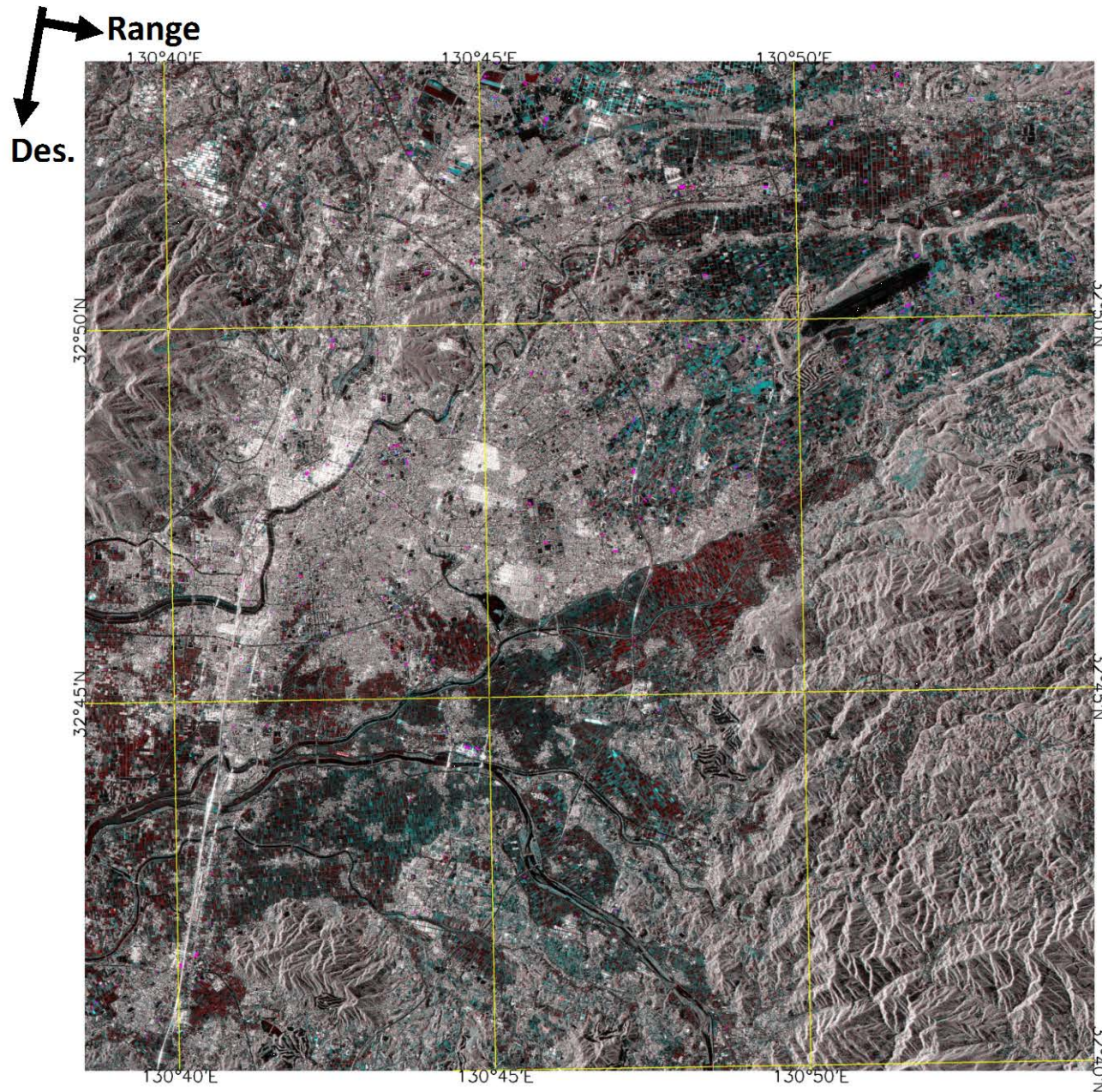
- 1) Cabinet Office
- 2) Ministry of Land, Infrastructure and Transport
- 3) The Ministry of Agriculture, Forestry and Fisheries of Japan
- 4) Ministry of the Environment
- 5) Japan Medical Association

VAR: The University of Tokyo, Tokyo Tech., Chiba University, Yamaguchi University, Hiroshima Institute of Technology, Asian Institute of Technology, JAXA.

# chronology of events

- 14 Apr 2016 20:28 AU call submission
- 14 Apr 2016 21:03 ECO URF validation
- 14 Apr 2016 22:17 ERF sent to USGS, CNES, KARI, ROSCOSMOS, DMCII, CNSA, DLR, ISRO
- 15 Apr 2016 03:20 PM nominated
- 15 Apr 2016 16:14 The first Archive data from ROSCOSMOS
- 16 Apr 2016 07:29 The first newly acquisition data from USGS, WV-3
- 17 Apr 2016 18:08 Data Product received from MPP of ROSCOSMOS
- 17 Apr 2016 16:53 The first Value Added Product from Tokyo Tech.
- 21 Apr 2016 18:31 Additional Request to USGS and CNES for High Resolution Images
- 26 Apr 2016 03:57 The last acquisition data from USGS
- 29 Apr 2016 02:19 The last Value Added Product from Tokyo Tech.
- 29 Apr 2016 19:45 The activation was closed.

Agency	Satellite Instrument Mode	Sensing dates of requested products	Sensing / Reception dates of metadata / products			
			Attempt 1	Attempt 2	Attempt 3	Archive
DLR	RapidEye REIS MS	(Archive) 15/03/2016				15/04/2016
						15/03/2016
DLR	RapidEye REIS MS	(Archive) 17/03/2016				15/04/2016
						17/03/2016
DLR	RapidEye REIS MS	15/04/2016	17/04/2016			
			15/04/2016			
CNES	Pléiades	(Archive) 15/04/2016				15/04/2016
CNES	Pléiades	15/04/2016	17/04/2016	18/04/2016	21/04/2016	
DMCII	UK-DMC2 SLIM-6-22	(Archive) 02/03/2016				
						02/03/2016
DMCII	UK-DMC2 SLIM-6-22	19/04/2016				
USGS	WorldView-1	16/04/2016	19/04/2016	22/04/2016		
			20/04/2016			
USGS	WorldView-2	16/04/2016	16/04/2016			
			16/04/2016			16/04/2016
USGS	WorldView-3	15/04/2016	16/04/2016			
			15/04/2016			26/03/2013
USGS	Landsat-7,8	20/04/2016	20/04/2016			
			20/04/2016			16/04/2016
USGS	ASTER	20/04/2016	21/04/2016	22/04/2016	23/04/2016	
		21/04/2016	20/04/2016	21/04/2016	21/04/2016	
KARI	KOMPSAT-2 MSC PMS	17/04/2016				
			17/04/2016			
KARI	KOMPSAT-3 AEISS	14/04/2016	06/05/2016			
			14/04/2016			
KARI	KOMPSAT-3 AEISS PMS	18/04/2016				
			18/04/2016			
ROSCOSMOS	Resurs-P Geoton-L1	(Archive) 25/09/2015				25/09/2015
ROSCOSMOS	Resurs-P Geoton-L1	(Archive) 04/11/2015				
						04/11/2015
ROSCOSMOS	Resurs-P Geoton-L1	(Archive) 09/12/2015				
						09/12/2015
ROSCOSMOS	Resurs-P Geoton-L1	(Archive) 12/12/2015				
						12/12/2015
ROSCOSMOS	Resurs-P Geoton-L1	(Archive) 13/12/2015				
						13/12/2015
ROSCOSMOS	Resurs-P Geoton-L1	17/04/2016	06/05/2016			
			17/04/2016			
ROSCOSMOS	Resurs-P Geoton-L1	18/04/2016	18/04/2016	21/04/2016	24/04/2016	25/04/2016



Color campsite of the pre- and post-event PALSAR-2 intensity images for Kumamoto City, Japan

R: 2016/4/15

G&B: 2014/11/14

Polarization: HH

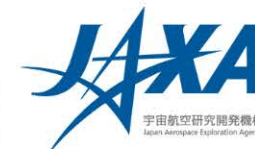
Off-nadir angle: 28.8°

Pixel size: 2.5 m

■ Changed urban area ( $z > 0.3$ )

Z-factor is calculated by the following equation, which is from -0.5 and 1.5. A high value shows high possibility for changes.

$$z = \frac{I_{\#}}{I_{\%}} - 0.5 +$$



# a. Hiroyasu-Nishi Primary School 広安西小学校



AIRBUS



Pléiades @CNES – Distribution Astrium Services/Spot Image S.A.


Pléiades @CNES – Distribution Astrium Services/Spot Image S.A.

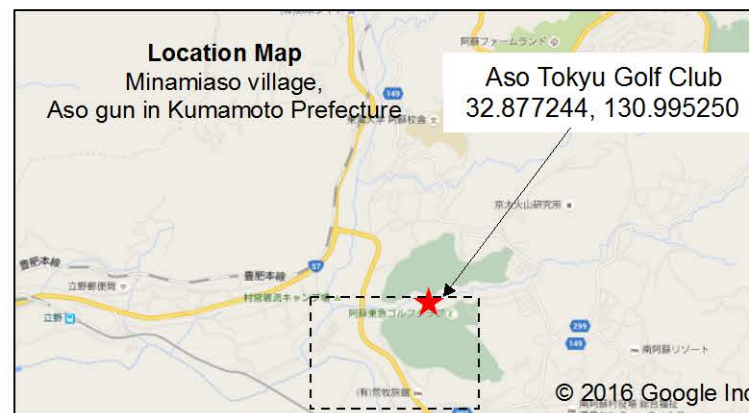




# Slope failure area due to earthquake, April 15,16, Japan



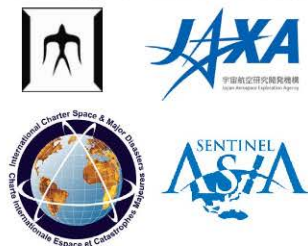
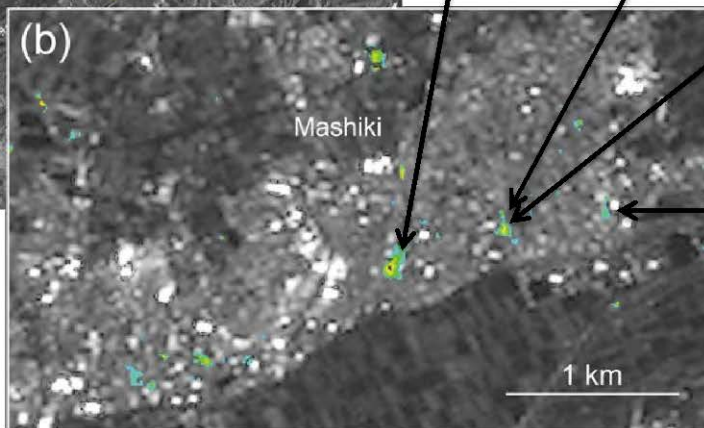
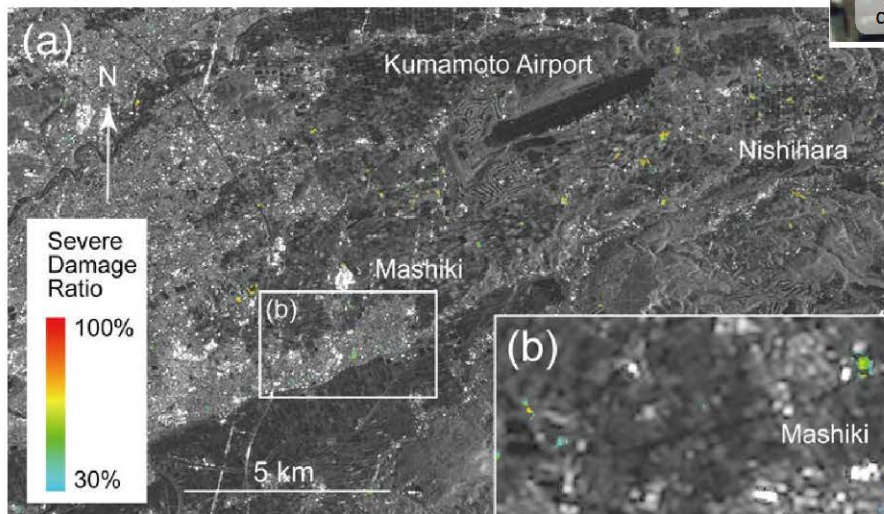
 window of slope failure area

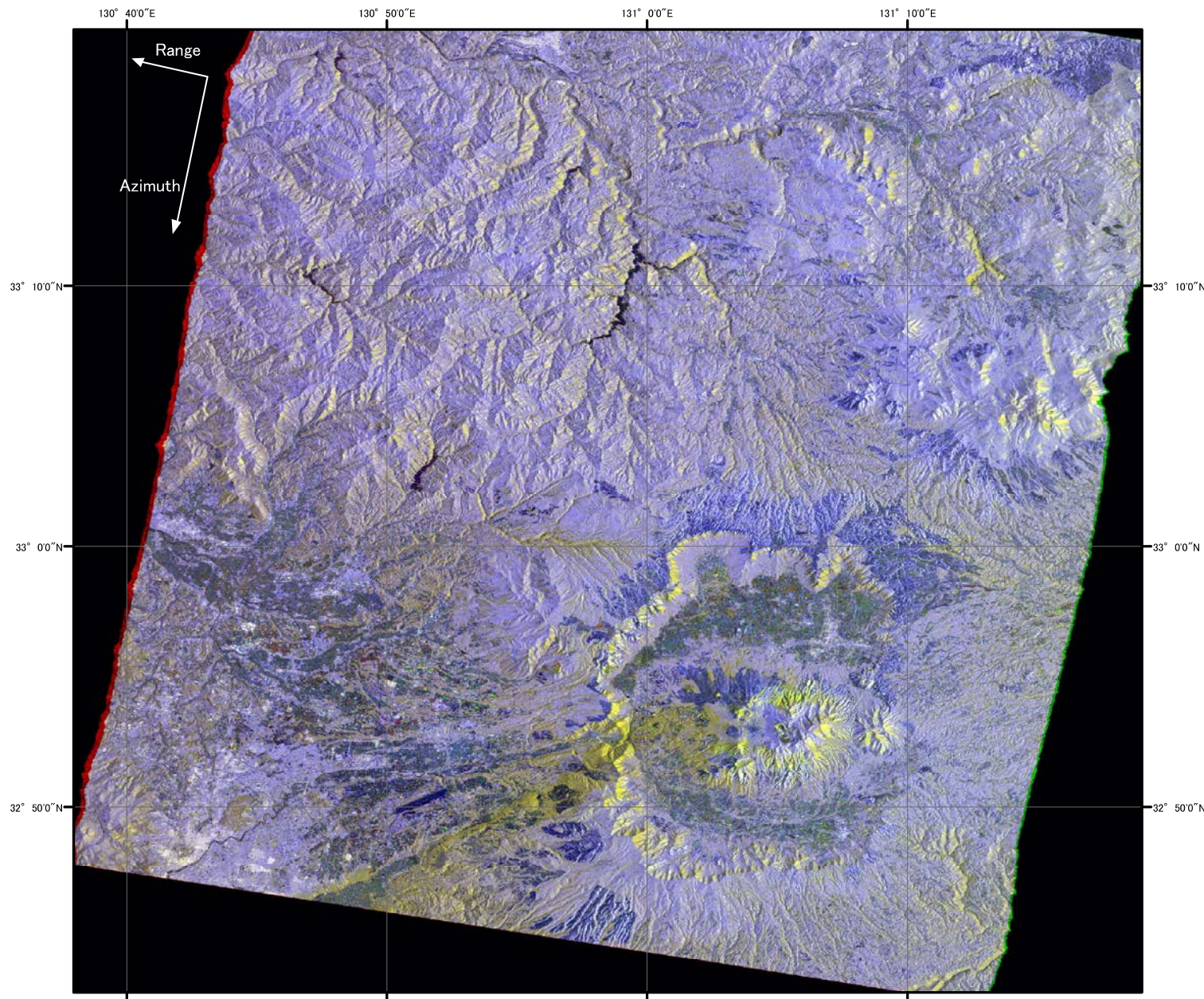


# Damage Ratio of Mashiki

Severely damaged areas are located in Mashiki town and show relatively good agreement with ground photos and WorldView satellite images.

益城町の被害率が高い地域と地上写真、WorldView衛星画像との比較。





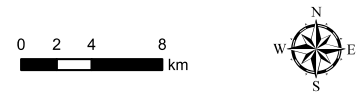
# 平成28年 熊本地震

発災日: 2016.04.16



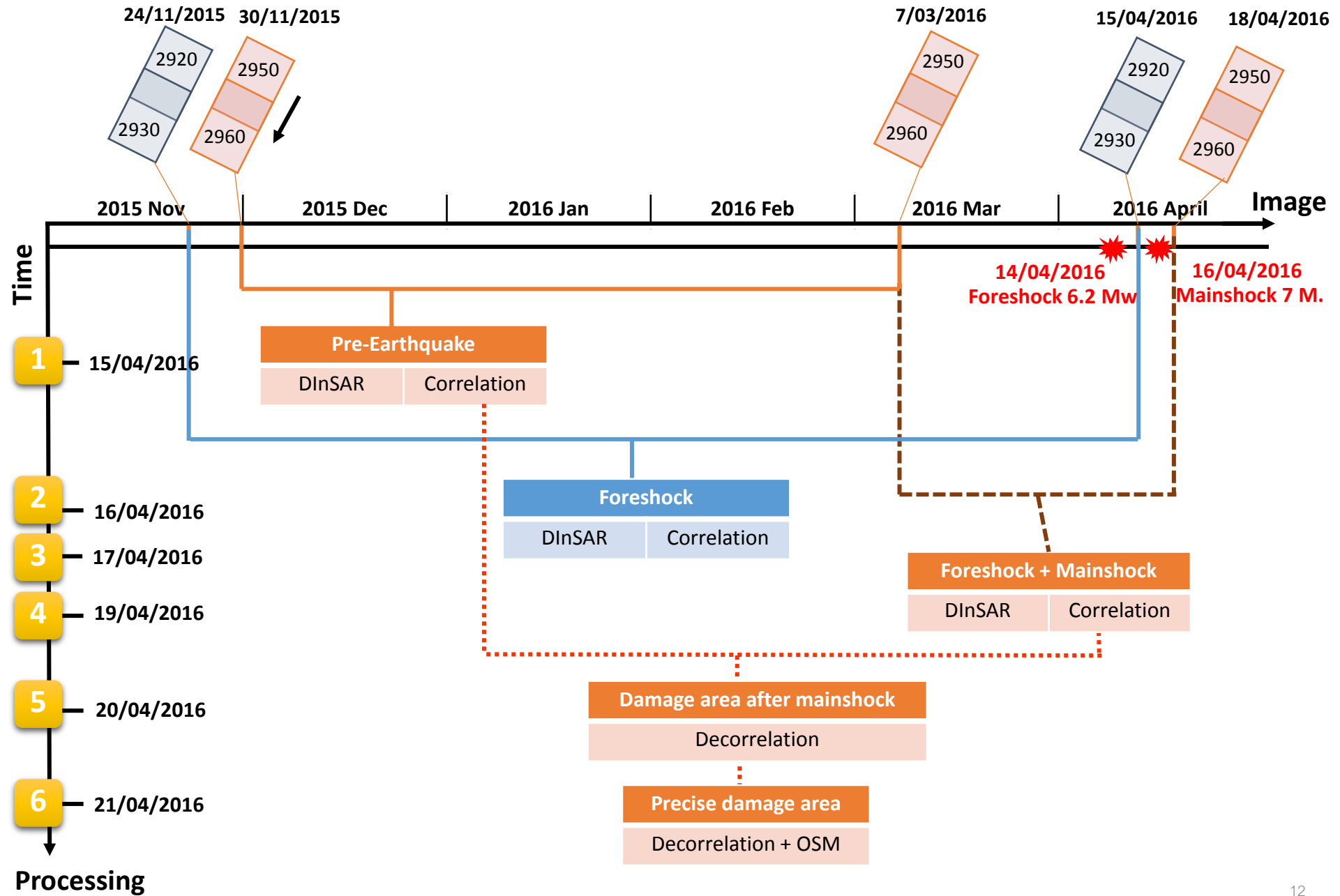
<衛星データ>  
ALOS-2/PALSAR-2 画像 ©JAXA  
2016.03.07 HH偏波  
2016.04.18 HH偏波

<解析>  
©広島工業大学菅雄三研究室

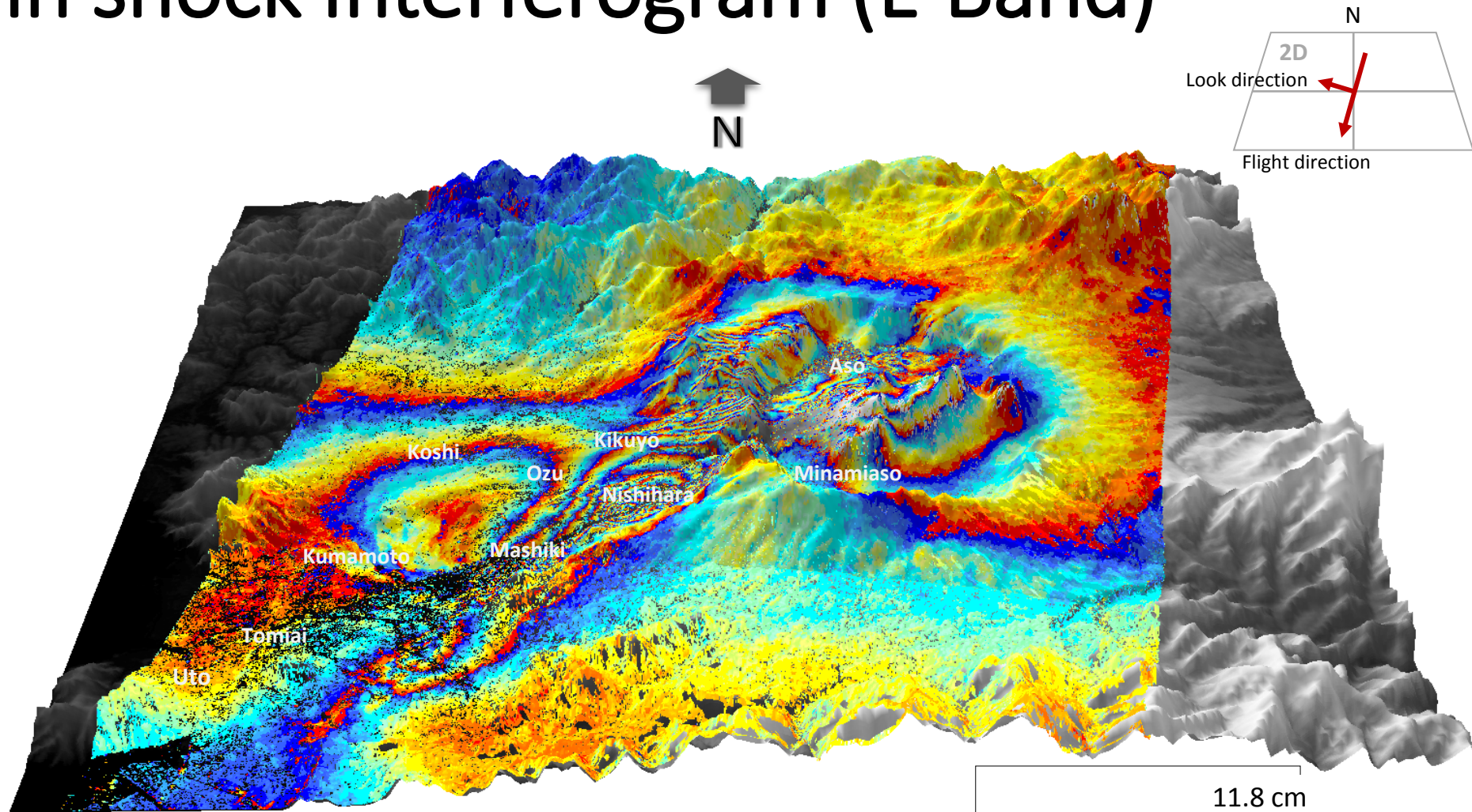


ALOS-2/PALSAR-2 画像 (R: 2016.03.07, G: 2016.04.18, B: Coherence)

# ALOS-2, Kumamoto, Japan Earthquake



# Main shock Interferogram (L-Band)

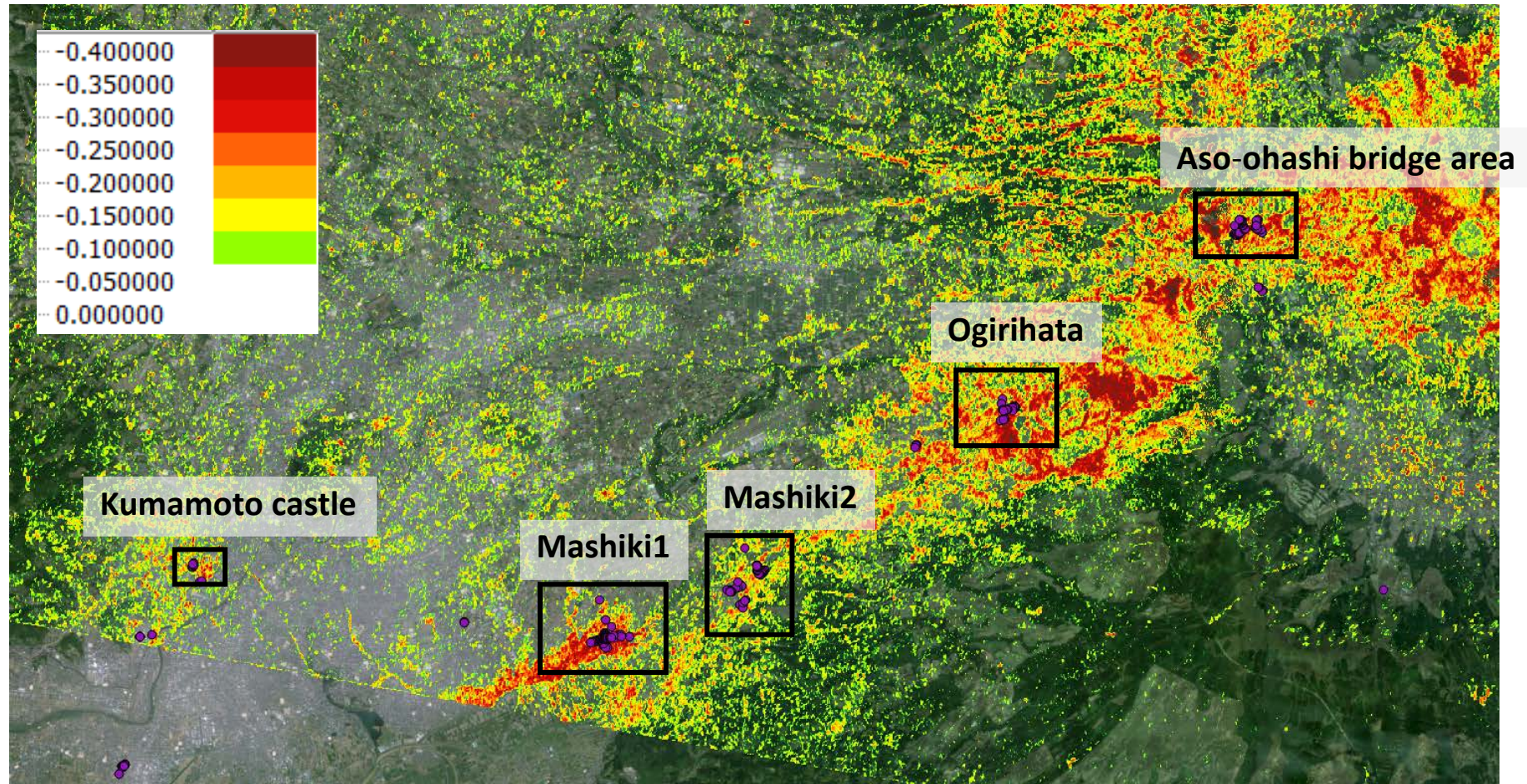


Temporal Baseline: 42 days

11.8 cm

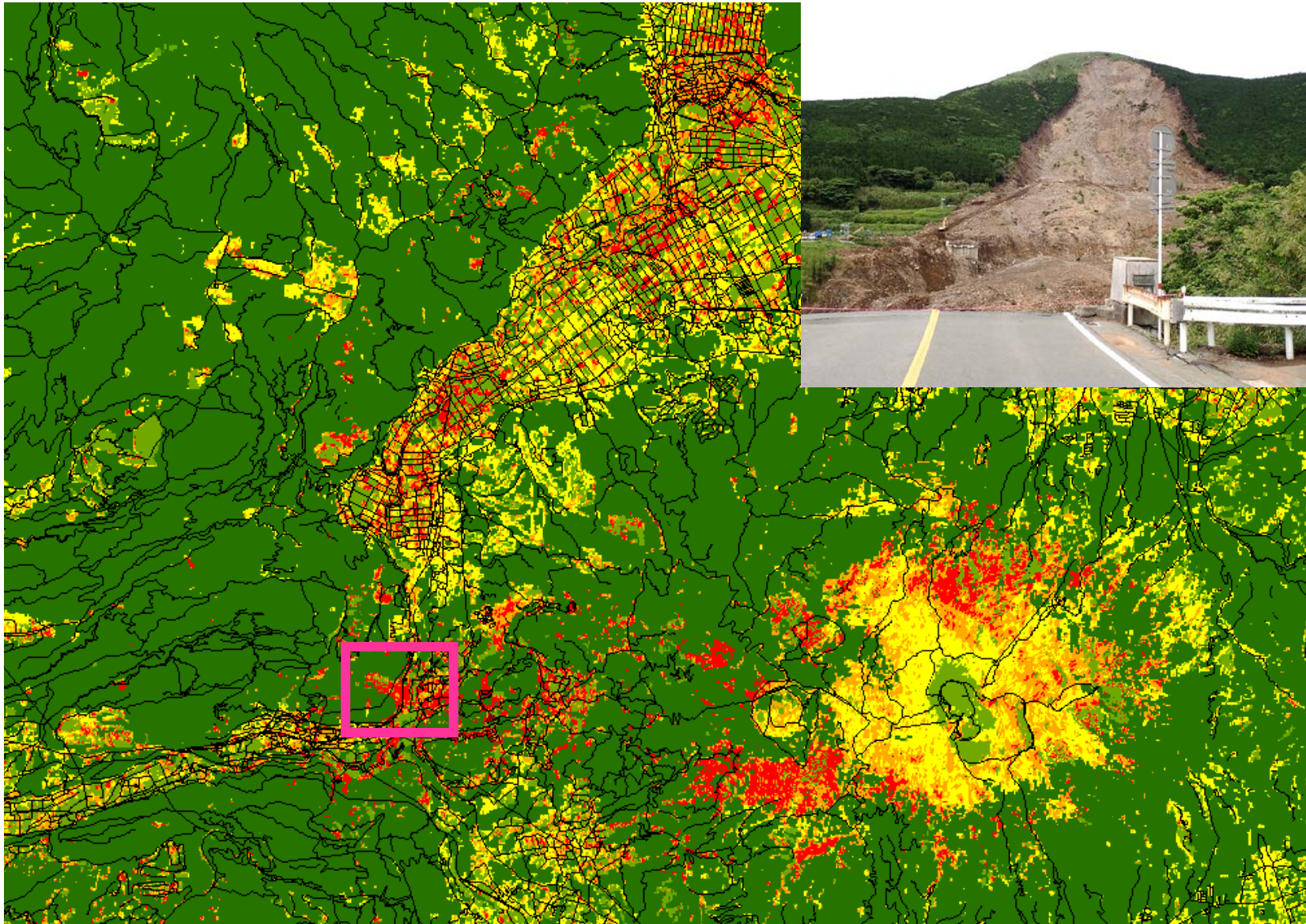
-11.8 cm

# Decorrelation and field survey on 6 – 7 June 2016

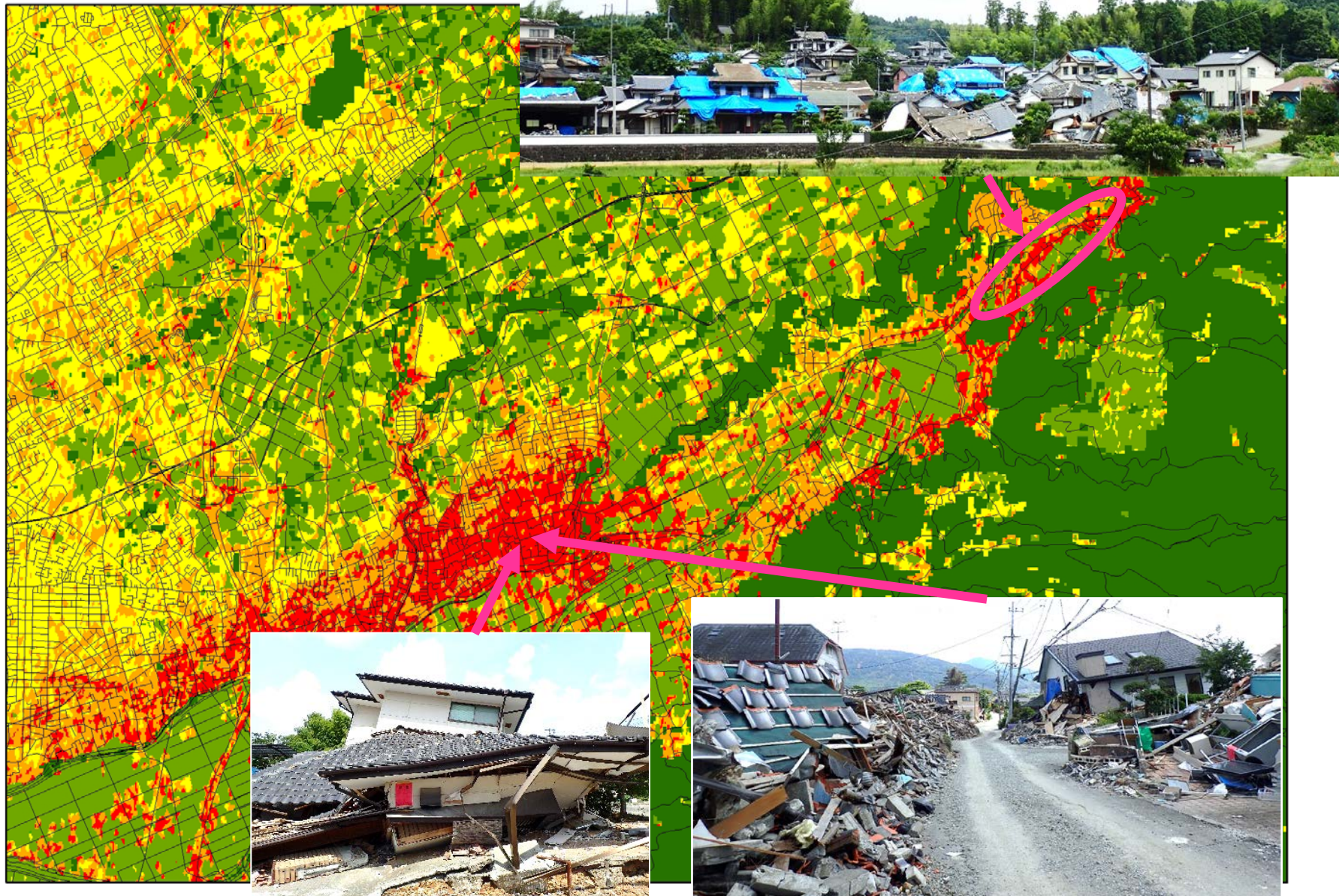


Decorrelation = Potential damage area and area of interested  
(affected locations)

## Large landslides (if optical image is after earthquake)



# Damaged Buildings





# Mashiki

