



Geoinformatics Unit

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# Introduction of RIKEN AIP's Geoinformatics Unit

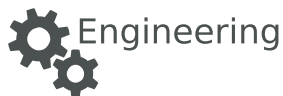
Gerald Baier, Bruno Adriano, Junshi Xia, Naoto Yokoya



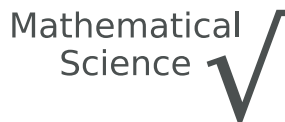
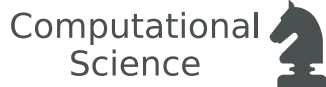
Sentinel Asia Joint Project Team Meeting – Bangkok, November 12, 2019

# RIKEN 理化学研究所

- National research institute in Japan
- Focus on natural science and mathematics



RIKEN



Center for Advanced Intelligence Project

# OVERSEAS PARTNERS (AS OF MARCH 2018)

RIKEN Facility Office at RAL  
(UK: Rutherford Appleton  
Laboratory)



## RIKEN Europe Office

(Brussels)

KFU-RIKEN Joint Research Labs  
(Russia: Kazan Federal University)

RIKEN-MPG Joint Research Center  
(Germany: Max Planck Society)

RIKEN-XJTU Joint Research Center  
(China: Xi'an Jiaotong University)

RIKEN-IMP Joint Research Center  
(China: Institute of Modern Physics,  
Chinese Academy of Sciences)

RIKEN-NCBS Joint Research Center  
(India: National Centre for Biological Sciences)

USM-RIKEN International Centre for Aging  
Science (Malaysia: Universiti Sains Malaysia)

RIKEN-Tsinghua  
Research Groups  
(China: Tsinghua University)

## RIKEN Beijing Representative Office

RIKEN-KRIBB Joint Research Center (Korea  
Institute of Bioscience and Biotechnology)

RIKEN-SJTU Joint Research  
Laboratory (China: Shanghai  
Jiao Tong University)

SIOM-RIKEN Joint Laboratory (China:  
Shanghai Institute of Optics and Fine Mechanics, CAS)

NCTU-RIKEN Joint Research Laboratory  
(Taiwan: National Chiao Tung University)

RIKEN-NTU Joint Research Centre  
(Singapore: Nanyang Technological  
University)

RIKEN  
Singapore  
Representative  
Office

RIKEN-MIT laboratory for Neural  
Circuit Genetics (USA: Massachusetts  
Institute of Technology)

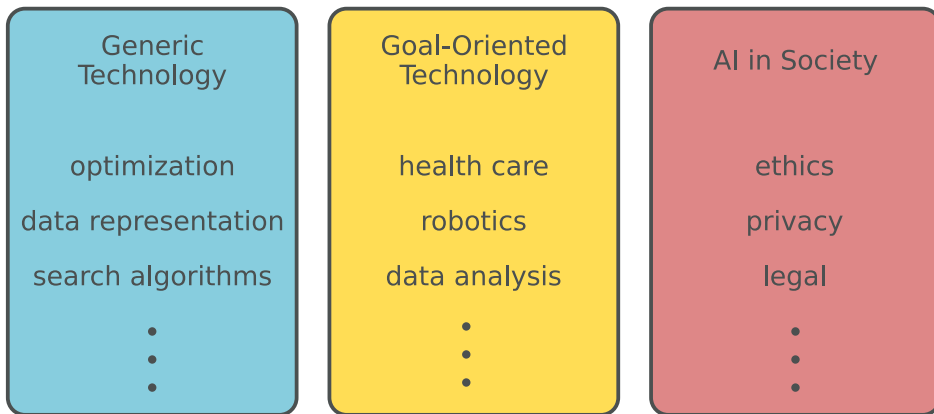


RIKEN-BNL Research Center  
(USA: Brookhaven National  
Laboratory)

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# RIKEN CENTER FOR ADVANCED INTELLIGENCE PROJECT (AIP)

- Basic and applied artificial intelligence research

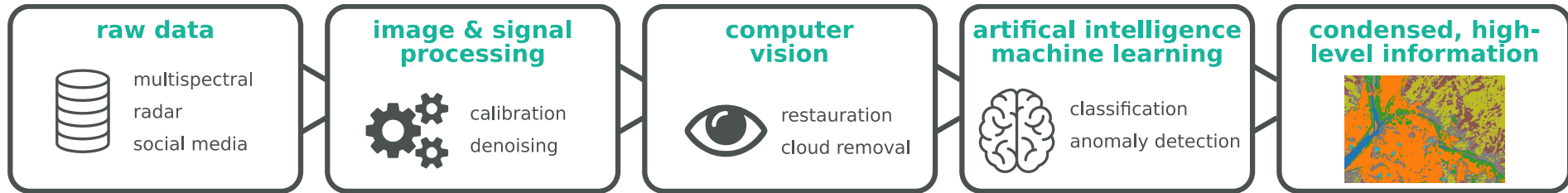


- Founded in April 2016
- About 550 researchers

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# RIKEN AIP'S GEOINFORMATICS UNIT

- Part of goal-oriented technology research group
- Application of artificial intelligence to remote sensing data



- Multispectral, synthetic aperture radar and social media

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# OUR TEAM



**BRUNO ADRIANO**

Tsunami simulation  
Building damage mapping



**GERALD BAIER**

Denosing of SAR data



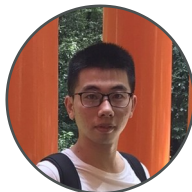
**NAOTO YOKOYA**

Image processing



**TATSUMI UEZATO**

Spectral unmixing



**WEI HE**

Image reconstruction



**JUNSHI XIA**

Land cover mapping



**DAT TIEN PHAM**

Mangrove monitoring



**REY RUSTY QUIDES**

Sea grass monitoring



**YAN YU**

SNS and EO for  
damage mapping

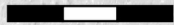
# Koriyama, Japan

## Before Hagibis (SAR)

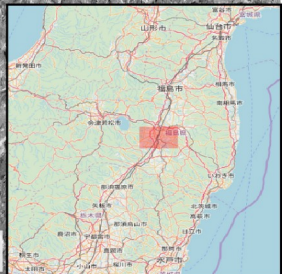
2019/10/6

SAR: Synthetic Aperture Radar

0 4 8 12 km



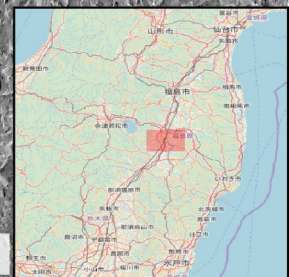
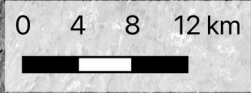
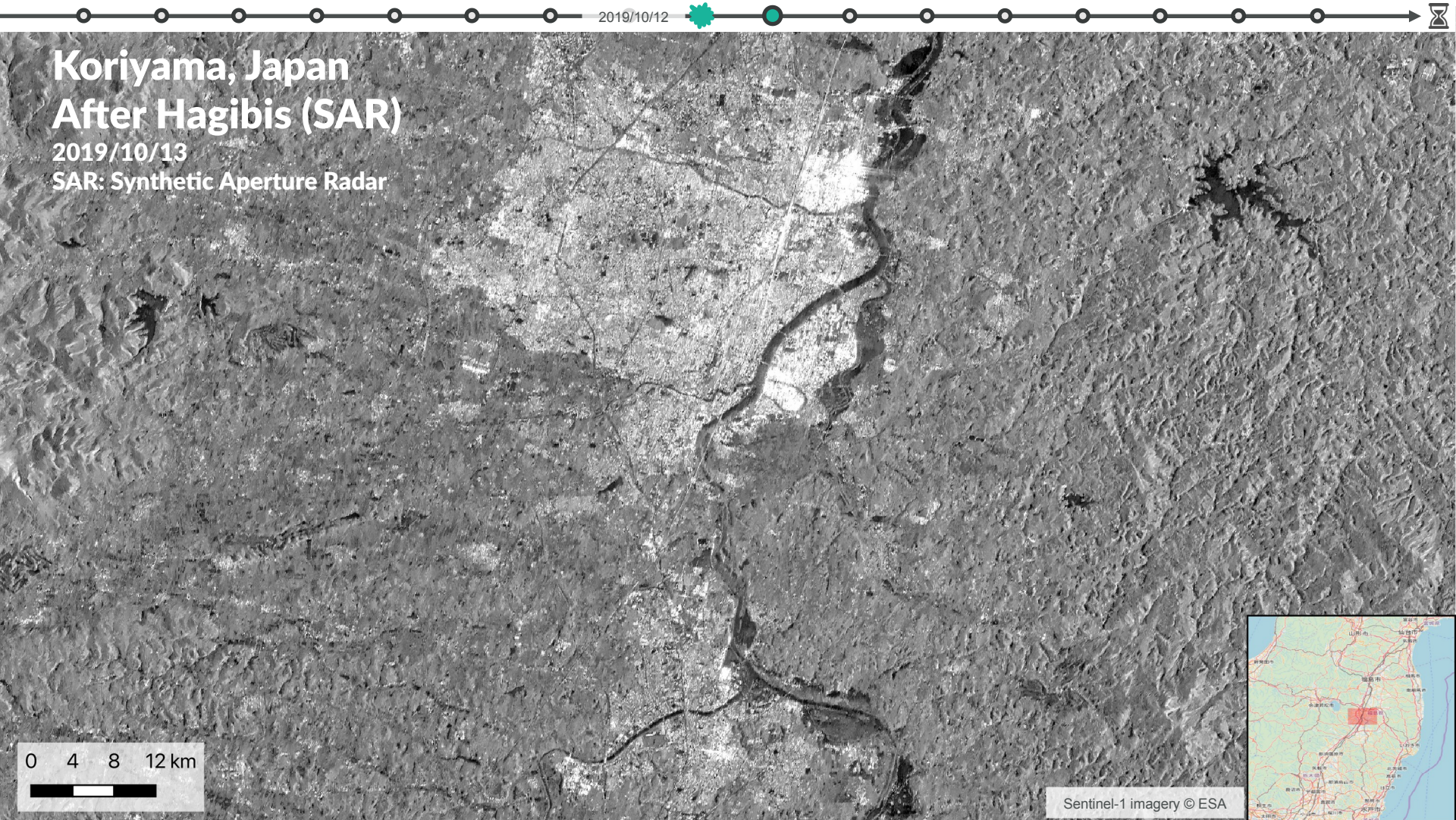
Sentinel-1 imagery © ESA



# Koriyama, Japan After Hagibis (SAR)

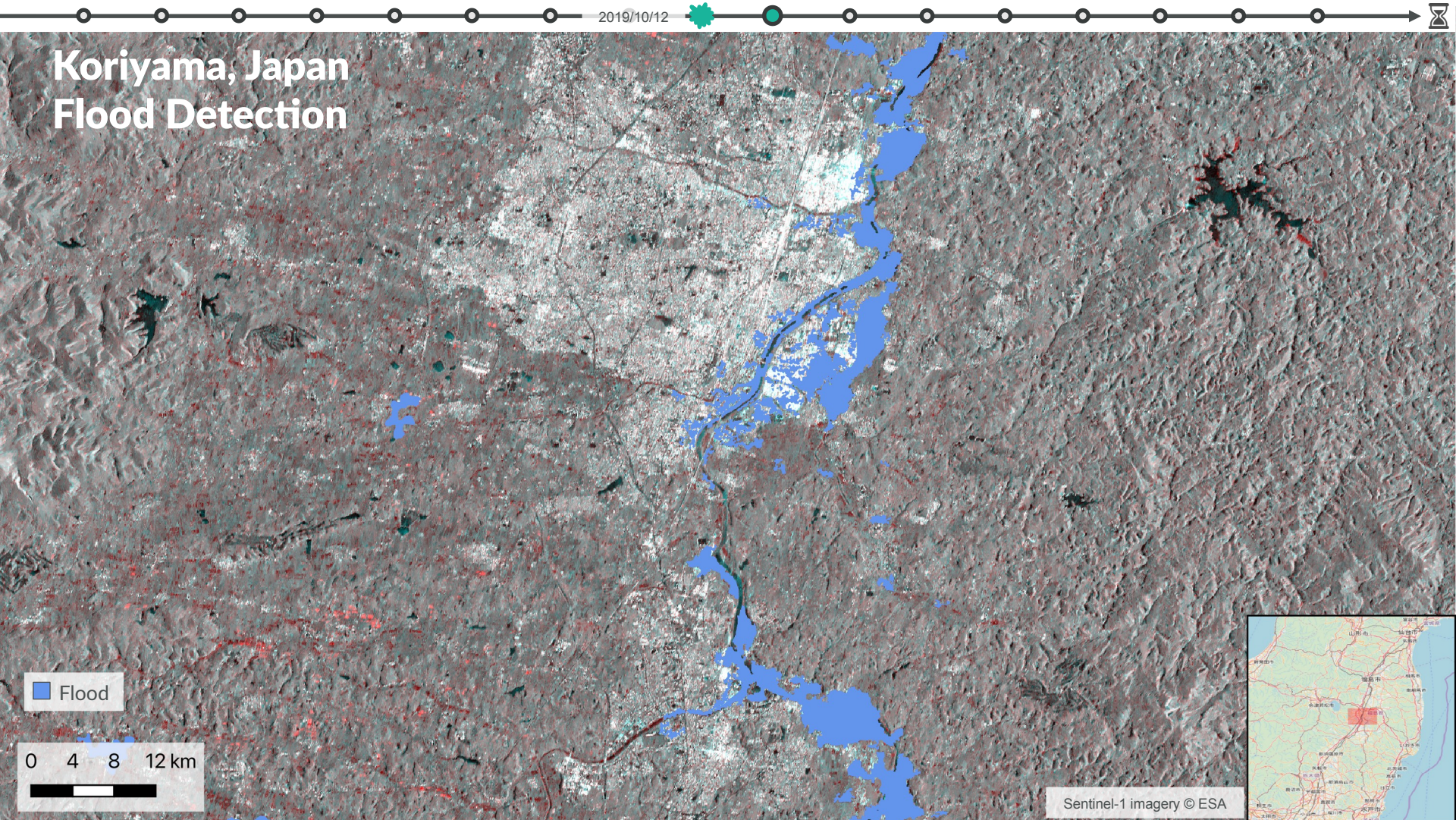
2019/10/13

SAR: Synthetic Aperture Radar



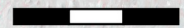


# Koriyama, Japan Flood Detection



Flood

0 4 8 12 km



Sentinel-1 imagery © ESA

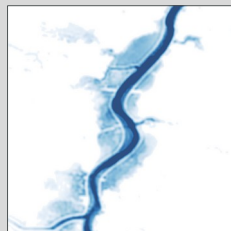


# AI x SIMULATION FOR DAMAGE MAPPING FROM SPACE

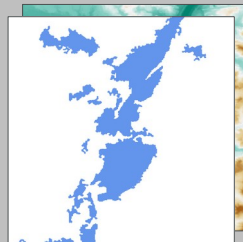
Inductive  
**Machine Learning x**

- Remote Sensing

Inundation depth estimation is challenging



Inundation depth



Flood areas

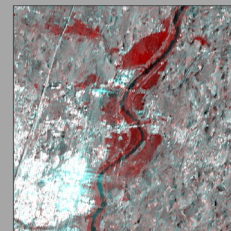


Image Analysis

SAR image



Inverse Problem  
Machine Learning

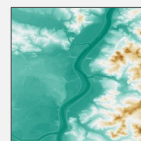
Rainfall

Parameters

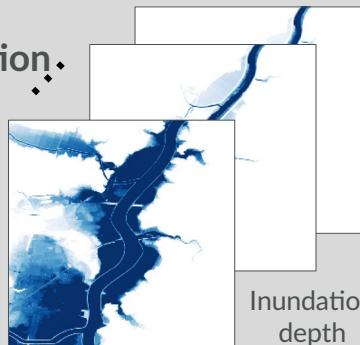


DEM

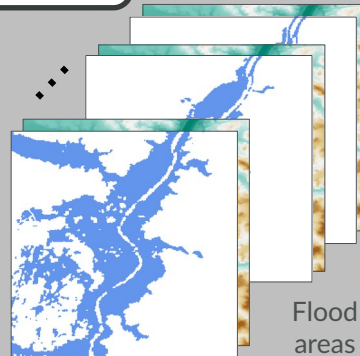
Land use



Simulation



Inundation depth



Flood areas

Deductive  
Numerical Simulation

Takes time to get accurate  
input data and parameters

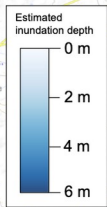
Input & Parameters for  
Simulation

Disaster Details

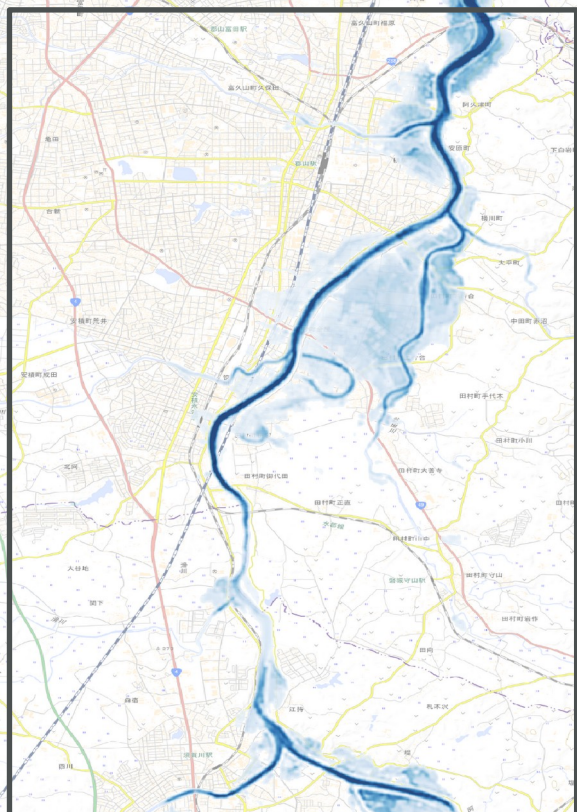
Binary Change  
Information

Satellite Imagery

# Koriyama, Japan Inundation Depth Estimation



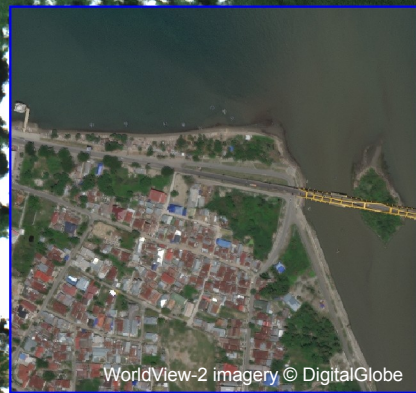
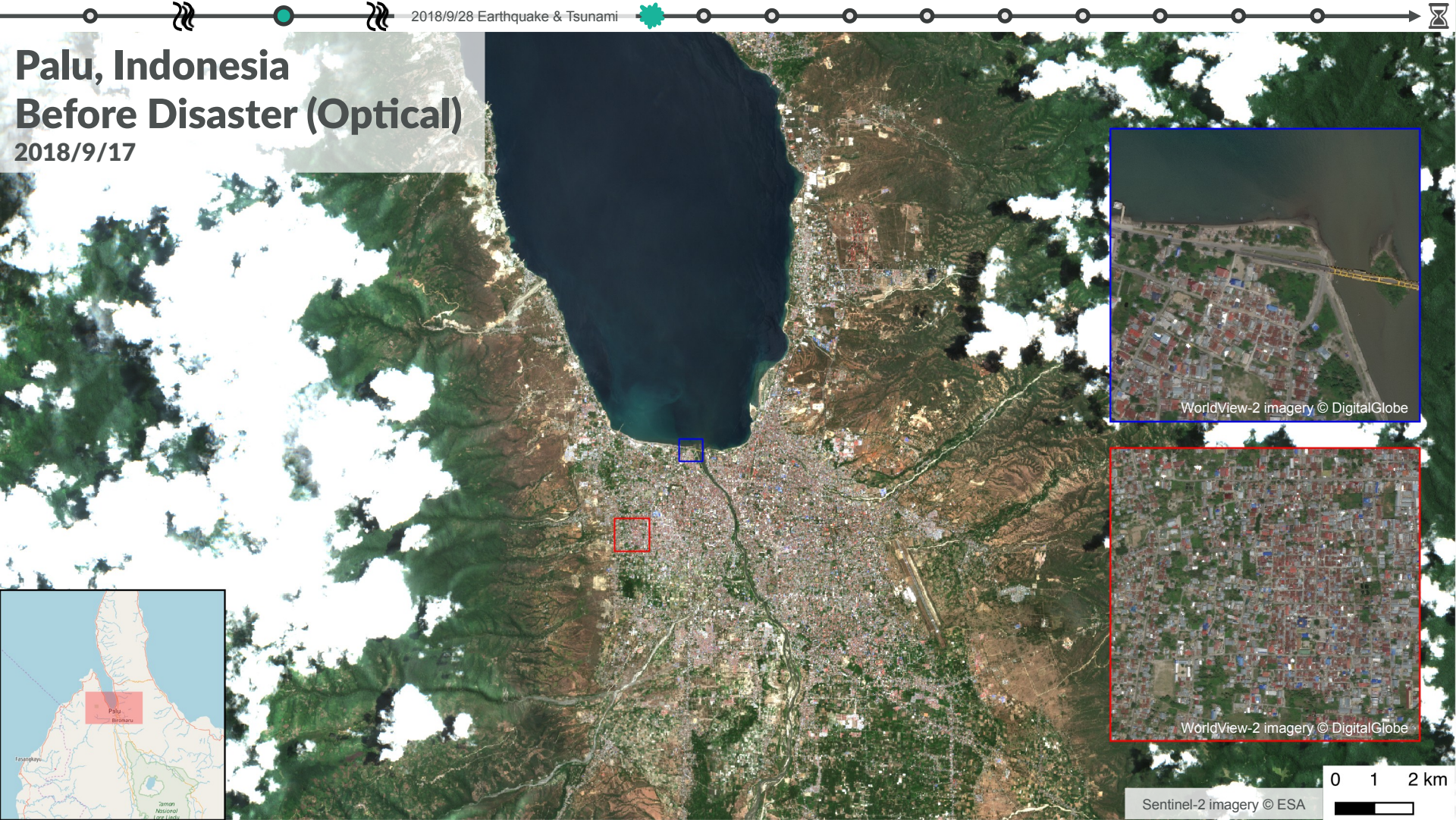
Background: GSI Standard Map





# Palu, Indonesia Before Disaster (Optical)

2018/9/17



0 1 2 km

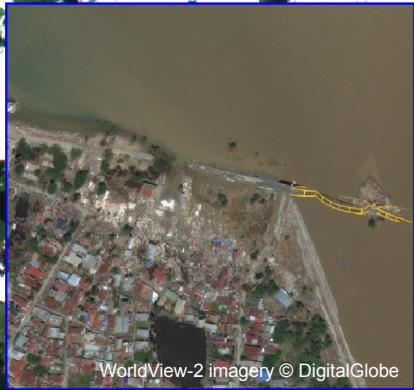
Sentinel-2 imagery © ESA





# Palu, Indonesia After Disaster (Optical)

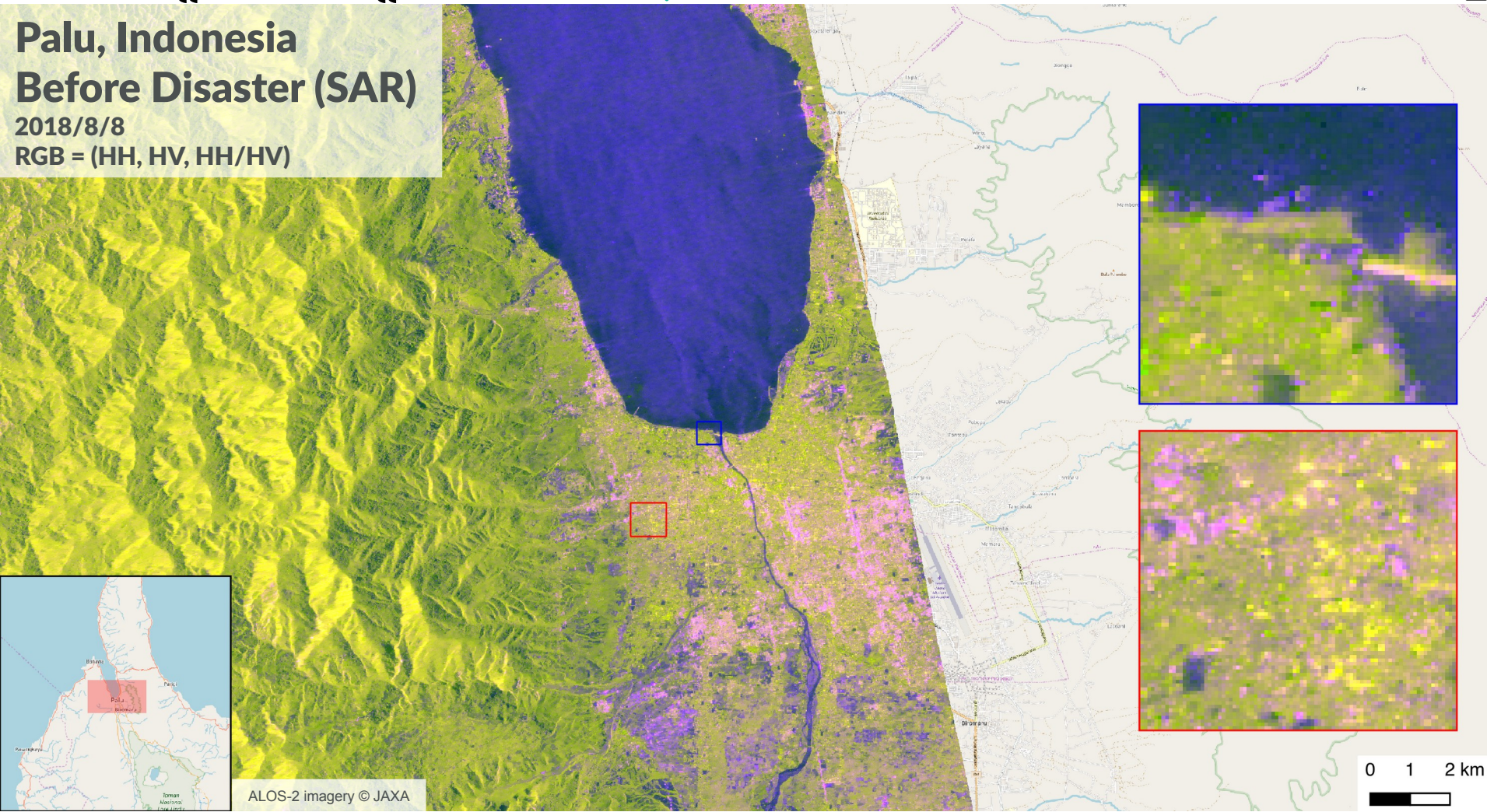
2018/10/2





# Palu, Indonesia Before Disaster (SAR)

2018/8/8  
RGB = (HH, HV, HH/HV)



ALOS-2 imagery © JAXA

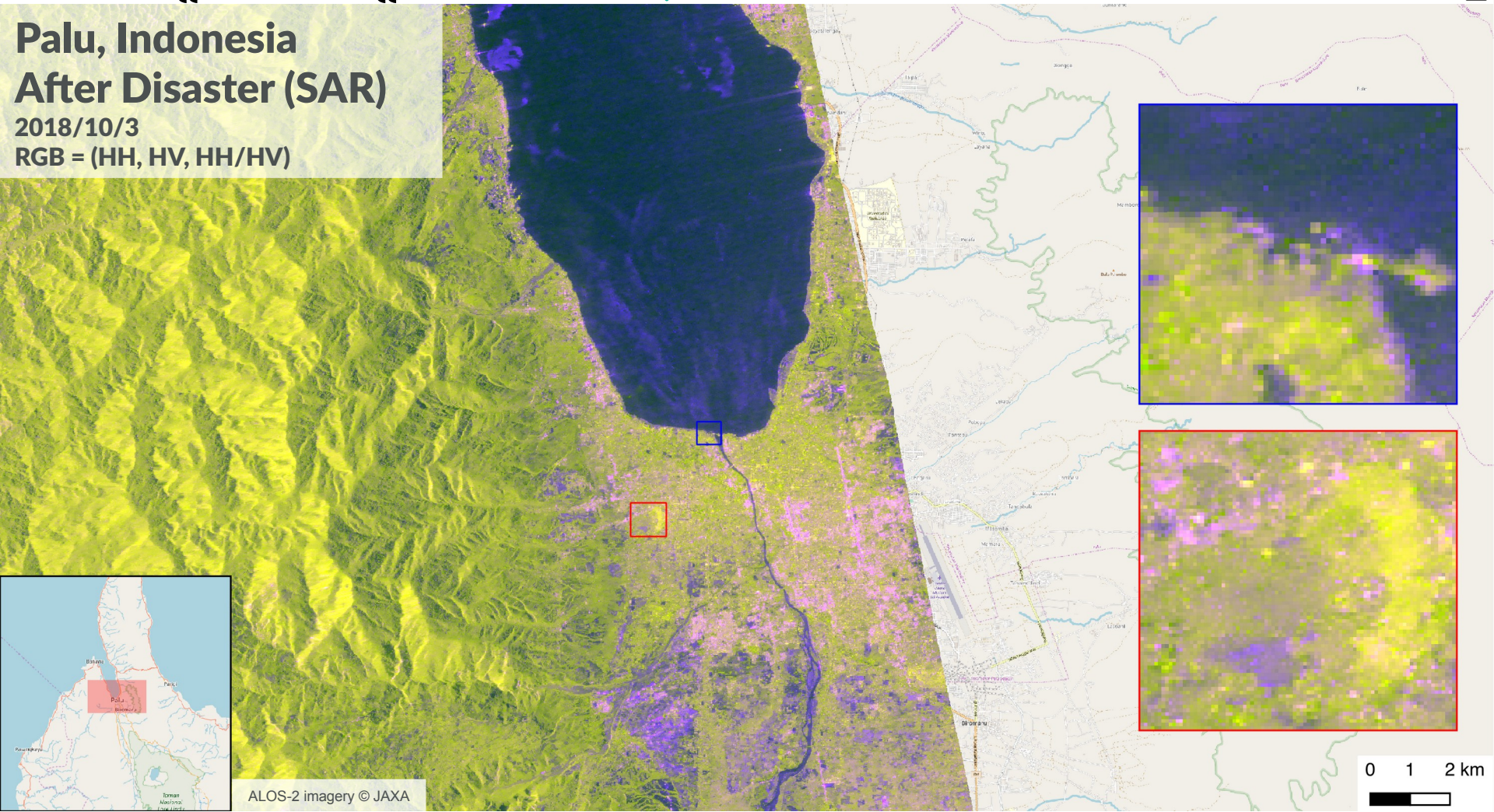
0 1 2 km





# Palu, Indonesia After Disaster (SAR)

2018/10/3  
RGB = (HH, HV, HH/HV)



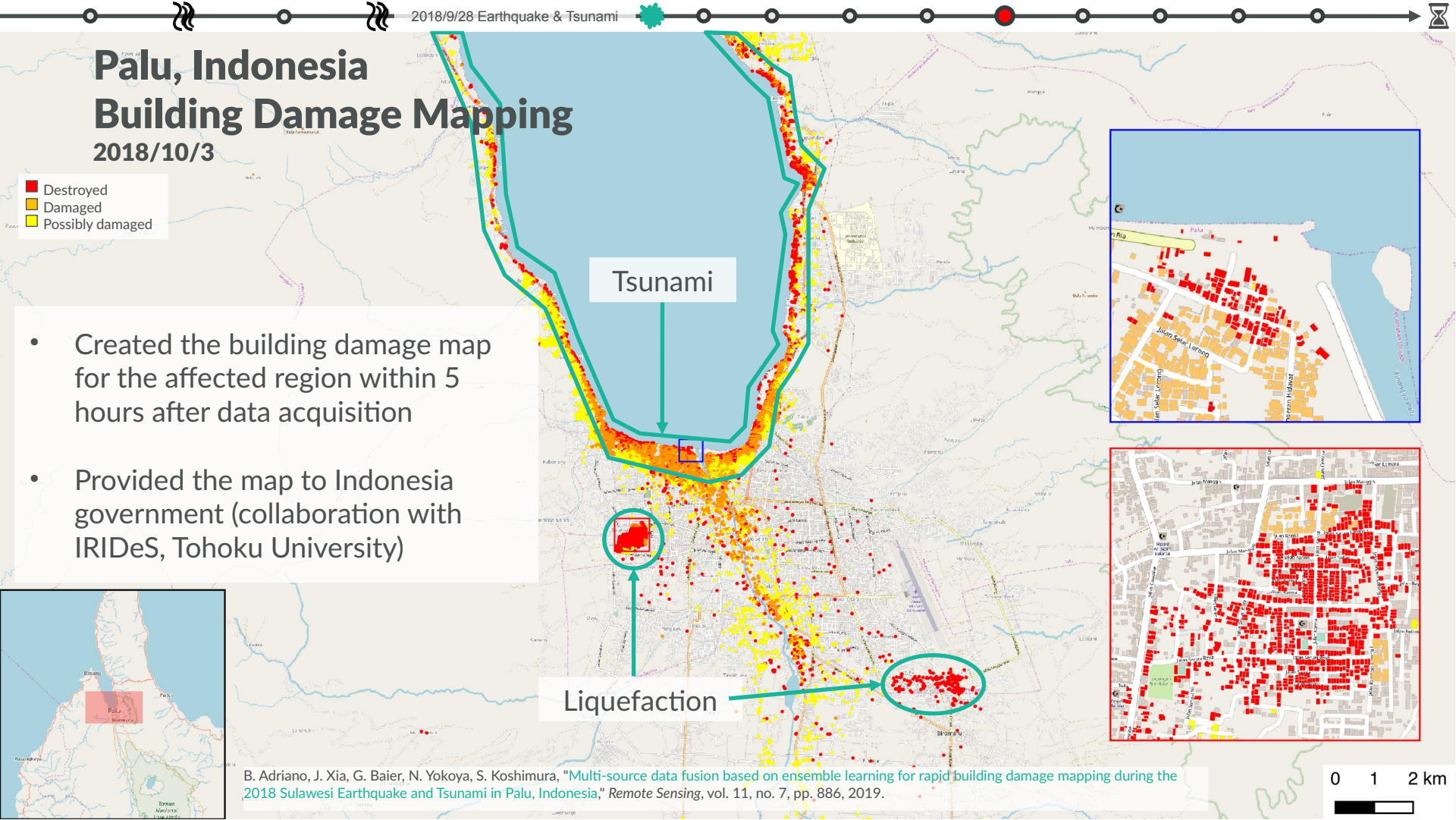
# Palu, Indonesia

## Building Damage Mapping

2018/10/3

- Destroyed
- Damaged
- Possibly damaged

- Created the building damage map for the affected region within 5 hours after data acquisition
- Provided the map to Indonesia government (collaboration with IRIDeS, Tohoku University)



Liquefaction



# Palu, Indonesia

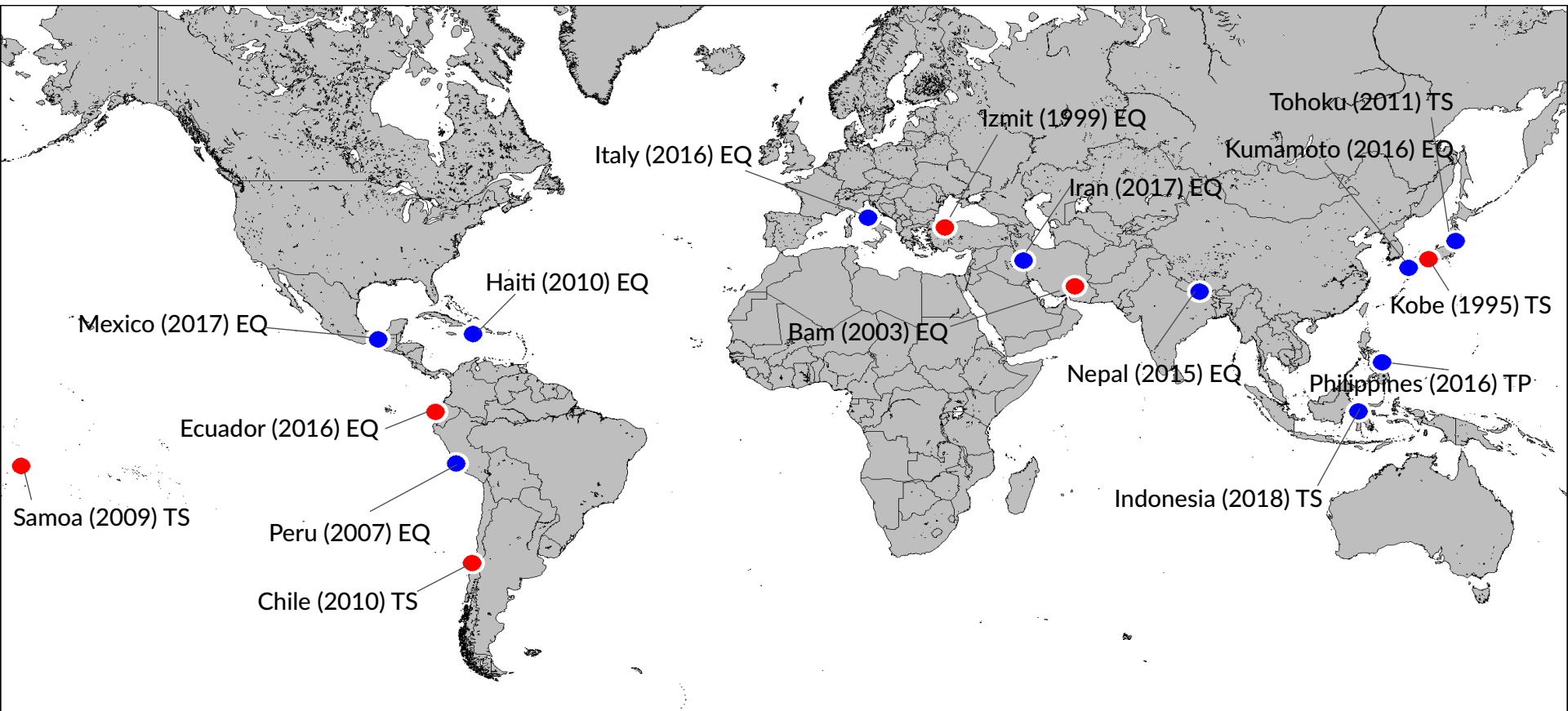
## Field Survey

2018/10/20



- Destroyed
- Damaged
- Possibly damaged
- Field survey photos

# RIKEN Building Damage Database (16 events)



EQ: Earthquake, TS: Tsunami, TP: Typhoon ● SAR + Optical (10 events) ● Optical (6 events) 1/8 ⏪ ⏩

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## LAST SLIDE ;)

- **Collaboration**
  - Database for Sentinel-Asia datasets, ground-truth, etc...?
  - Sharing of final products, e.g. flood maps as shapefile?
- **Acknowledgements**
  - Bruno Adriano, Junshi Xia and Naoto Yokoya provided tons of material for this presentation