Report by JAXA as Data Provider Node

2019.11.14

Japan Aerospace Exploration Agency (JAXA)
Satellite Applications and Operations Center (SAOC)

Yuki Takakura

OUTLINE

1. **Summary of ALOS-2 Emergency Observations in 2019**

2. **Typhoon Hagibis in Japan of October 2019**

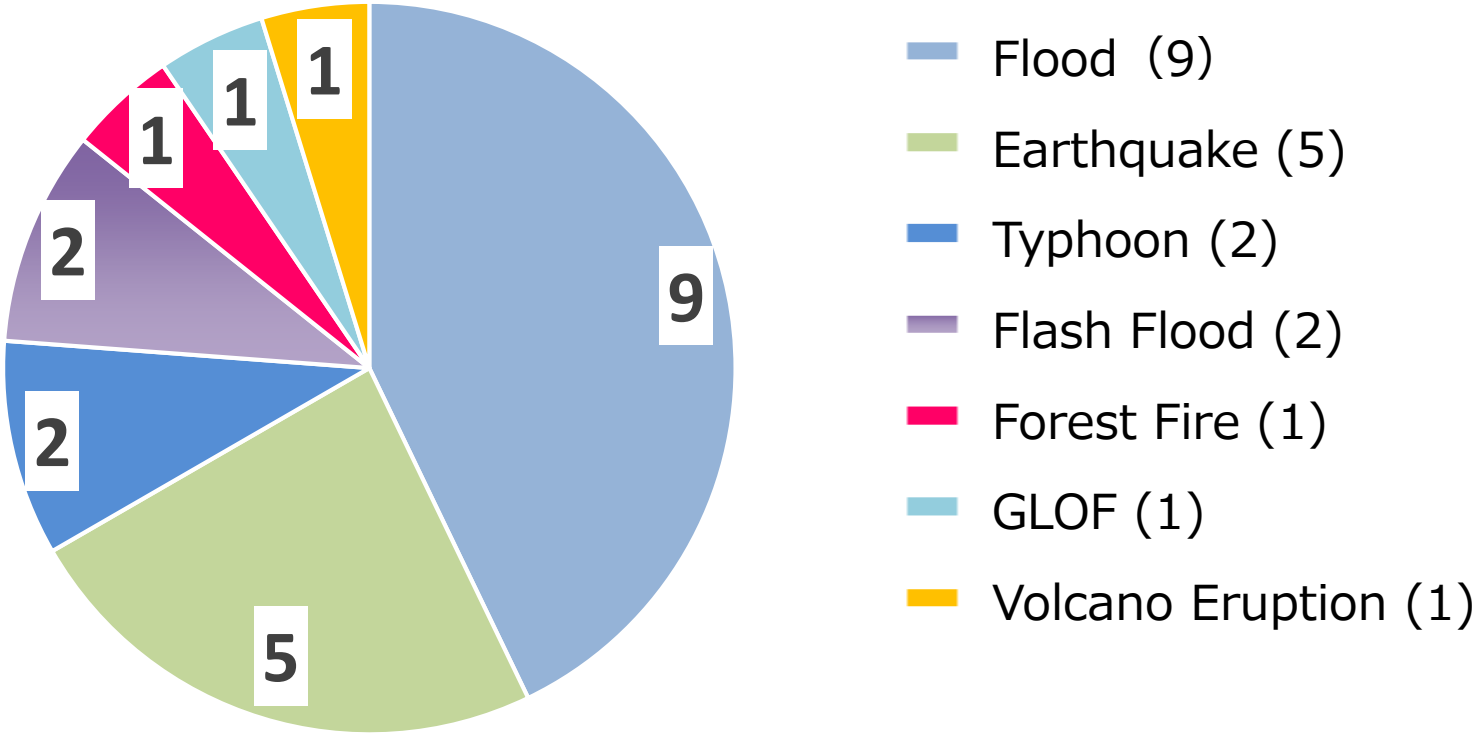
   Thank you for your cooperation !!

3. **Tsunami in Indonesia of December 2018**

4. **ALOS Future Plan**

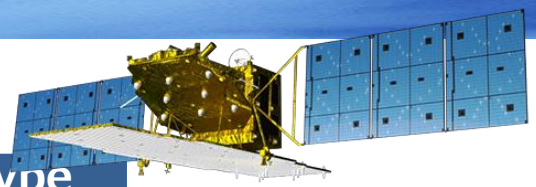
1. Summary of ALOS-2 Emergency Observations in 2019

In this year, 21 Emergency of Requests (EORs) are activated.



In this year, the most common disaster was ”Flood”,
and more than half were “water related disasters”.

1. Summary of ALOS-2 Emergency Observations in 2019

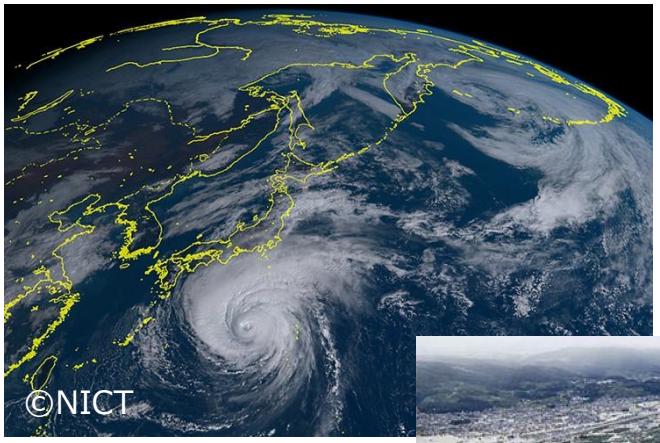


18 Observations by **ALOS-2** for 21 EORs in 2019

	Disaster Occurrence Date	Country	Disaster Type
1	2019/01/17	**Japan**	Volcano eruption
2	2019/03/16	Indonesia	Flood
3	2019/03/31	Nepal	Typhoon
4	2019/04/22	Philippines	Earthquake
5	2019/05/2	India	Flood
6	2019/05/16	Turkey	Landslide
7	2019/06/17	China	Earthquake
8	2019/06/20	Bhutan	Flash Flood
9	2019/06/24	Vietnam	Flash Flood
10	2019/07/14	Indonesia	Earthquake
11	2019/08/08	Myanmar	Flood
12	2019/08/26	Laos	Flood
13	2019/08/28	**Japan**	Flood
14	2019/09/20	Thailand	Flood
15	2019/09/30	India	Flood
16	2019/10/12	**Japan**	Typhoon
17	2019/11/02	Philippines	Earthquake
18	2019/11/12	Vietnam	Flood

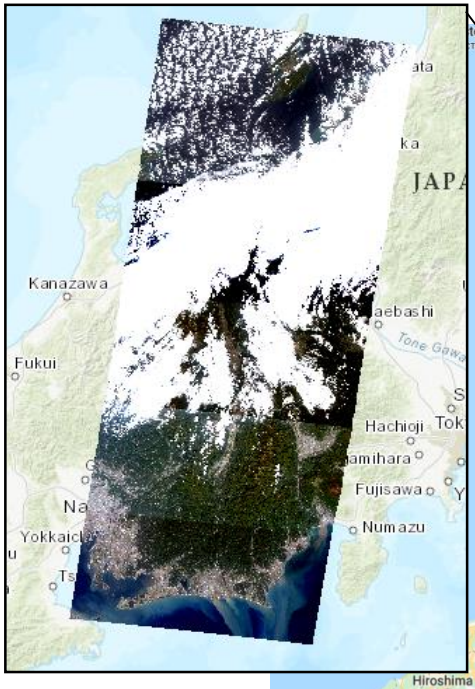
2. Typhoon Hagibis of Oct. in Japan

- Typhoon Hagibis landed on the Izu Peninsula on October 12, 2019 and directly hit Tokyo and its surrounding areas. It brought record-breaking rainfall and strong winds.
- River flooding, embankment break occurred one after another over a wide area, causing major damage such as large-scale inundation.
- 90 people died, 5 people were missing and 71 rivers burst their embankments (As of 7 Nov., NHK).

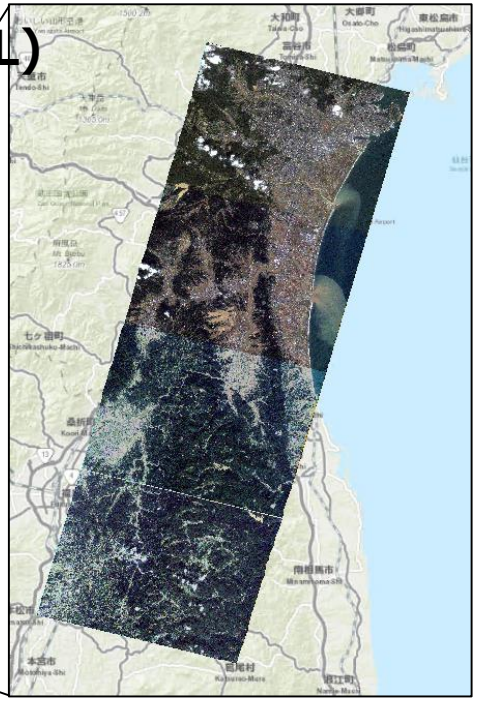


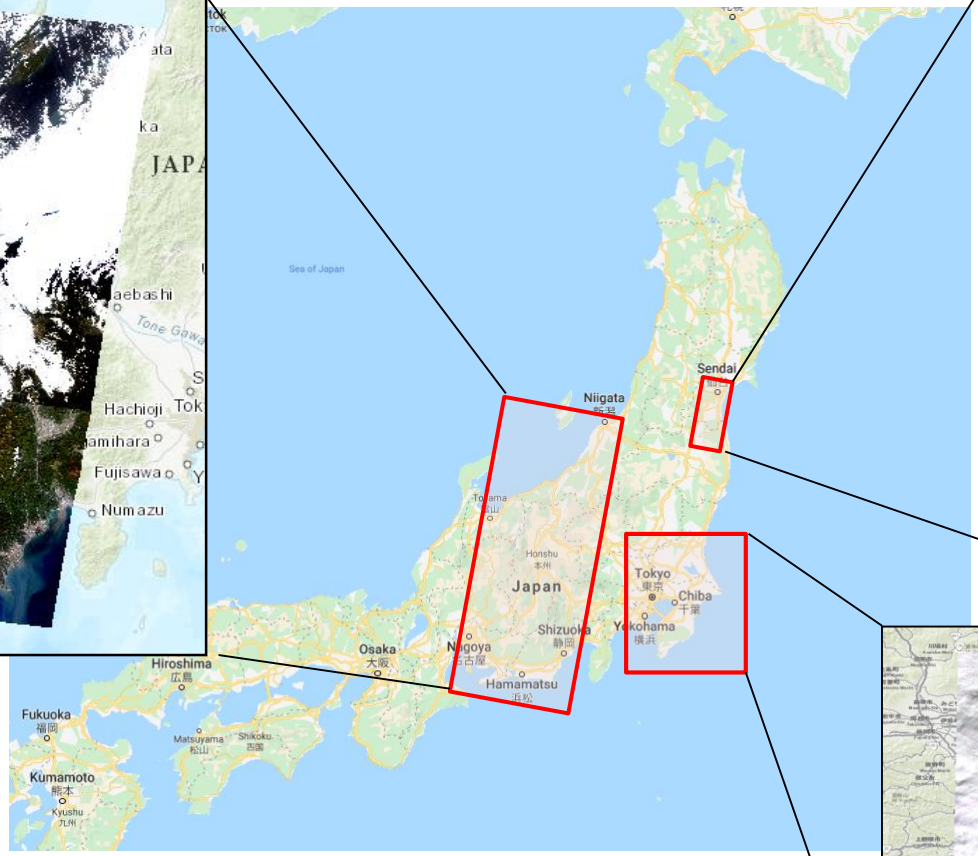
2. Typhoon Hagibis of Oct. in Japan

Thaichote (GISTDA)
13/Oct/2019 00:40

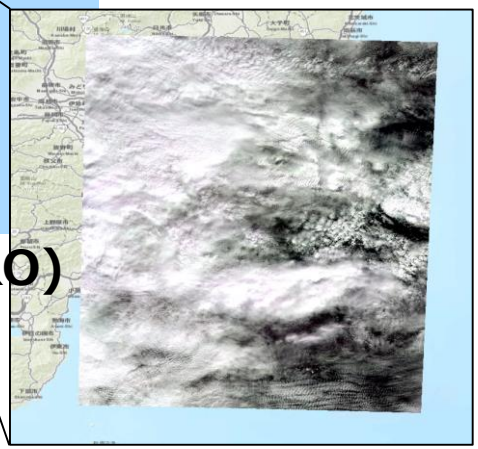


FORMOSAT-5 (NARL)
16/Oct/2019 02:08





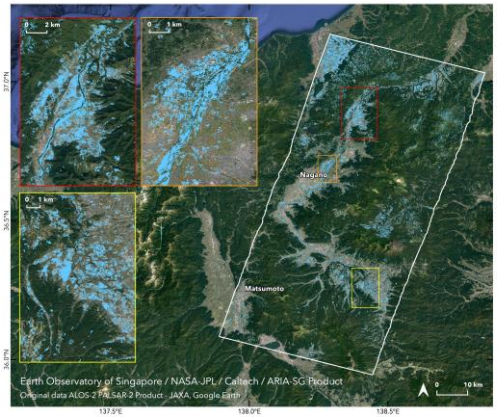
Resourcesat-2 (ISRO)
10/Oct/2019 10:30



These data are shared with our users via Web-GIS.

2. Typhoon Hagibis of Oct. in Japan

EOS

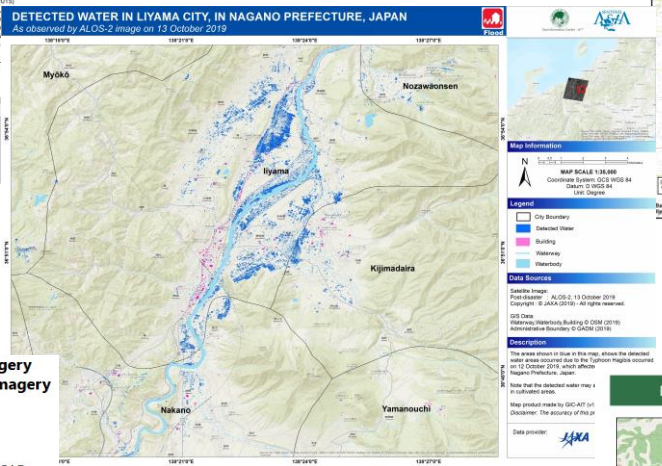


ARIA-SG Flood Proxy Map: Japan Typhoon Hagibis, 15 Oct 2019, v0.1

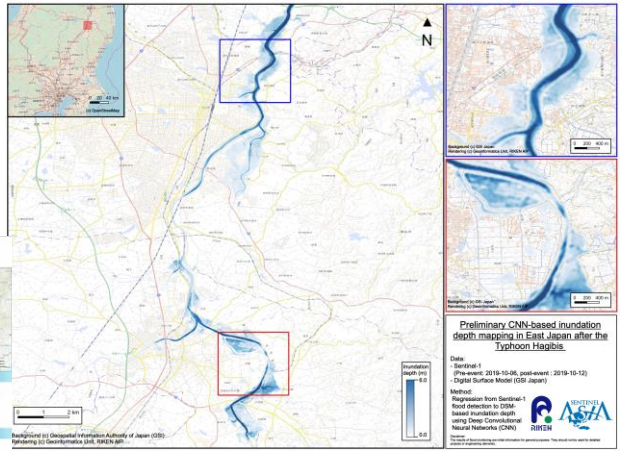
This preliminary map shows areas that are likely flooded (shown by light blue pixels of 25 m in size) in Nagano Prefecture, Japan due to heavy rains brought by Typhoon Hagibis. The map extents are indicated by the white polygons. This map should be used as a guidance to identify areas that are likely flooded, and is less reliable over URBAN and vegetated areas.

Derived from synthetic aperture radar data acquired by the ALOS-2 satellites operated by the Japan Aerospace Exploration Agency (JAXA) before (16 June 2015) and during (15 Oct 2019, 03:37) the event. Data [illegible] provided by Sentinel Asia. Analysed by the ARIA-SG at the Earth Observatory Singapore (EOS) in collaboration with NASA and Caltech.

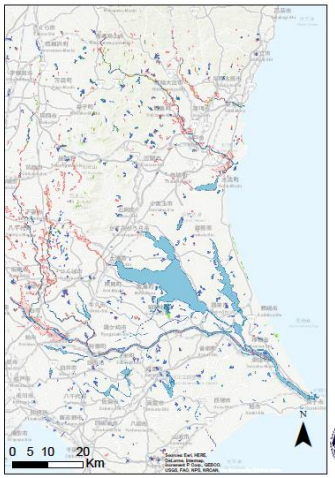
AIT



RIKEN



CHIBA



Sentinel-1 (S1) imagery
TerraSAR-X (TSX) imagery

ID: 2019-038-JPN
Typhoon No. 19 in 2019

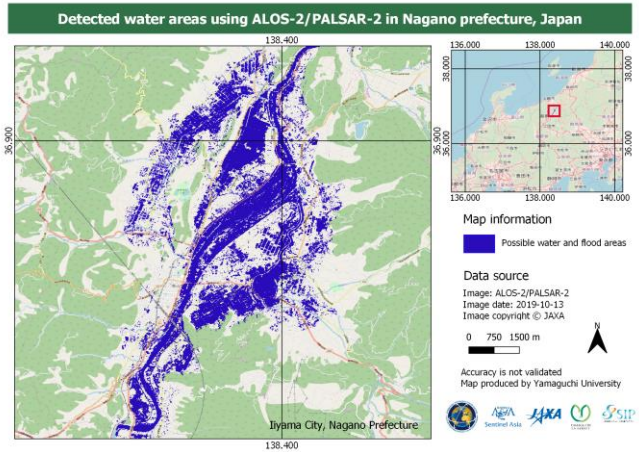
Water extraction from three-temporal SAR intensity images.
Water was extracted by the thresholding value
$W_{dB} > \mu_w + 2\sigma_w$
The water sample was selected from Kasumigaura Lake.

TerraSAR-X/TanDEM-X © DLR e. V. 2019, Distribution Airbus DS GEO GmbH
Sentienl-1 image was owned by ESA, downloaded from OpenHub.

Water regions
- S1 (17:33 JST on Oct. 7, 2019)
- TSX (05:44 JST on Oct. 12, 2019)
- S1 (17:34 on Oct. 13, 2019)

JAXA DLR esa European Space Agency CHIBA UNIVERSITY

JPYU



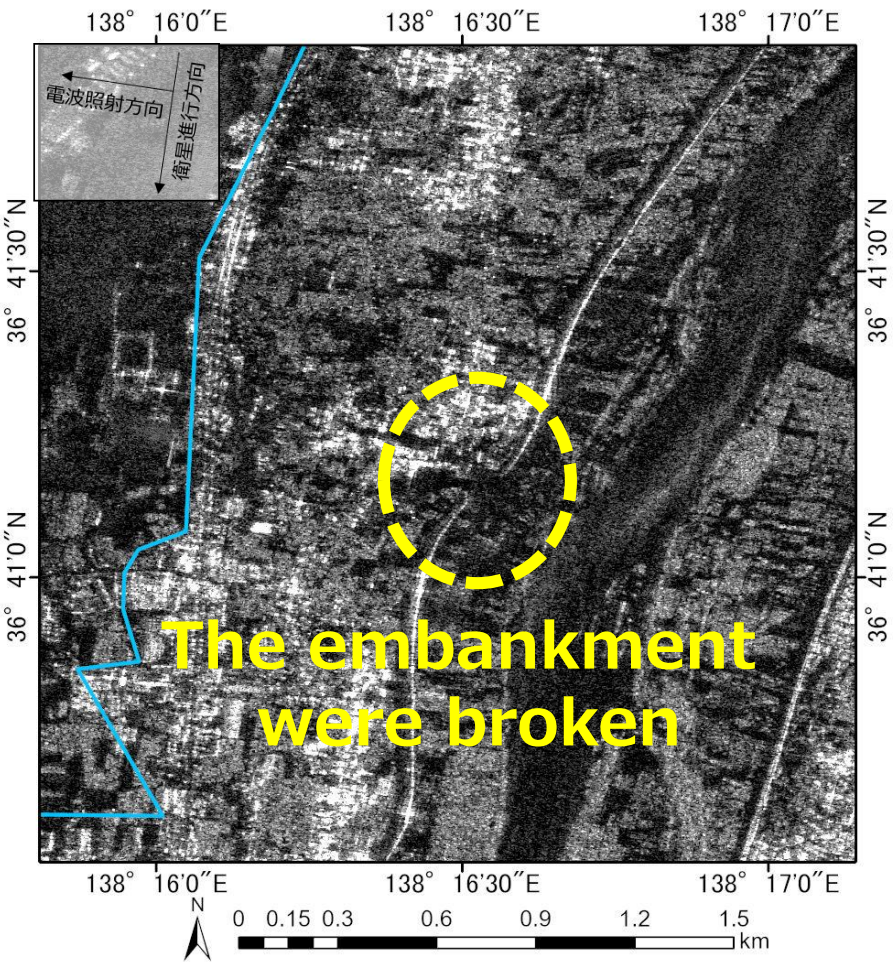
Thank you for very much for your cooperation!!

2. Typhoon Hagibis of Oct. in Japan

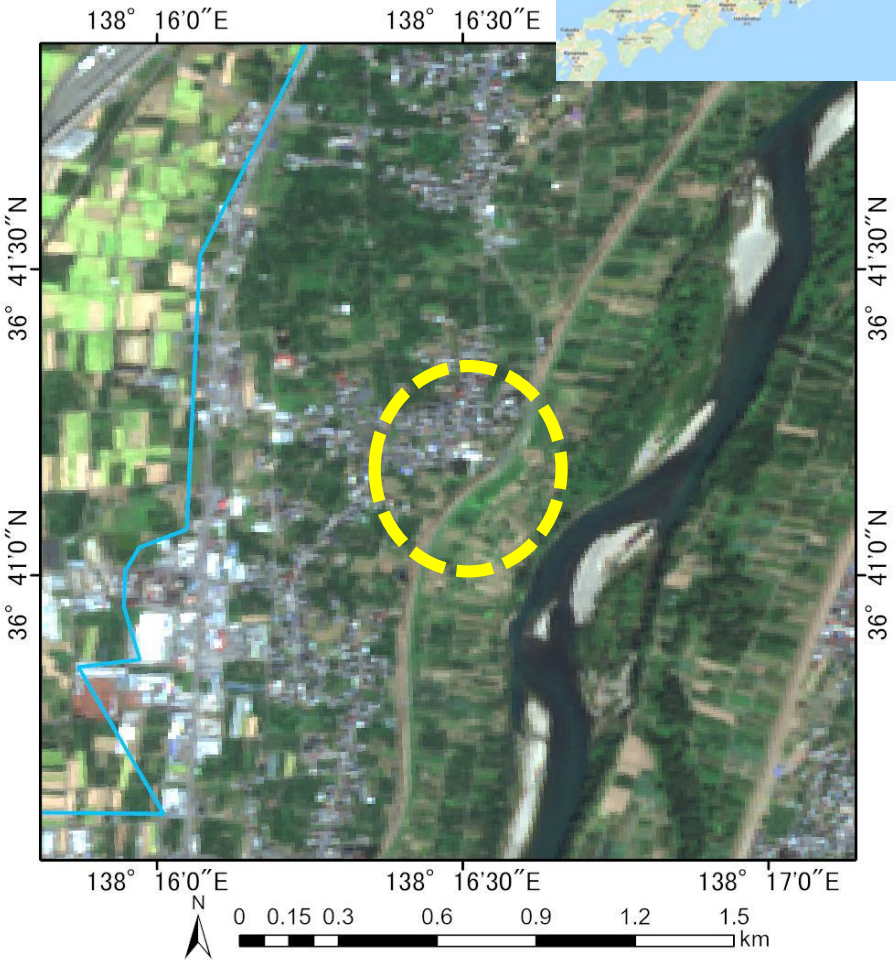
Unfortunately, Thaichote (GISTDA) data was cloudy in this area.

Collapsed embankment of the Chikuma River

ALOS-2（After disaster）
(2019.10.13)



Optical data (Before disaster)
(Sentinel2, 2019.10.10)



Estimated flood area

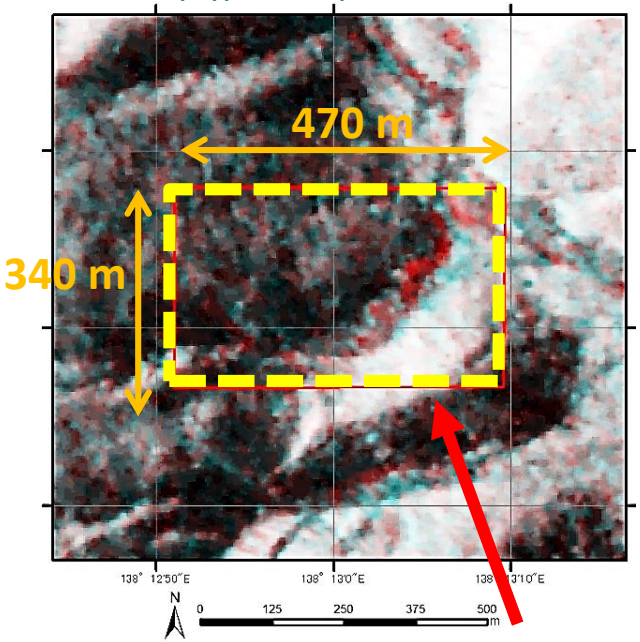
2. Typhoon Hagibis of Oct. in Japan

Detection of **Landslide**

ALOS-2（Difference）

Pre (Red): 2015.6.16

Post (Light Blue): 2019.10.13



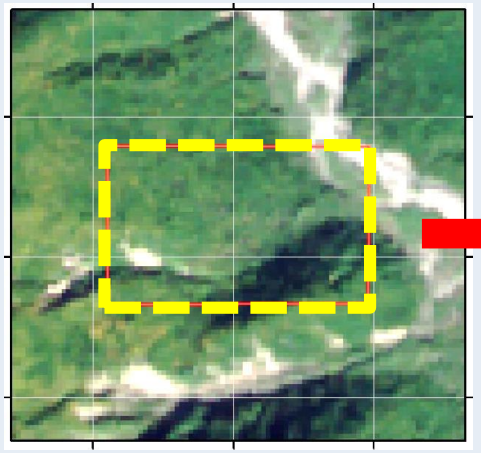
Difference is detected

Optical data

Before disaster

Sentinel-2

2019/10/10



After disaster

Thaichote

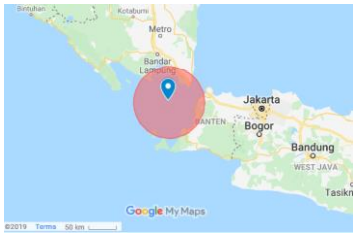
2019/10/13

MS data only in this area

Detected change seen as Landslide by ALOS-2 was confirmed by Thaichote data.

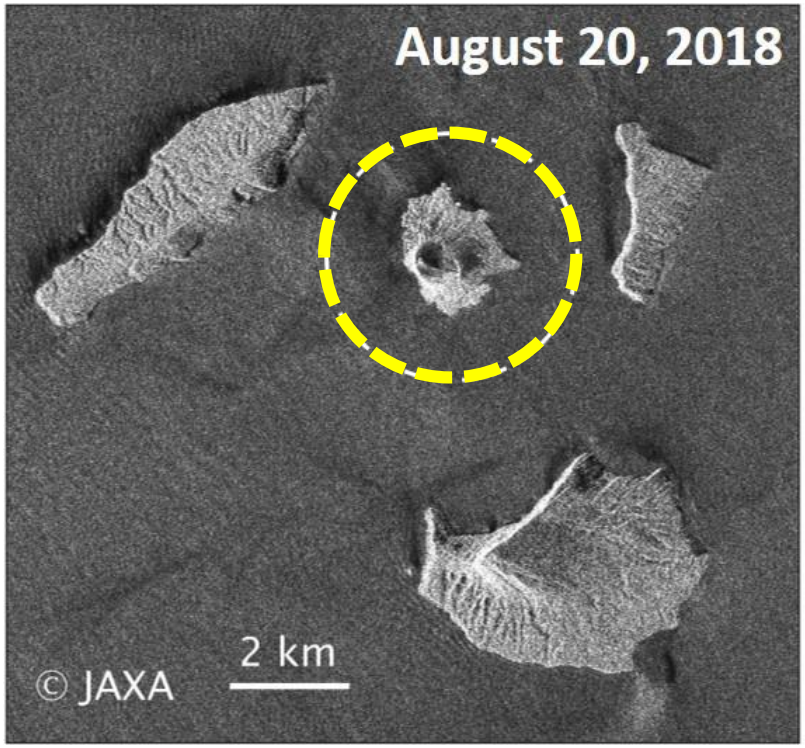
3. Tsunami in Indonesia of Dec. 2018

On 22th Dec., 2018, Tsunami caused by the eruption of Krakatau volcano in Indonesia.

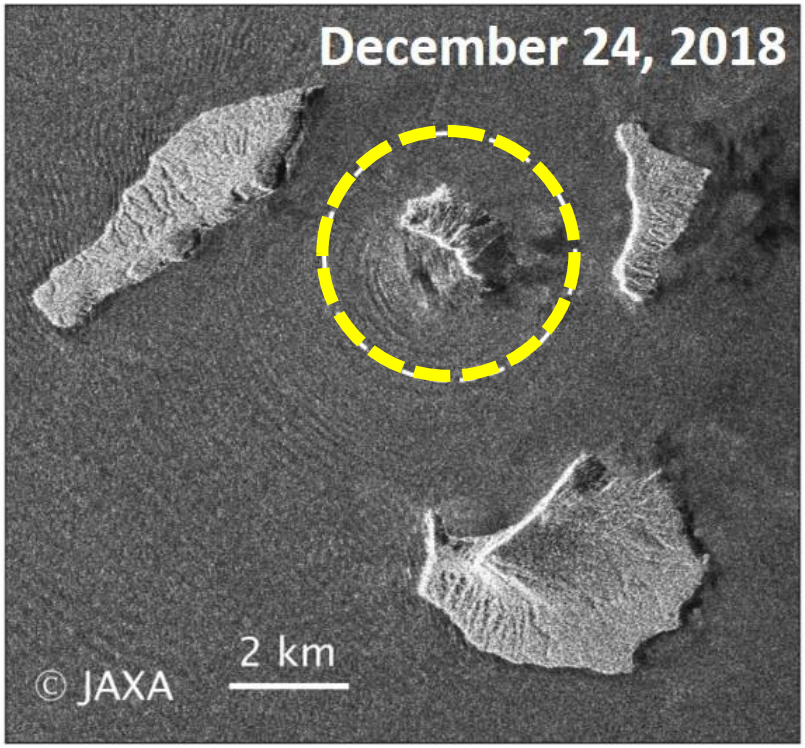


ALOS-2 data

Before Eruption



After Eruption

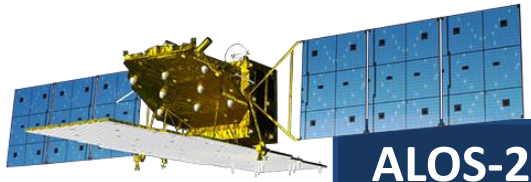


ALOS-2 captured a clear topographic change in the southwestern part of the mountain of Anak Krakatau volcano. By 24th Dec., the southwestern part of the 2 km square island is seen to be collapsed.

4. ALOS Future Plan

ALOS Series

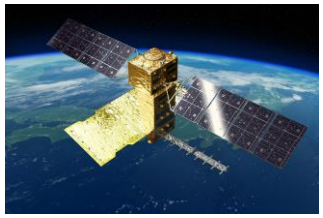
2006 2011 2014 2019 Future plan



ALOS-2 (Radar)

JFY 2021(TBD)

ALOS-4 (Radar)



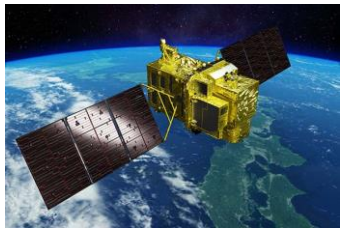
Radar Sat

Wide range, high resolution SAR satellite

ALOS (Optical&Radar)

JFY 2020

ALOS-3 (Optical)

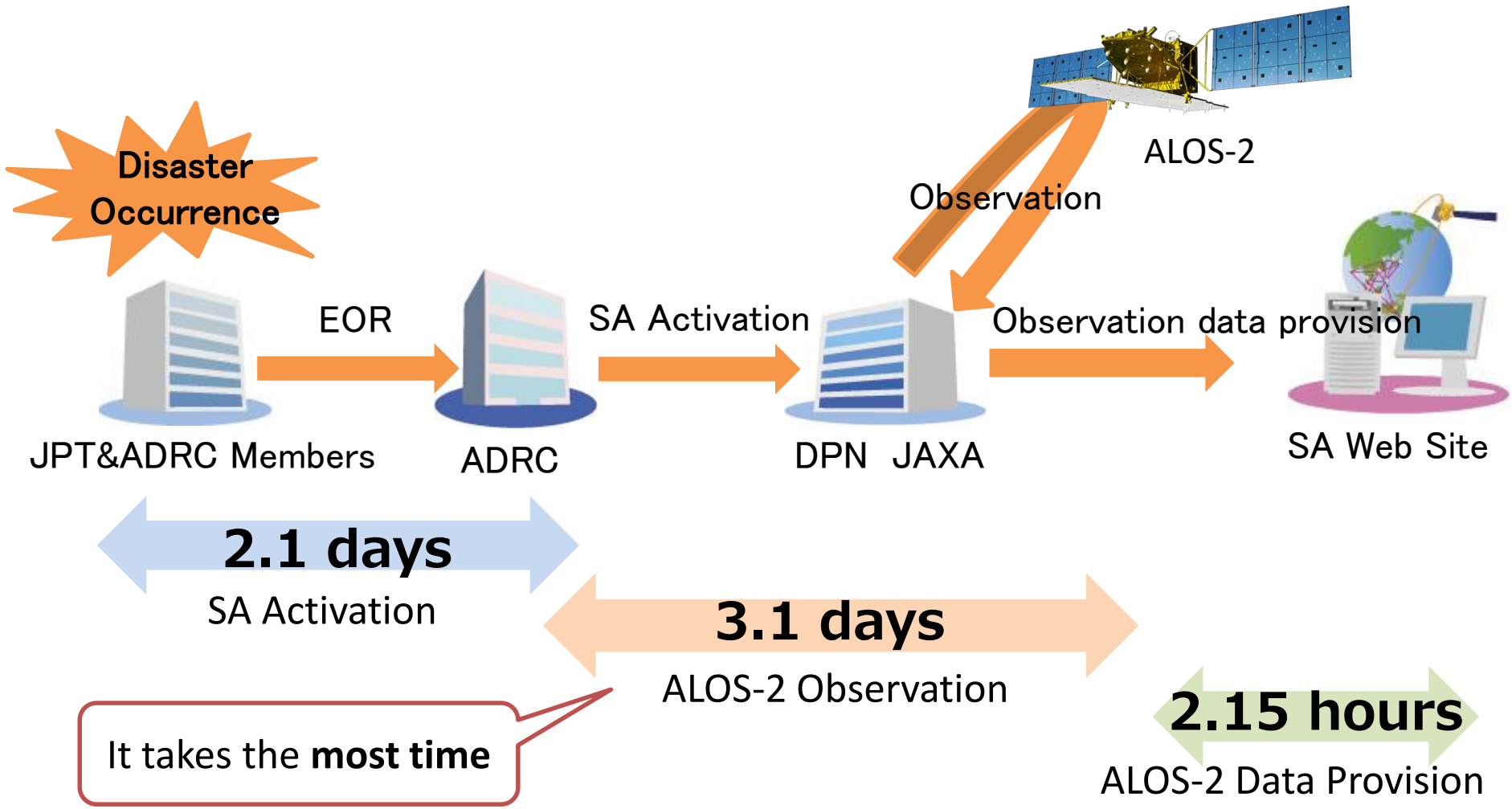


Optical Sat.

Wide range, high resolution Optical satellite

4. ALOS Future Plan

Average time schedule taken for Emergency Observation in 2019



When ALOS-3 and ALOS-4 are launched, this time will be shortened.

Thank you!

JAXA makes ALOS-2 Emergency Observations for EOR by SA activations as ever

参考資料（非表示）

Major Characteristics

Mission instrument	Wide-swath and high-resolution optical imager ● Panchromatic band (black and white) 70km / Ground resolution: 0.8 m / Swath width: 70km at nadir ● Multi-band (color) Ground resolution: 3.2 m / Swath width: 70km at nadir Band 1 0.40～0.45μm (Coastal) Band 2 0.45～0.50μm (Blue) Band 3 0.52～0.60μm (Green) Band 4 0.61～0.69μm (Red) Band 5 0.69～0.74μm (Red Edge) Band 6 0.76～0.89μm (Near-Infrared)
Data transmission method	Direct transmission to the ground Optical data transmission . the optical data relay sate
Size	5m x 16m x 3.5m (after the solar paddle deployed)
Mass	Approx. 3 tons
Design life	Over 7 years
Operational orbit	Sun-synchronous subrecurrent orbit at an altitude of 669 km Revisit time 35 days (Sub-cycle: about 3 days*) Local solar time at descending node: 10:30 (a.m.) +/- 15 minutes

Figure 1 Comparing observation swath

Comparing observation swath

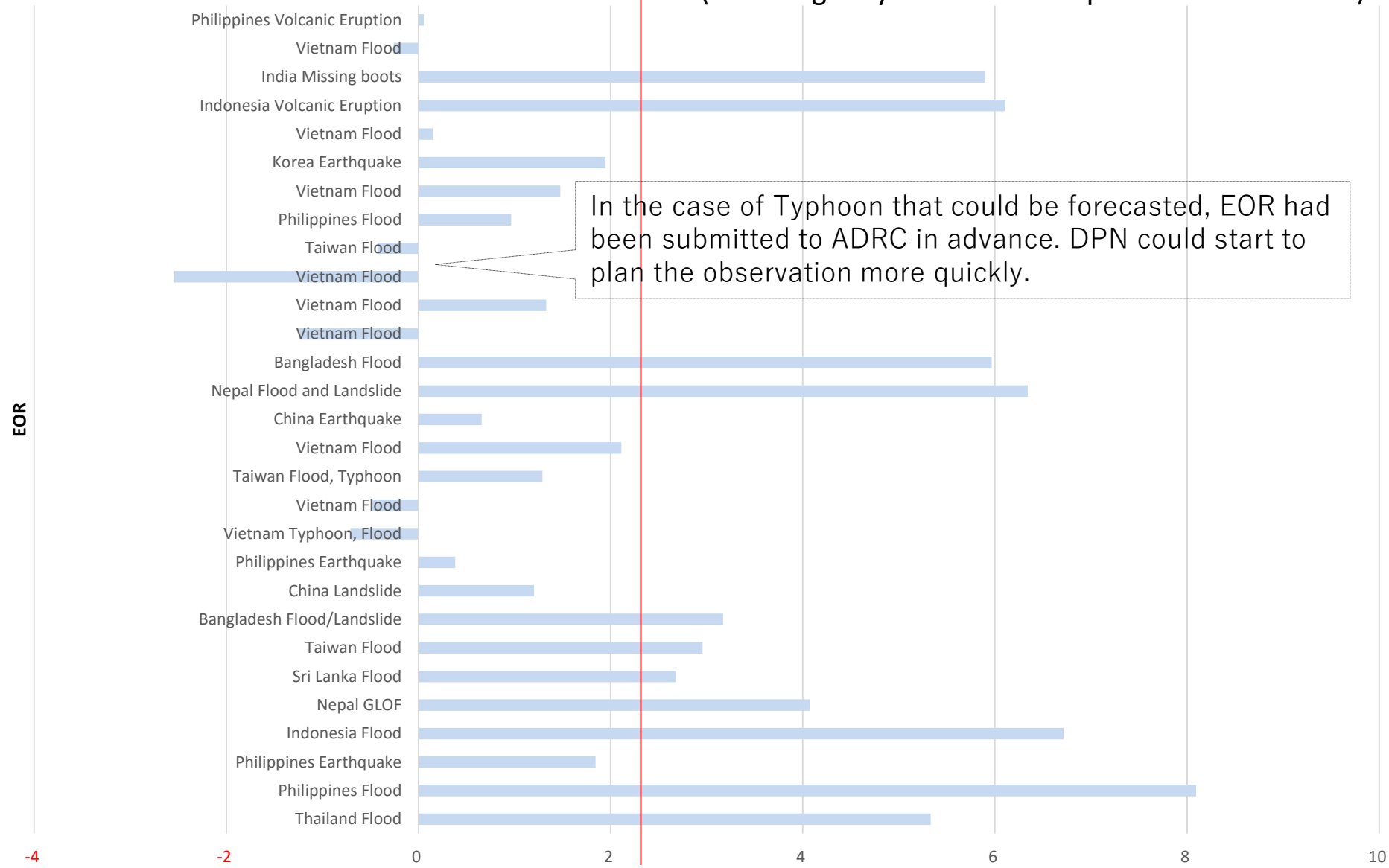
Resolution	ALOS-2	ALOS-4
Stripmap mode (Resolution 3 m, 6 m, 10 m)	50km, 70km	100km-200km
ScanSAR mode (Resolution 25 m)	350km, 490km	700km
Spotlight mode (Resolution 1 m x 3 m)	25km X 25km	35km X 35km

Comparison of observation frequency in Japan

Resolution	ALOS-2	ALOS-4
Stripmap mode (Resolution 3 m)	Four times a year	20 times a year (once every two weeks)

Time taken for SA activation after disaster occurrence in 2017

(including Mayon Volcanic Eruption of 15 Jan. 2018)



In the case of Typhoon that could be forecasted, EOR had been submitted to ADRC in advance. DPN could start to plan the observation more quickly.

On average, it took 2.2 days.

To shorten time for disaster response activities

- Time taken for SA activation

  •JAXA has been regularly watching the precipitation amount of GSMaP and JMA's typhoon track forecast, in case that there seems to occur some disaster, JAXA has been asking you and your DMO to consider EOR. In 2017, EORs related to typhoon are getting to be submitted in advance.

- Time taken for Observation

  •The average 3.7 days by one ALOS-2 observation could not be much shortened. But if DPNs' satellite collaboration is realized, it could shorten this time to compliment each observation. The observation plan by this satellite collaboration could be realized by OPTEMIS provided by GISTDA. This OPTEMIS will work on the next SA cloud-computing system.

- Time taken for Data Provision

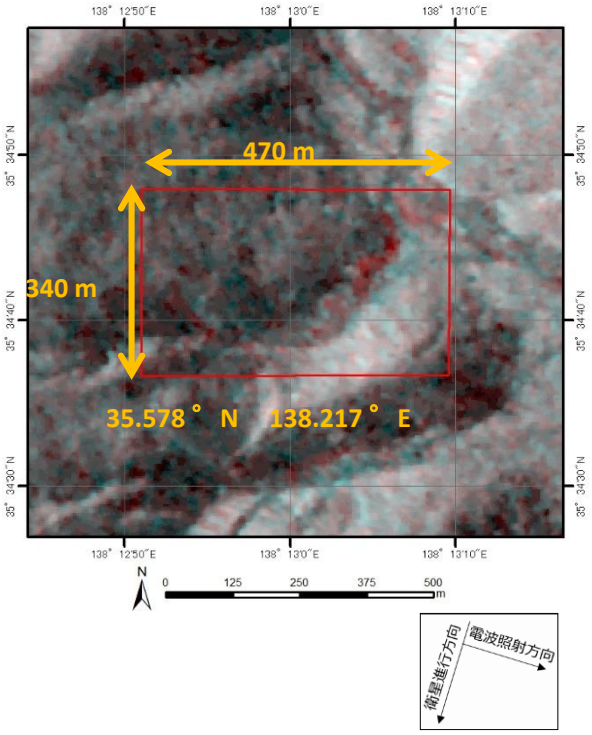
  •It takes the average 1.7 days (41 hours) to provide data. Because data are uploaded on SA Web site by man operation. This data provision way must be changed to be done by Machine to Machine. In the case of JAXA, ALOS-2 data could be provided within ca. 4 hours after observation. This data provision time could be reduced 41 hours to ca. 4 hours in the next SA cloud-computing system. We could start to analyze the observation data every time, regardless of the day and night and day of the week and holiday. DAN, good luck with your work.

1. 静岡県静岡市葵区田代

「だいち2号」の観測画像より、2015/6/16から2019/10/15 の間に色の変化が確認できました（下図左参照）。
2019/10/10の光学画像（下図中央参照）と2019/10/13の光学画像（下図右参照）との比較から、裸地域の拡大が確認されたため、土砂移動の可能性があります。

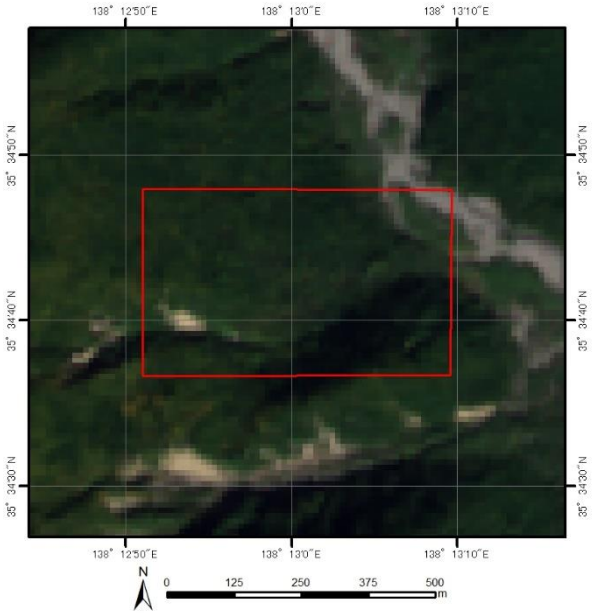
だいち2号（ALOS-2）

2015/6/16 時点→2019/10/13
時点の変化を表現した画像

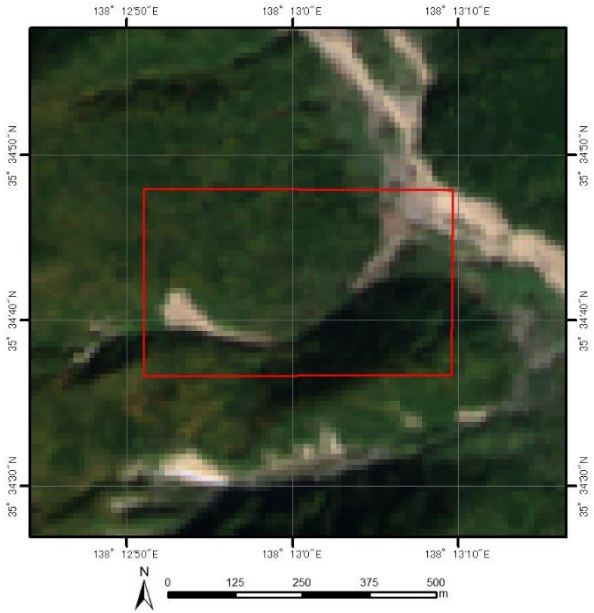


Sentinel-2

2019/10/10



2019/10/13



1. Summary of ALOS-2 Emergency Observations in 2019

- JAXA provides a pre&post-disaster data for an damage analysis
  - -L1.1 data for an Interferometric Analysis
  - -L1.5(*1)/L2.1(*2) data for a Polarization Analysis
  - (*1)Non-Orthorectified data
  - (*2)Orthorectified data