

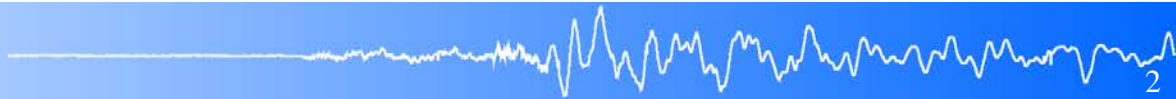
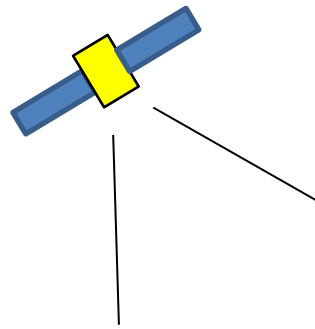
Volcano Monitoring



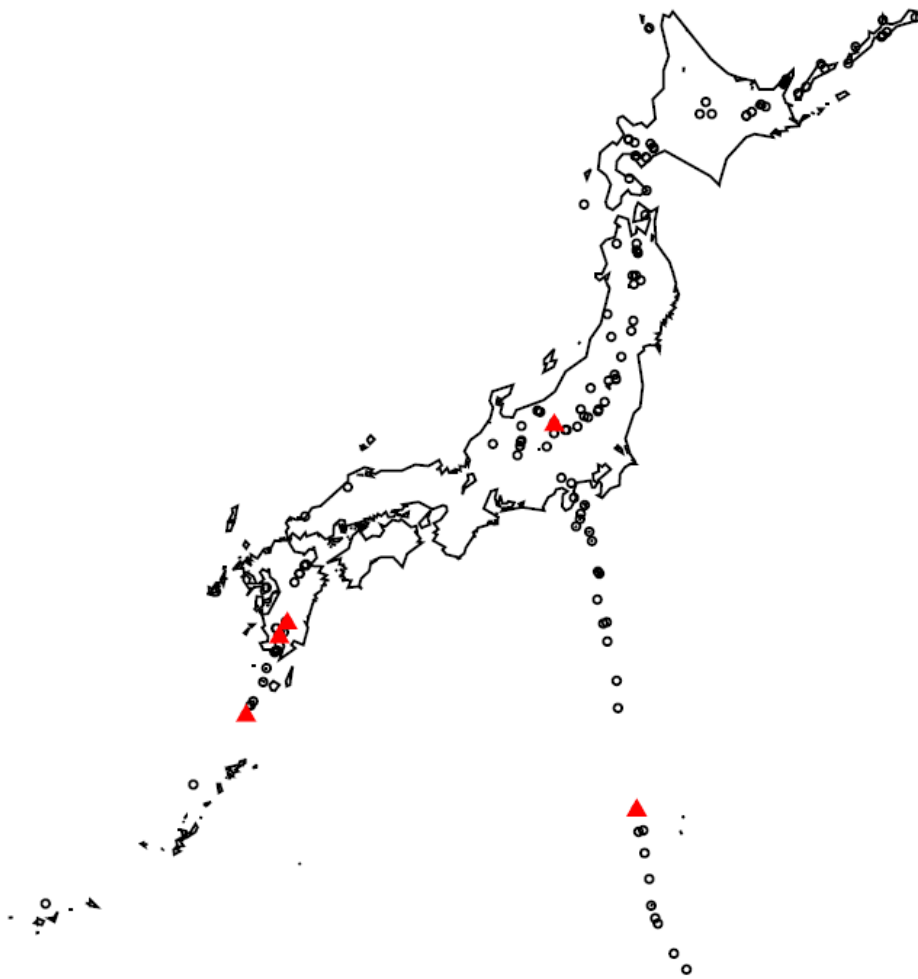
Location : Sakurajima
Date : Jan. 2, 2013
Camera : Canon EOS 60D
F number : 5.6
Shutter speed : 30 seconds
ISO : 800
Photographer : JMA expert

Today's topics

HOW CAN WE USE **ALOS-2** DATA FOR MONITORING VOLCANOES?



Active Volcanoes in Japan



circle: active volcanoes, red-triangle: erupted this year

- **111** active volcanoes
(Active volcanoes: it erupted within 10,000 years)
- **5** volcanoes erupted this year
(Kusatsu-Shiranesan, Kirishimayama (Shinmoedake, Iwo-yama crater), Nishinoshima, Sakurajima, Suwanosejima)
- **50** volcanoes are continuously monitored.



Volcanic Observation and Warning Center

Continuous Observation stations

Seismometer

GNSS

Tiltmeter

Camera

Remote sensing data

Volcanic Observation and Warning Center

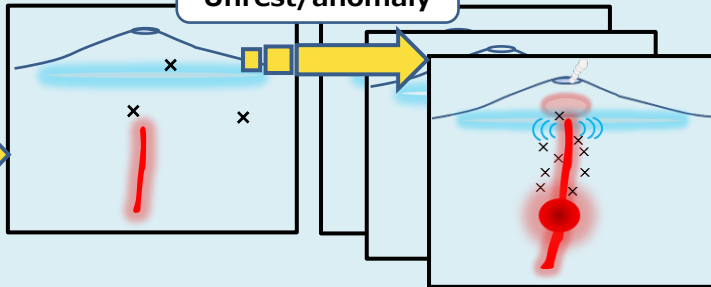
offline

Volcanic Observation and Information System (VOIS)

Schema of volcanic process

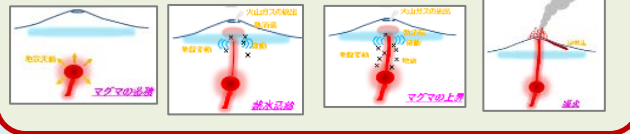
Volcanic activity
Unrest/anomaly

Multi Monitoring and Analysis



reference

Past events DB



Quick Evaluation

Warning/
Information

- Local Governments
- Mass media
- Public

Web Site

Collaborative Work

Coordinating
Committee for
Prediction of
Volcanic Eruption

JMA
Experts

Mobile
PC

Local
Governments

Explanation

online



JMA

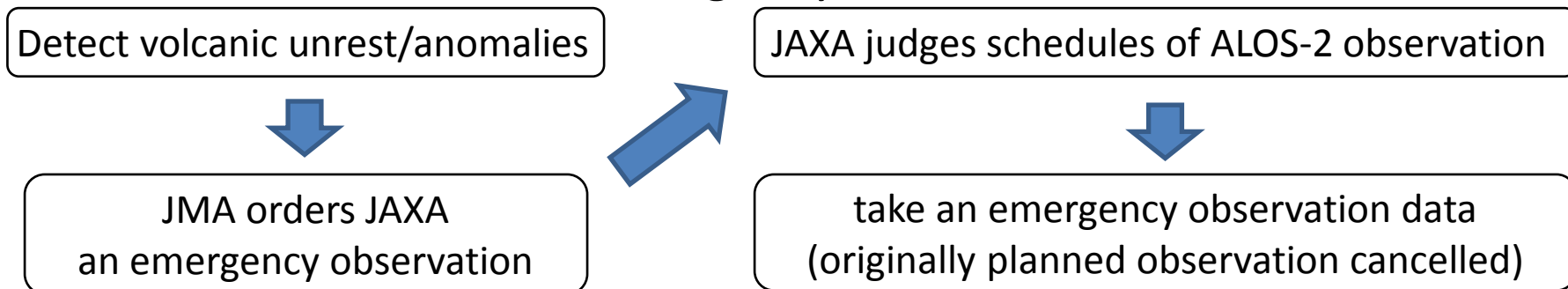
Japan Meteorological Agency

Advantages of ALOS-2(PALSAR-2) data

	GNSS	ALOS-2 data
Observed data	Coordinate of point	Land-covering deformation
Equipment on land	Need to built observation stations	NOT need to built observation stations

- ✓ In spite of **isolated islands** or **activated volcanoes** where we can't access, volcanic activities are monitored.

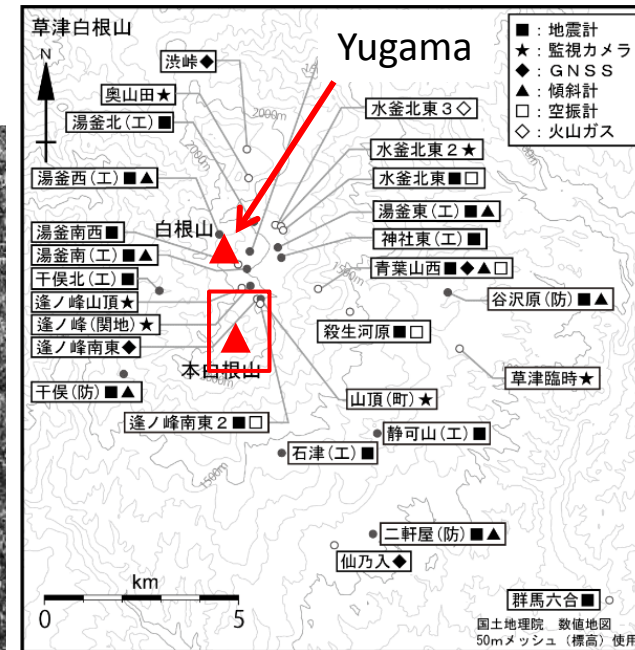
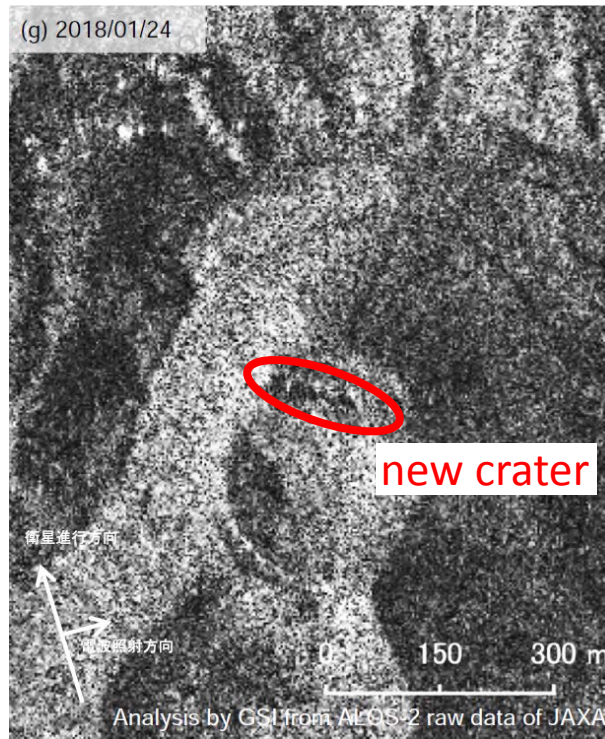
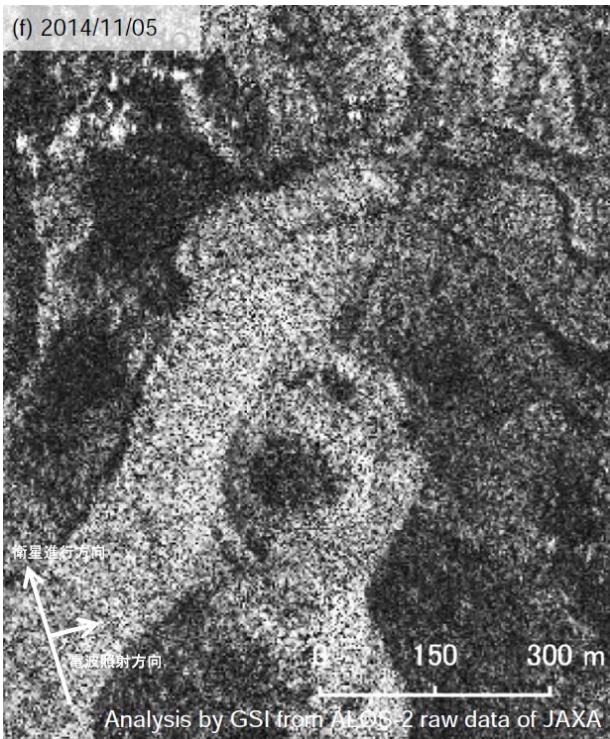
~ In Emergency situation ~



Kusatsu-Shiranesan volcano

Erupted on Jan. 23th, 2018

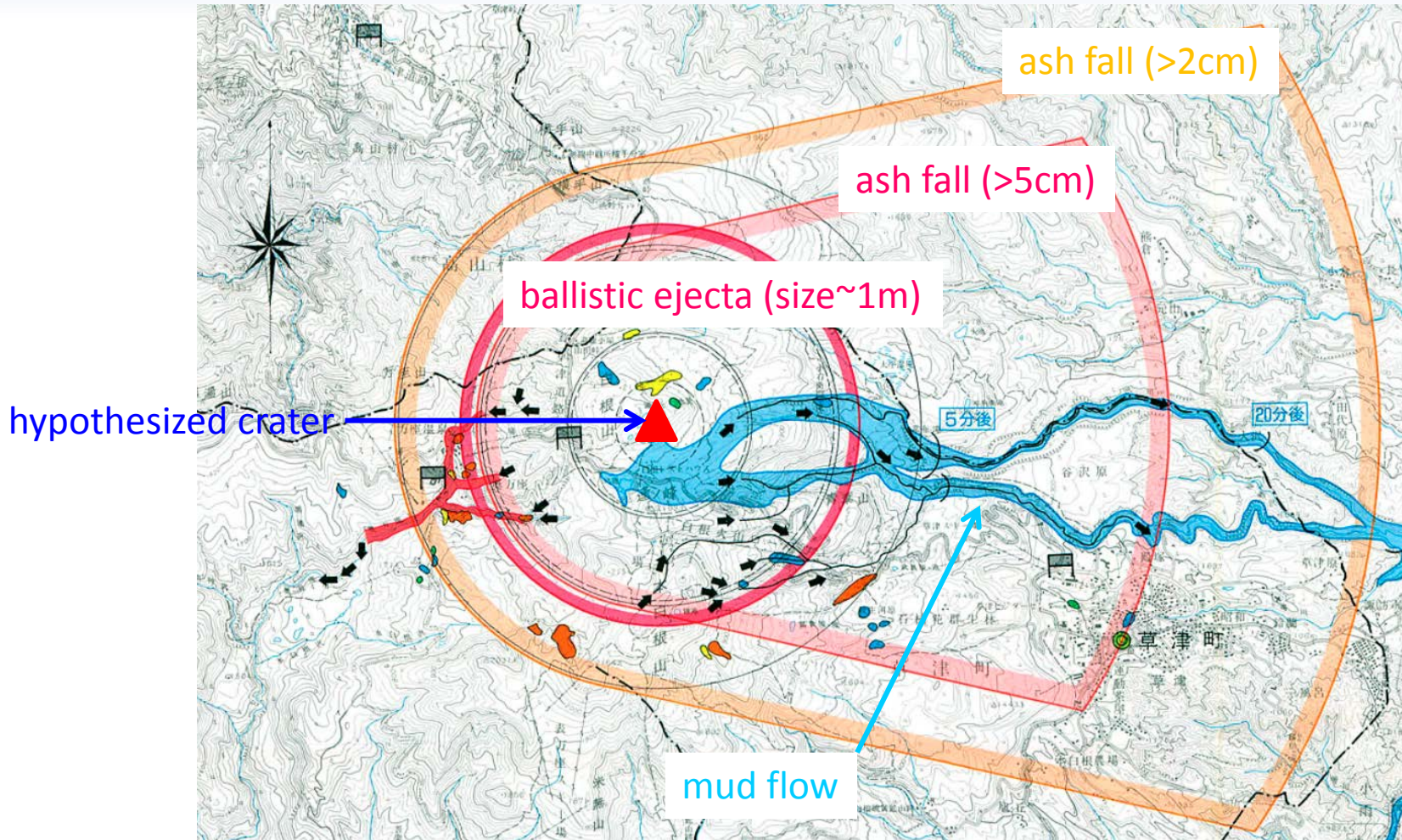
- Kusatsu-Shiranesan is an active volcano which has 3 pyroclastic cones.
- Yugama is the most active crater of Kusatsu-Shiranesan.
- Most observation was targeted Yugama.
- However, eruption occurred at about 2km south of it.



SAR intensity images of ALOS-2 (PALSAR-2)

GSI report of 140th Coordinating Committee for Prediction of Volcanic Eruptions (CCPVE)

Why the crater location is important



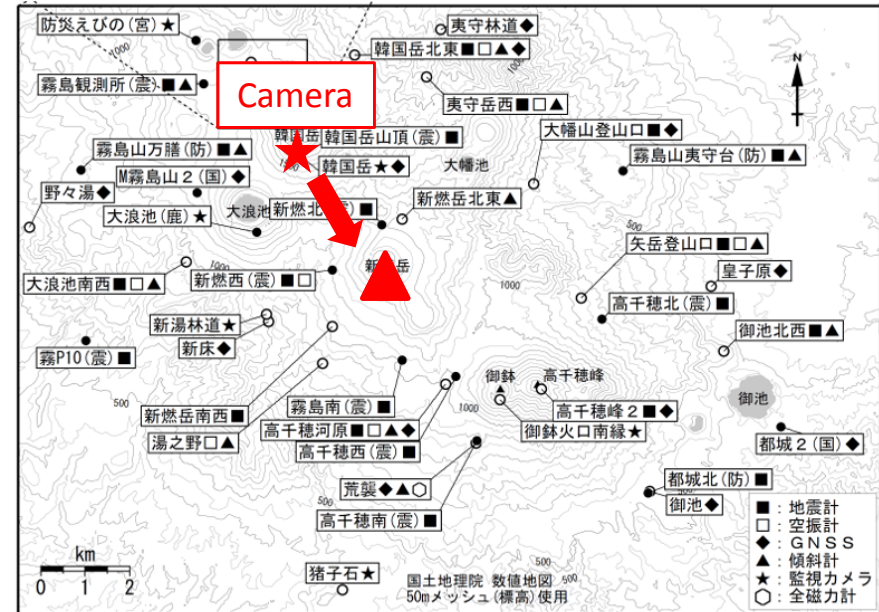
hazard map of Kusatsu-Shiranesan volcano



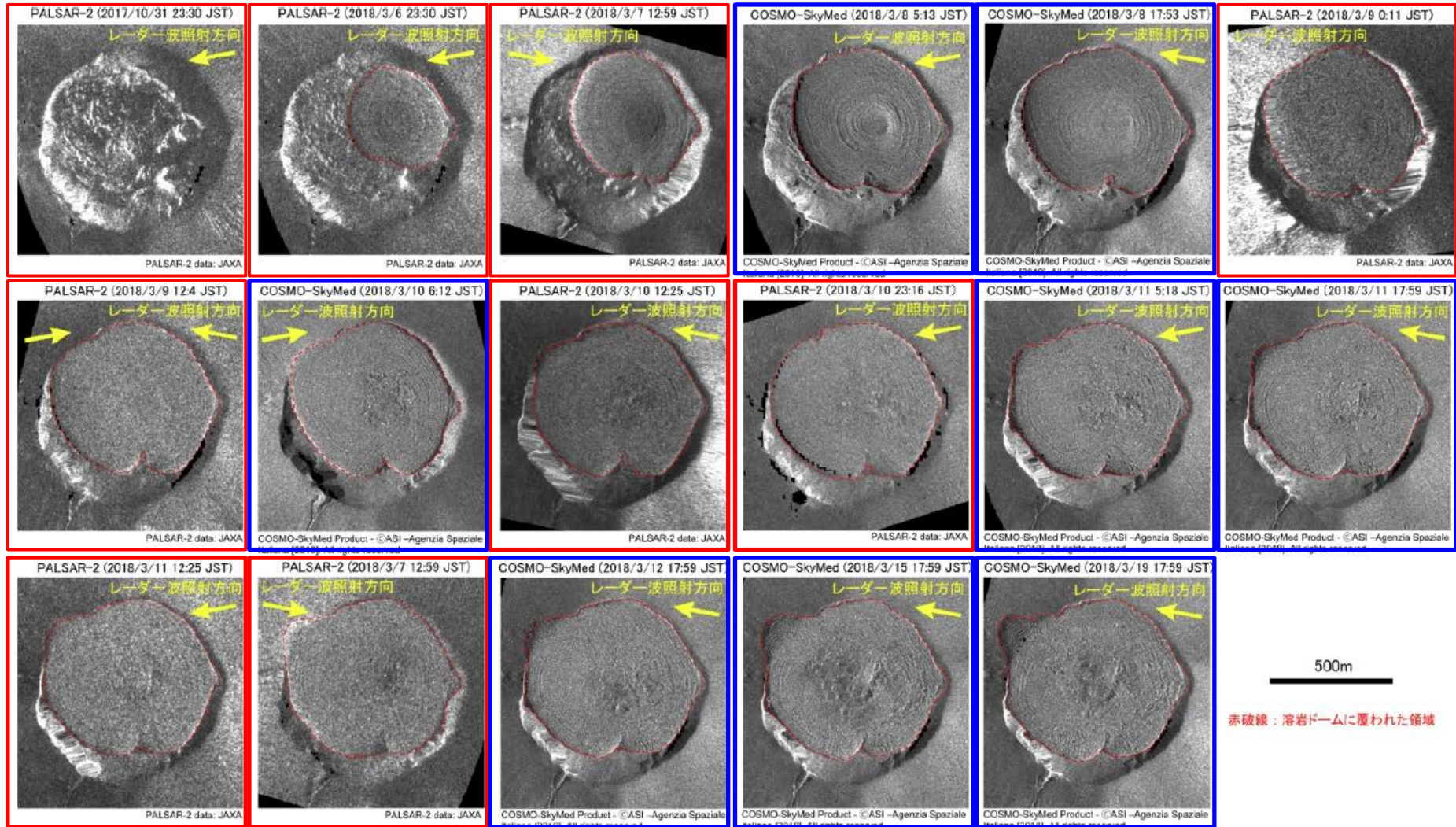
Kirishimayama volcano(Shinmoedake crater)

Erupted on Mar., 2018

- Kirishimayama is a large volcanic complex of more than 20 Quaternary volcanoes.
- Shinmoedake and Iwo-yama are the one of the most active craters of Kirishimayama.
- Shinmoedake and Iwo-yama erupted this year, and Shinmoedake erupted in 2011, too.
- There are many observation stations around Kirishimayama.



Kirishimayama volcano (Shinmoedake crater)

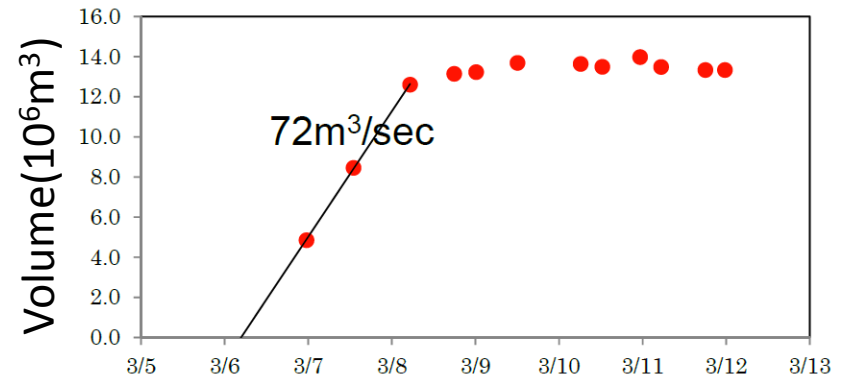
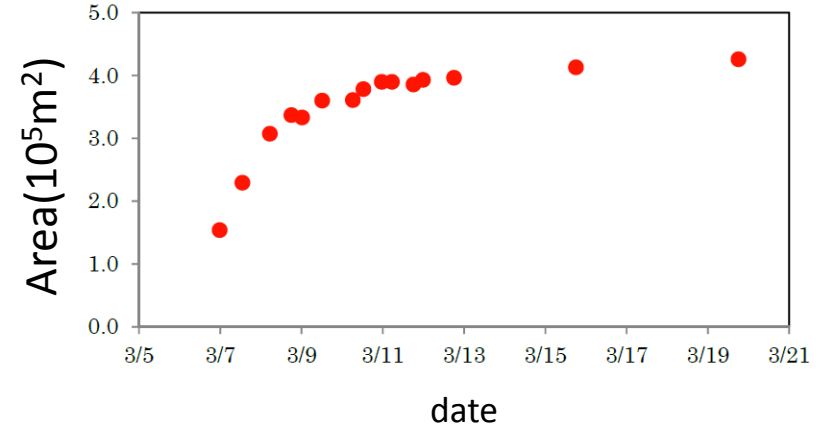
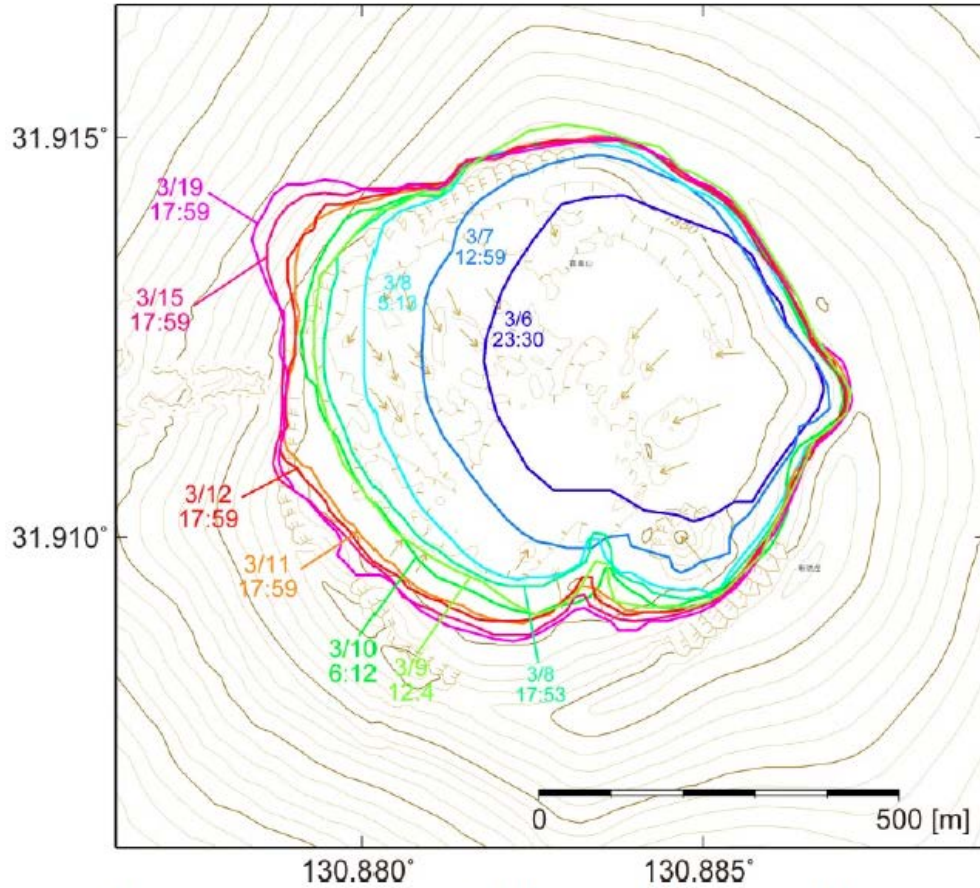


Temporal variation of Shinmoedake crater

NIED report of 141th CCPVE



Kirishimayama volcano (Shinmoedake crater)

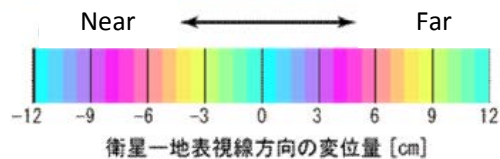
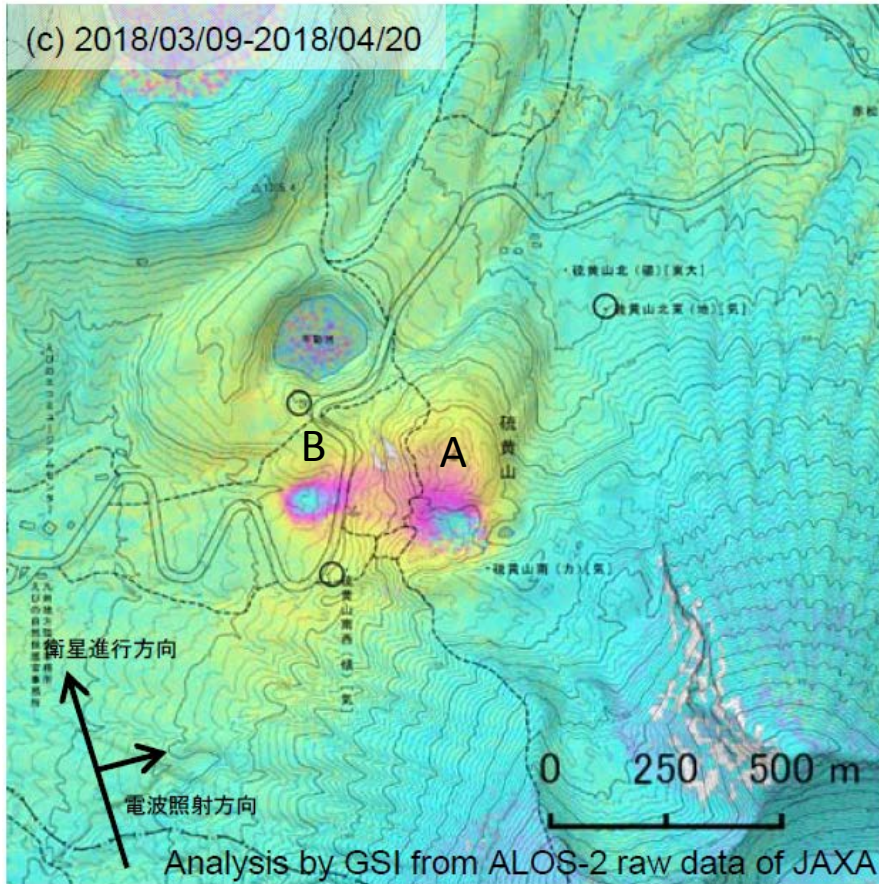


NIED report of 141th CCPVE



Kirishimayama volcano (Iwo-yama crater)

Erupted on Apr. 19th and 26th, 2018

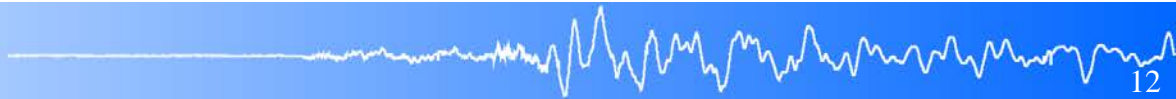


GSI report of 141th CCPVE

Nishinoshima volcano

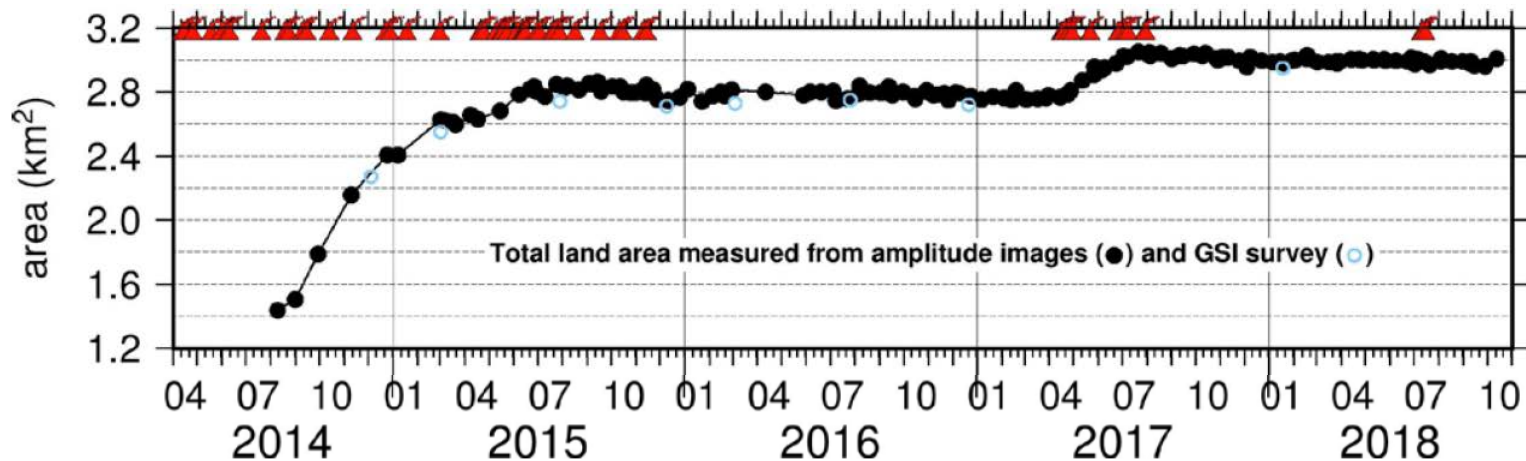
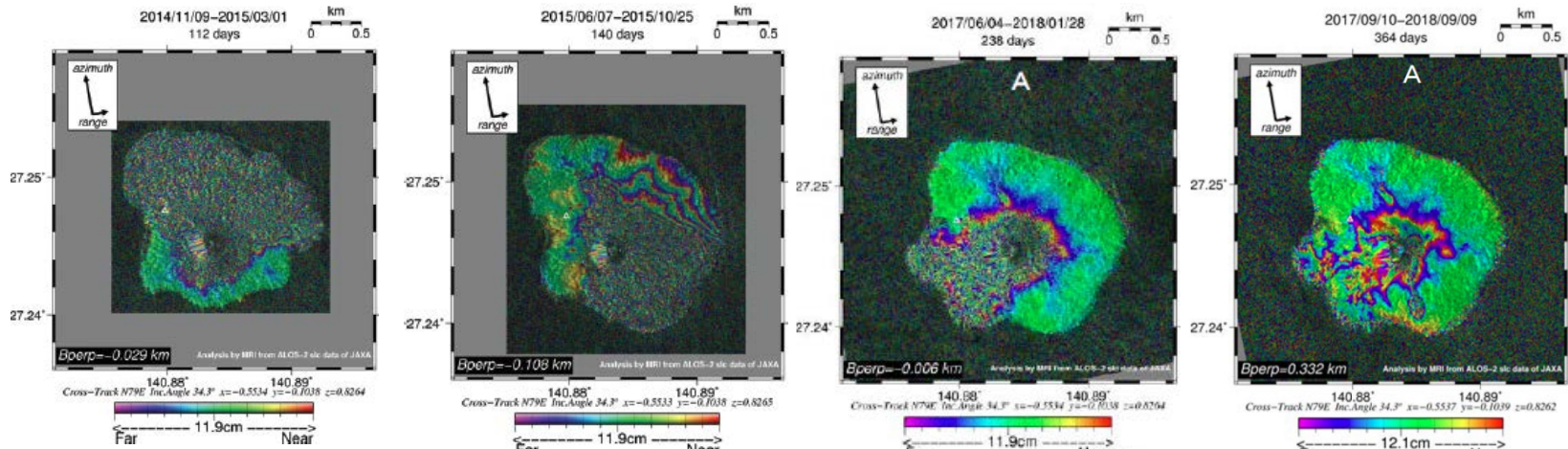


- Nishinoshima is located about 1,000km south of Tokyo.
- Nobody lives in the island.
- In 2013, a small island was created near the former island.
- The new island joined up with original island due to its volcanic activity.
- After the eruption in 2013, the volcano erupts intermittently.



Nishinoshima volcano

- In Nishinoshima volcano, monitoring methods are limited (eg. airplane or ship observation).
- InSAR analysis shows volcanic activities such as lava flow.



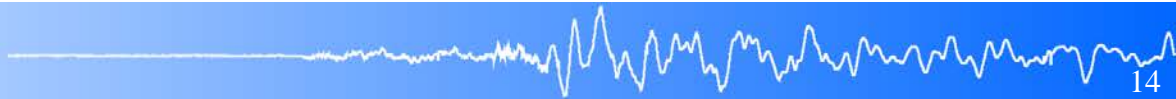
Technical Reports of the Meteorological Research Institute, 2017; MRI report of 141th and 142th CCPVE



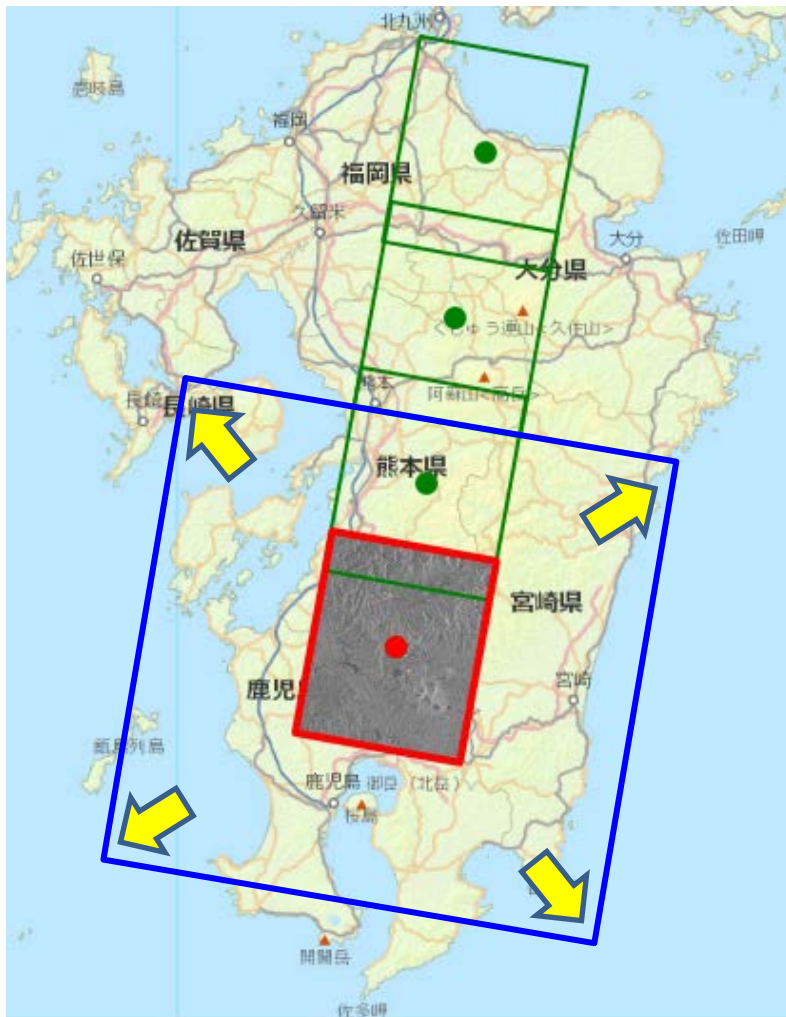
FEATURES of ALOS-2(PALSAR-2) data

	GNSS	ALOS-2 data
Observed data	Coordinate of point	Land-covering deformation
Equipment on land	Need to built observation stations	NOT need to built observation stations
Temporal frequency	<ul style="list-style-type: none">▪ Continuous observation<ul style="list-style-type: none">▪ Independent of other observations	<ul style="list-style-type: none">▪ Every 2 weeks (earliest)▪ Conflict other observations

✓ It is difficult to monitor volcanic activities constantly.



Expectation for remote sensing data



- Some volcanic observation was cancelled due to other disasters (and vice versa).
- Cancelled observation was recovered by cooperation of JAXA.
- If observation range was wider, it would be NOT cancelled...



Summary

- ALOS-2(PALSAR-2) data is quite effective for monitoring of volcanic activity (crustal deformation, changes of volcanic surface).
- Remote sensing data is becoming more and more important for volcanic monitoring.
- Observation opportunities sometimes conflict with other hazard monitoring(earthquake, flood and etc.).
- We hope that wide range, high temporal frequency and high spatial resolution observation will be available in future.

Thank you for your attention!

Japan Meteorological Agency
Seismology and Volcanology Department
Volcanology Division, Isao Kageyama

