

## Lava discharge rate in Nishinoshima volcano, Ogasawara Islands revealed using ALOS-2/PALSAR-2

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Nishinoshima volcano, Ogasawara Islands, where the eruption began in November 2013, the eruptive activity is still continuing to this day. Eruptive activities are roughly classified into the following four phase:

Phase I: Nov.2013–Dec.2015

Phase II: Apr.2017–Aug.2017

Phase III: Jul.2018–Aug.2018

Phase IV: Dec.2019–(ongoing)

The lava flow associated with the eruption activity reached the coast and expanded land area, except for the eruption during the third phase. The land area in Nishinoshima volcano measured from the amplitude images obtained with ALOS-2/PALSAR-2 is approximately 3.2 km<sup>2</sup> as shown in Fig. 1 (as of January 31, 2020).

We have been analyzing mainly crustal deformation around large-scale earthquakes and volcanoes using ALOS-2/PALSAR-2 data since August 2014. ALOS-2/PALSAR-2 has been imaged in multiple observation modes around Nishinoshima. In particular, the spotlight (SPT) mode observation (resolution 3m (range) x 1m (azimuth)) newly installed in PALSAR-2 is observed every 14 days, which is almost equal to the number of regression days. For this reason, high spatial resolution and high temporal resolution observations have been realized in Nishinoshima.

In this presentation, we mainly discuss coherence image analysis using SPT mode observation. The coherence image is obtained by imaging the correlation degree distribution of each pixel unit from 0 to 1 by accurately aligning the observation data of the two periods. If the active volcanic activity continues, its surface will change every moment, and the degree of correlation will decrease significantly over time. However, it was found that the SPT mode data that can be acquired every 14 days maintains a very high degree of correlation when no eruption occurs. Therefore, assuming that the low degree of correlation during the eruption corresponds to the lava flow area, we calculated the lava discharge rate at each interval. The thickness of the lava was assumed to be 2.5–5 m on land and 10 m on the sea area from the report of the Earthquake Research Institute of the University of Tokyo (ERI). As a result, the average lava discharge rate for each eruptive activity period is as follows (see the figure for the time series):

Phase I (Second half: Mar.2015–Dec.2015):  $0.09\text{--}0.16 \times 10^6 \text{ m}^3/\text{day}$

Phase II (Apr.2017–Aug.2017):  $0.10\text{--}0.18 \times 10^6 \text{ m}^3/\text{day}$

Phase III (Jul.2018–Aug.2018):  $0.04\text{--}0.07 \times 10^6 \text{ m}^3/\text{day}$

Phase IV (Dec.2019–Mid-Feb. 2020):  $0.21\text{--}0.38 \times 10^6 \text{ m}^3/\text{day}$

Maeno et al (2016) estimates that the average lava discharge rate in Phase I (first 15 months) is  $0.2 \times 10^6 \text{ m}^3/\text{day}$  and that in its peak period (September 2014) is  $0.5 \times 10^6 \text{ m}^3/\text{day}$ . Comparing our results with these results, we found that the Phase IV eruptive activity, which began in December 2019, has a lava discharge rate comparable to Phase I. We would also like to discuss the distance changes in the satellite line-of-sight extension that are frequently detected near lava flows.

The PALSAR-2 data were prepared by the Japan Aerospace Exploration Agency (JAXA) via Coordinating Committee for the Prediction of Volcanic Eruption as part of the project 'ALOS-2 Domestic Demonstration on Disaster Management Application' of the SAR analysis of volcano Working group. The PALSAR-2 data belongs to JAXA. Gamma and RINC (Ozawa et al, 2016) were used for PALSAR-2 analysis. In the process of

the InSAR, we used ‘the digital elevation map 2.5m-mesh’ provided by the Geospatial Information Authority of Japan (technical data: C1-No.448, 453, 458, 462, 463, 478, 489). We used GMT (Wessel and Smith, 1998) to draw the map.

Keywords: ALOS-2/PALSAR-2, spotlight mode, coherence analysis, lava discharge rate, Nishinoshima

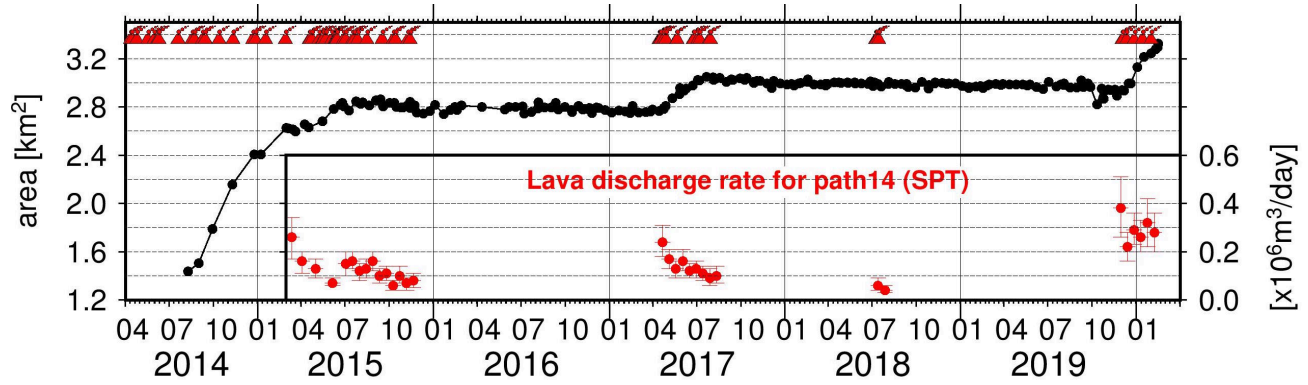


Fig. Time series in a land area of Nishinoshima measured by all ALOS-2/PALSAR-2 amplitude images, and lava discharge rates estimated from coherence images in spotlight mode (Path14).