Investigation of the emergency interpretation of landslides using SAR satellites

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1. Introduction

The method to interpret and examine large-scale landslides using images from synthetic-aperture radar (SAR) is proposed to identify the onset of landslides regardless of day, night, or weather.[1] The constant observation by high-resolution SAR satellites has accumulated data in recent years, which increased the opportunity to gain images before and after a natural disaster observed under the same conditions. The comparison of radio wave reflection intensity before and after a natural disaster makes it easier to find areas with changes in the ground surface covering two periods of time. While images captured after a natural disaster alone were mainly targeted for the interpretation of the large-scale movement of sediment, such as deep-seated landslides, SAR images may be able to target the interpretation of small-scale phenomena by comparing two periods of time.

This paper reports how the National Institute for Land and Infrastructure Management (NILIM) interpreted landslides that occurred in the heavy rain in northern Kyushu in July 2017 using images captured before and after the natural disaster and the outcomes of the interpretation.

2. Responses with interpretation and outcomes of the interpretation

For the heavy rain that occurred mainly in the city of Asakura, Fukuoka, on July 5, 2017, ALOS-2 was observed around 12:50, July 7 when images were captured before and after the heavy rain for the purpose of interpreting the locations of landslides. NILIM received the observation data around 14:20 and reported the interpretation outcome to the Kyushu Regional Development Bureau via the Ministry of Land, Infrastructure, Transport and Tourism around 20:00. The interpretation was based on RGB color composite images of data captured before the disaster (April 29, 2016) and after the disaster (July 7, 2017) (figure 1) and optical images captured before the disaster to identify conditions before the damage.

The interpretation found no major landslides or blockages of rivers like the ones in the Ono District, city of Hita, Oita. Yet, it found many areas with possible outflows of landslides along the valleys on slopes. The result of the interpretation was used to select focused areas of helicopter investigations near Toho Village, Fukuoka, where no helicopter investigation could be conducted after the onset of the disaster due to the effect of bad weather.

Some of the identified areas indicated changes in the ground surface covering, which was probably artificially modified through deforestation, although the interpretation was correct as to finding areas with changes in radio wave reflection intensity. Yet, it still has a problem in determining its certainty when it is used to find areas with the onset of new sediment movement. Although it successfully identified small-scale sediment movements of a few thousand square meters, it missed collapses larger than 10,000 square meters because of ambiguous changes in the SAR images compared to surrounding areas due to the relationship among ground covering conditions, slopes, and the direction of radio wave irradiation (figure 2).

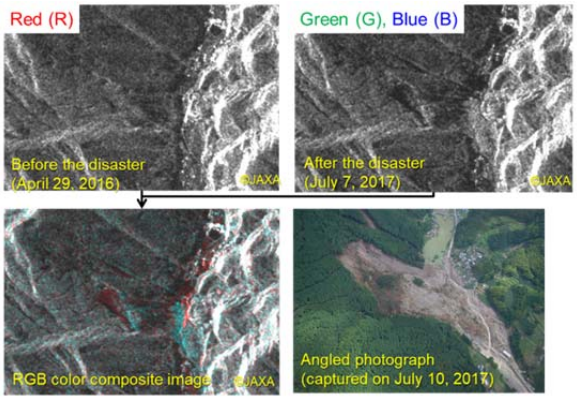

Figure 1: Examples of color composite images (Ono District, city of Hita: about 60,000 m^2 of area)

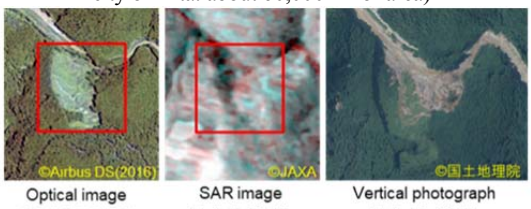

Figure 2: Examples of overlooked collapses (about 15,000 m^2 of area)

3. Summary

The authors are examining the ranges of application and investigation methods in regard to the interpretation of sediment movement using images captured in two periods of time before and after a natural disaster. The authors are going to continue this study to effectively use SAR images as the technology to investigate damage from natural disasters.

☞For detailed information

1) NILIM reference No. 791

http://www.nilim.go.jp/lab/bcg/siryou/tnn/tnn0791.htm