Case of early clarification of wide area sediment disasters using satellite images

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1. Introduction

When an earthquake or torrential rainfall etc. causes a landslide forming a large natural dam etc., there is a danger of a secondary disaster such as an inundation caused by the collapse of the natural dam, so when the Great East Japan Earthquake and typhoon No. 12 of 2011 caused disasters, wide area landslide ground interpretation was performed using satellite images, quickly clarifying the landslide ground which had appeared.

2. Interpreting landslide ground over a wide area after Great East Japan Earthquake

During the Great East Japan Earthquake, strong seismic intensity was observed over a wide region, so in order to confirm and clarify the state of the occurrence of large-scale landslide ground, over a wide area without omission, optical satellite images were used to visually interpret the landslide ground. The regions which were the object of the landslide ground interpretation were “regions encompassing districts where the seismic intensity was weak 6 or more, and districts where the seismic intensity was strong 5 or more” (see Fig. 1), based on the estimated seismic intensity distribution announced by the Meteorological Agency. The regions whose images were used for the interpretation were, in order to more accurately discriminate landslide regions, allotted and interpreted beginning with images with high resolution selected from among obtainable images in the sequence: Google Earth images, ALOS stereopia images, ALOS pan-sharpened images, and ALOS-AVNIR-2 images.

The results of the interpretation of landslide ground using satellite images showed that there were approximately 200 landslide locations covering a total of about 300,000 m^2 of ground. It also confirmed that there were no landslides large enough to have formed a natural dam.

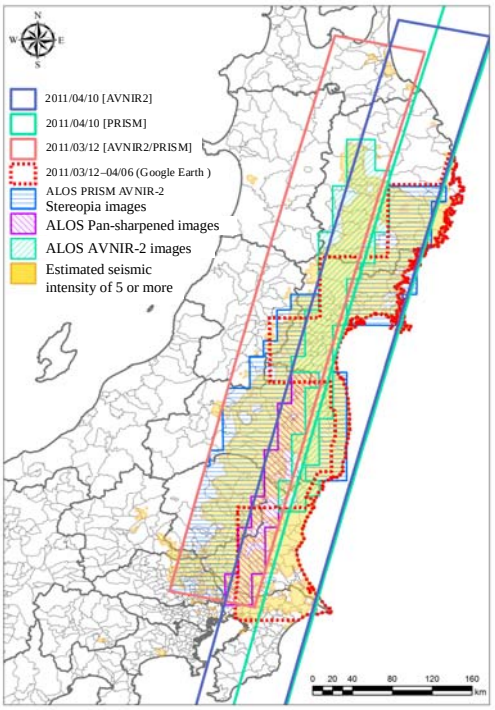

Figure 1. Region with Seismic Intensity of Strong 5 or Higher and Region Interpreted

3. Searching for river course blockages (natural dams) caused by Typhoon No. 12 of 2011

Typhoon No. 12 of 2011 brought prolonged intensive rainfall ending September 4, causing severe damage on the Kii Peninsula. So on September 5, a helicopter was used to conduct a survey to check for the formation of natural dams. The results confirmed large-scale natural dams at two places (Nagadono, Kumano), but most of the region was cloud-covered, so it could not be surveyed by helicopter. So satellite SAR images, which are obtained by wide area photography (30km×50km) were used to search for image patterns similar to those of the natural dam formed at Nagadono to interpret landslide ground, abstracting unconfirmed river course blockages at 8 locations including Akatani and Kurihira (see Fig. 2

for example at Akatani). On the following day, September 6, after the weather had returned to normal, the river course blockage locations abstracted by the satellite SAR images were visually confirmed from helicopters, and an emergency survey stipulated by the Sediment Related Disaster Prevention Law was started at the sites of large-scale river course blockages at Nagadono, Akatani, Kurihira, and Kumano.

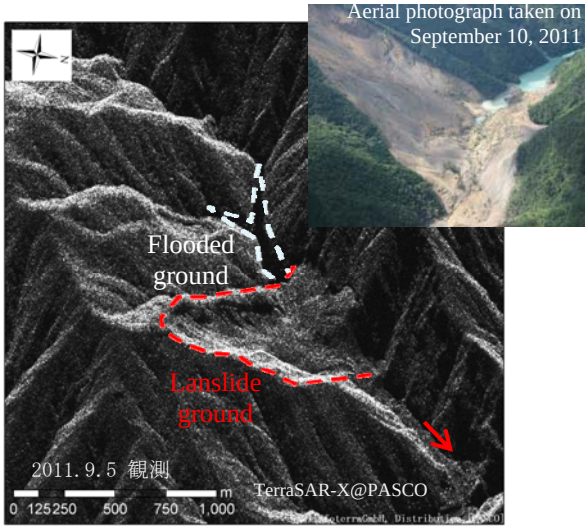

Figure 2. River Course Blockage at Akatani
Discovered by the Satellite SAR

In the past it was impossible to perform surveys to confirm the formation of natural dams at night and during bad weather, but interpreting landslide ground using wide-area satellite SAR images successfully sped up the search for previously unconfirmed natural dams in mountains even during bad weather, accelerating the start of emergency surveys and evacuation of downstream residents as required by the Sediment Related Disaster Prevention Law when a large-scale sediment disaster is imminent.