## Automatic extraction analysis of widespread sediment disasters from satellite images in the Heavy Rain Event of July 2018, Japan

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[Introduction]The rain front and Typhoon Prapiroon caused the Heavy Rain Event of July 2018, which was a wide area heavy rain disaster in Japan, especially in its western part. Floods and sediment disasters occurred in various places and resulted in a lot of deaths and missing persons. On the occasion of these widely spread simultaneous multiple disasters, there are concerns about delay of starting the initial response. In order to identify the broadly scattered sites of sediment disasters, we applied an automatic extraction analysis using satellite images of wide area coverage.

[Status and issues of existing methods]Aerial photographs are mainly utilized for grasping damage situation in devastating disasters. A number of responsible organizations implemented the aerial photographing at the heavy rain disaster. Geospatial Information Authority of Japan created the land surface failure distribution maps based on the aerial photographs of Southern District of Hiroshima Prefecture, Uwajima Island and Ozu District of Ehime Prefecture, Iwakuni District of Yamaguchi Prefecture, acquired during 9 to 19 July<sup>1)</sup>. PASCO CORPORARION provided the distribution maps of sediment moving scars for the possibly-damaged areas (Kure City and others) developed from the satellite images of SPOT 7 for Hiroshima, Okayama and Ehime Prefectures during 9 to 16 July<sup>2)</sup>. Both results were obtained only for a part of affected areas because of limited image acquisition or analysis. Besides, even well-skilled experts need a lot of time for processing. These issues are mentioned as the problems need to be solved in the field of early response to the widespread disasters.

[Automatic extraction analysis from satellite images]The SPOT Satellites provide images with 60km swath width. In addition, their plural satellite operation endorses the revisit capacity of almost daily basis. These characteristics are superior, although the 1.5m ground resolution is inferior to 20cm of aerial photographs. Our target area of satellite image acquisition is 11,400km<sup>2</sup> including Okayama, Hiroshima and Ehime Prefectures. We applied the automatic extraction analysis to this area in order to identify the affected sites of sediment disasters quickly. The analysis method is based on a supervised maximum likelihood classification method, frequently used in the sphere of remote sensing image analysis. After the classification using the slope failure sites in the images as the supervised data, several sites were extracted as the possibly-affected areas. Then, the forest area data of the National Land Numerical Information was used to eliminate playgrounds or other bare lands in the urban area. The analysis results were compiled into the standard grid square (about 1km by 1km) map with color based on the occupancy area ratio of affected sites in each grid. The analysis time of the process is about one day which is shorter than human-wave tactics. However, some of small surface failure sites (e.g. narow debris flow zone) are not extracted. Past-affected sites and cutover areas are also misidentified. Although these individual issues should be treated more carefully, the density distribution map is helpful to grasp an overview of the damages.

[Conclusion]We showed the availability of the wide area satellite images to grasp an overview of sediment disasters, even in the Heavy Rain Event of July 2018 which devastated widely in Japan, although the usual aerial photograph analysis could achieve only limited areas. Because the optical satellite images of 1.5m resolution provide less clear view than aerial photographs, we will research to define the reasonable conditions to utilize satellite images for understanding of sediment disasters in details. We will also approach the development of automatic interpretation technologies using artificial intelligence in order to

obtain further extraction accuracy, because current our method still remains several misidentified or not-extracted sites.

Keywords: Heavy Rain Event of July 2018, sediment disasters, satellite images, automatic extraction analysis