**Evaluation of Deformation Detection Performance of Highway Slope Using SAR Image Simulator**

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***ABSTRACT***

Landslides and ground deformation often happen around highways, so it is important to accurately detect early signs and damaged areas. Currently, methods using SAR images are being studied, but these methods sometimes fail to detect changes in slopes well because of problems like relative azimuth angles and radar shadows. These issues are one reason why business operators hesitate to buy expensive SAR images. To encourage the use of SAR images, we need to understand the conditions under which slope deformations can be accurately detected. In this study, we developed a simulator that creates SAR images using satellite orbits, sensor information, and topographic data. We checked how the performance of slope deformation detection changes when the satellite's relative azimuth angle and orbit are varied. The simulator reproduced radar shadows and calculated backscatter coefficients from soil moisture content to show the effect of soil moisture on the intensity image. We used the PSInSAR method to analyze the deformation by selecting pixels with stable backscatter.

Our verification results show that deformation on the same side of the slope as the satellite can be detected quite accurately, while detection on the opposite side is less stable. Additionally, when there is a lot of moisture in the soil, the backscatter coefficient becomes lower. This makes it harder to accurately detect deformations on slopes that have a high moisture content. Understanding these factors is important for improving the reliability and effectiveness of SAR images in detecting slope deformations around highways. In summary, the evaluation of detection performance using the simulator is effective. In the future, we would like to verify the accuracy of deformation detection for structures of various shapes.

**Keywords:** SAR image, simulator, PSInSAR, deformation detection