**Title**

Landslide detection and mapping on Synthetic Aperture Radar amplitude satellite imagery

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**Abstract**

There is a growing demand for detailed and accurate landslide maps and inventories worldwide. The mapping of landslides is essential for emergency response, disaster mitigation and a better understanding of landslides. Currently, it is still difficult to detect the timing and extent of landslides accurately through satellite imagery. Most often optical satellite imagery is used, but this is limited since it requires daylight as well as cloud-free conditions in order to observe anything on the Earth's surface. Synthetic Aperture Radar (SAR) amplitude imagery shows great potential since it can overcome these disadvantages, the speckle and geometric effects make it difficult to detect landslides. Both SAR amplitude images without temporal averaging and with temporal averaging, within a time window of one month, were tested. This study introduces the use of SAR amplitude images by two Deep Learning models, a U-Net and a Pix2Pix conditional Generative Adversarial Network, to detect and map landslides. These two models are trained and tested on several regions in South-East Asia where landslides have occurred recently.  
The two models were not able to detect and map the landslides based on the SAR amplitude imagery, as shown by the mean Intersection over Union values which are smaller than 0.01 and the inaccurately predicted images.  
Speckle reduction by temporal averaging of pre-and post-event images and consequently taking the log-based amplitude ratio, Aratio, is recommended when using SAR amplitude imagery. Additionally, reduction of geometric effects by averaging images of descending and ascending order together is recommended.  
Despite the application of these measures, the two Deep Learning models used in this study don't have a successful outcome. In fact, a positive Aratio returns landslide scars better than the models. The landslide detection becomes more effective when temporal averaging is done over more time, although this is impractical for timely landslide detection. In general optical imagery is recommended over SAR amplitude imagery, if available within three months after the landslide event. Otherwise, SAR amplitude imagery can be used, by using the aforementioned averaging and a threshold method on positive Aratio.