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Sentinel-1 and Deep Learning for rapid landslide mapping

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Multiple landslide events happen frequently across the world. They have the potential to wreak significant harm to both human life and infrastructure. Although a substantial amount of research has been conducted to address the speedy mapping of landslides using optical Earth Observation (EO) data, significant gaps and uncertainties remain when engaging with cloud obscuration and 24-hour functioning. To solve the issue, we investigate the use of SAR data to automatically map landslides with the aid of advanced deep learning segmentation models. We use a Deep Learning (DL) design developed for pixel-based classification, the so-called Attention U-Net, to evaluate the landslide mapping capability of bi- and tri-temporal SAR amplitude data from the Sentinel-1 satellite. Four separate combinations are investigated, each of which consists of two different amplitude combinations per two satellite orbits. Furthermore, the effect of augmentations is assessed individually for each dataset. Through F1-score and other standard criteria, the models' predictions are compared to an accurate landslide inventory collected by hand mapping on pre- and post-event PlanetScope data. The enhanced ascending tri-temporal SAR composite produced the best results. Augmentations have a beneficial influence on the rising Sentinel-1 orbit, but they harm the descending route (in this case). Our findings show that integrating SAR data with other data sources can aid in the rapid mapping of landslides, especially during storms and deep cloud cover. However, further research and improvements are required, starting from novel sample and pre-processing strategies to mitigate the effect of the geometric distortions on model performance.