

Abstract

Several studies have demonstrated the advantages of using Interferometric Synthetic Aperture Radar (InSAR) coherence and SAR backscatter intensity data for change detection and flood mapping. Most of these works, however, are limited to a few case studies or use high resolution SAR data not freely available to the public. The purpose of this study was to determine the effectiveness of fusing 10-meter resolution Sentinel-1 intensity and InSAR coherence data across geographically diverse regions for semantic water segmentation. We fused Sentinel-1 intensity and InSAR coherence as inputs to uni- and bi-temporal classification models cross-trained using optically derived Sentinel-2 water masks. We trained Attention U-Net convolutional neural network models and XGBoost pixel-wise classifiers to assess the relative improvements gained by adding the coherence data to a bi-temporal model relative to a uni-temporal intensity-only model. We found that the bi-temporal intensity and coherence fusion models improve the water intersection over union by over 3% when aggregated over all geographical regions studied. We also found that the bi-temporal intensity and coherence fusion models improve the water-class recall by over 4%, systematically reducing the false negative rate across all the geographic regions studied. The reduction in the water-class false negative rate comes at the expense of the false positive rate, however. We found that the uni-temporal intensity only models outperform the bi-temporal intensity and coherence fusion models by 1 to 2% in terms of water-class precision. With a 6-day repeat cycle, the Sentinel-1 platform democratizes high resolution SAR data access that is complementary to its optical counterparts. This is especially important as we continue to develop, improve, and operationalize methods to manage and respond to natural disasters such as extreme flooding events.