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CONTINUOUS BIOMASS MONITORING BASED ON SENTINEL-2 AND GEDI DATA FOR WILDFIRE CO2 RELEASE ESTIMATION USING MACHINE LEARNING

Abstract

Forests play a crucial role in the carbon cycle and in climate regulation. In the last years, global CO2 emissions due to wildfires amounted to more than one and a half times the emissions of the European Union caused by the burning of fossil fuels. To assess the magnitude of the release of CO2 stored in plant matter due to wildfires on a global scale, accurate knowledge about the above-ground biomass (AGB) inventory is necessary. There have been significant developments to generate global scale AGB maps by utilizing various remote sensing techniques and sensors from the optical and the microwave domain. However, most datasets provide data only for a specific investigated period and location. Hence, existing global AGB products differ significantly in their spatiotemporal extent and up-to-date AGB estimates are often not available for a specific location. To overcome this limitation, our objective is to create a machine learning based processor capable of generating continuous, global, timely and high-resolution AGB maps based on multispectral Sentinel-2 MSI data. An extensive dataset for supervised learning is created by spatiotemporally matching sparse GEDI (Global Ecosystem Dynamics Investigation) level 4A AGB data points from the years 2020 and 2021 with Sentinel-2 MSI data. This dataset is used to train a variety of classifiers to learn the mapping of Sentinel-2 MSI spectral information to dense AGB estimates, followed by a detailed evaluation and comparison of their performance. While GEDI data serves as ground truth during training, the trained classifiers require only Sentinel-2 MSI data as input features. This allows the generation of AGB maps for each newly acquired Sentinel-2 product which in turn enables detecting changes in AGB with a temporal resolution of 2-5 days. In a further step, this up-to-date AGB information is combined with our high resolution burnt area product to provide estimates on the CO2 release due to biomass burning. The results of this study will be presented.