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CONTROL ID: 1814915

TITLE: Mapping stand-age distribution of Russian forests from satellite data

ABSTRACT BODY: Russian boreal forest is a critical component of the global boreal biome as approximately two thirds of the boreal forest is located in Russia. Numerous studies have shown that wildfire and logging have led to extensive modifications of forest cover in the region since 2000. Forest disturbance and subsequent regrowth influences carbon and energy budgets and, in turn, affect climate. Several global and regional satellite-based data products have been developed from coarse (>100m) and moderate (10-100m) resolution imagery to monitor forest cover change over the past decade, record of forest cover change pre-dating year 2000 is very fragmented. Although by using stacks of Landsat images, some information regarding the past disturbances can be obtained, the quantity and locations of such stacks with sufficient number of images are extremely limited, especially in Eastern Siberia. This paper describes a modified method which is built upon previous work to hindcast the disturbance history and map stand-age distribution in the Russian boreal forest. Utilizing data from both Landsat and the Moderate Resolution Imaging Spectroradiometer (MODIS), a wall-to-wall map indicating the estimated age of forest in the Russian boreal forest is created. Our previous work has shown that disturbances can be mapped successfully up to 30 years in the past as the spectral signature of regrowing forests is statistically significantly different from that of mature forests. The presented algorithm ingests 55 multi-temporal stacks of Landsat imagery available over Russian forest before 2001 and processes through a standardized and semi-automated approach to extract training and validation data samples. Landsat data, dating back to 1984, are used to generate maps of forest disturbance using temporal shifts in Disturbance Index through the multi-temporal stack of imagery in selected locations. These maps are then used as reference data to train a decision tree classifier on 50 MODIS-based indices. The resultant map provides an estimate of forest age based on the regrowth curves observed from Landsat imagery. The accuracy of the resultant map is assessed against three datasets: 1) subset of the disturbance maps developed within the algorithm, 2) independent disturbance maps created by the Northern Eurasia Land Dynamics Analysis (NELDA) project, and 3) field-based stand-age distribution from forestry inventory units. The current version of the product presents a considerable improvement on the previous version which used Landsat data samples at a set of randomly selected locations, resulting a strong bias of the training samples towards the Landsat-rich regions (e.g. European Russia) whereas regions such as Siberia were under-sampled. Aiming at improving accuracy, the current method significantly increases the number of training Landsat samples compared to the previous work. Aside from the previously used data, the current method uses all available Landsat data for the under-sampled regions in order to increase the representativeness of the total samples. The final accuracy assessment is still ongoing, however, the initial results suggested an overall accuracy expressed in Kappa > 0.8. We plan to release both the training data and the final disturbance map of the Russian boreal forest to the public after the validation is completed.

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