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Estimation of percent tree cover in Asia using simulation data

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Trees are important structural members of forests. They remove carbon dioxide from the atmosphere when they grow, and emit it when they decay or burn. So far some attempts to produce global percent tree cover maps have been made from this aspect. These maps can be used for deriving carbon cycle models as one of the environmental parameters in it, deciding environmental policies and understanding the present environmental situation on school education. Previous maps of global tree cover percentage produced by some organizations or researchers are not so accurate. The final goal of our study is to produce a precise global percent tree cover map in a certain year and to investigate the change of tree cover.
In this study, percent tree cover was estimated in Asia. It was estimated by regression tree method using MODIS data. The original MODIS dataset (MOD43B4) was converted into the annual predictor variables, such as yearly maximum band values, yearly maximum NDVI value and yearly average band values. The produced predictor variables were used for constructing regression tree model and estimating the percent tree cover. QuickBird images and Google Earth images were used for getting training data. Because the actual land covers are very complicated, many types of training data were needed to make more precise estimate. For instance, cropland, urban area and many kinds of trees and soils are there in one pixel (1km x 1km). To deal with this problem, simulated training data was created by combining a lot of ground truth data that consist of single land cover type according to linear mixture model. In this study, the percent tree cover meant the percentage of the ground surface area covered by a vertical projection of the foliage and branches of trees at the time when trees have grown thick. Small openings inside the crown and small gaps between crowns are included.
The accuracy of the estimation improved by the use of simulated training data with the mean absolute error of 10%. But the majority of improvement was in areas where training data were collected. In areas where training data were not collected, the number of pixels whose absolute error was larger than 30% became smaller, though mean absolute error was not improved. The areas where the estimation result was bad were the south of Vietnam and high latitude areas. One of the reasons is that agricultural fields in Southeast Asia consist of a lot of types in intensity and cropping season. Another reason is that we did not use any training data in water area.
These results suggest that we have to collect more training data throughout Asia. More accurate validation and the comparison with previous researches will be necessary.

Keywords: Global MODIS 2003 data, Google Earth, decision tree