

Combination strategies of variables with various spatial resolutions derived from GF-2 images for mapping forest stock volume.

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Abstract: Combining remote sensing data with few grounds measured samples is a common method for mapping forest stock volume (FSV) in various regions. Recently, various optical remote sensing images have been widely used for estimating forest FSV by capturing canopy structure compositions and growth information of forest. And spectral features (SFs) and texture features (TFs) derived from these optical images with difference spatial resolution are commonly employed to construct various models. However, the accuracy of mapping FSV using optical images with high spatial resolution (one meter or sub-meters) is often lower than medium resolutions (larger than 10 m) using the same type of features and approaches. To overcome the limitation of high spatial resolution images in mapping FSV, meter-resolution images (GF-2) and medium resolution images (Landsat 8 OLI and Sentinel 2) were acquired in this study. And down-scaled images with spatial resolutions ranged from 2 m to 30 m were obtained to interpret the relationships between spatial resolutions of features and accuracy of mapping FSV. Finally, combination strategies of variables with various spatial resolutions were proposed to improve the accuracy of mapping forest FSV using high spatial resolution of images (GF-2). The results show that the spatial resolution of features significantly affects the performance of employed models in estimating FSV, and the sensitivity between spectral features and FSV gradually increases with the decreasing of spatial resolutions. Moreover, the highest correlation between texture features and FSV was obtained from the images with spatial resolutions of 1 m and 2 m. The results also illustrate that the optimal spatial resolutions of two types of features are not synchronized in mapping forest FSV using GF-2 images. After using combination strategies of variables with various spatial resolutions, the rRMSE and R^2 ranged from 24.66% to 28.55%, and from 0.55 to 0.67, respectively. And the optimal result was obtained from variable set (GF-2(SF (30m) + TF(1m))) using SVM model. The results demonstrate that the accuracy of mapped FSV using proposed combination strategies is significantly higher than these results derived from GF-2, Sentinel-2 and Landsat-8 images with the same spatial resolutions of variable sets. It is proved that texture features derived from GF-2 images have great potential to improve the accuracy of mapping FSV, and the contribution of features depend on the approaches of extracting and combination strategies.