Inversion of forest structure parameters using multi-source remote sensing data

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The inversion of forest structure parameters, which are needed in forest management planning, is carried out through the joint use of Sentinel-1A, Sentinel-2A, Landsat-8, GF-2 and field survey data. After atmosphere and terrain correction, Optical bands' reflectance value, intensity of C-band SAR and a series of extracted vegetation index were used in the construction of random forest regression model, terrain factors of slope and aspect were also within consideration. 1 m resolution GF-2 panchromatic imageries were used as the data source of texture analysis and the influences of different size of convolution window were analyzed. We introduce the concept of Normalized Difference Time Index (NDTI) to reflect the impact seasonal changes, which is proved to be an influential variable in our regression model. Through the above work, this article is dedicated to explore the possibility of a practical forest structure remote sensing inversion solution in mountain areas around Three Gorges basin of Yangtze River, which was previously thought as one of two most difficult regions for remote sensing in China.

Vegetation indexes used in this article include Normalized Difference Vegetation Index (NDVI), Enhanced Vegetation Index (EVI), Soil Adjusted Vegetation Index (SAVI), Modified Soil Adjusted Vegetation Index (MSAVI), Normalized Difference Moisture Index (NDMI). Normalized Difference Time Index is expressed in the following form:

$$NDTI = (Band\ X_{summer} - Band\ X_{winter}) / (Band\ X_{summer} + Band\ X_{winter})$$

Texture factors include Mean, Variance, Homogeneity, Contrast, Dissimilarity, Entropy, Second Moment and Correlation of different convolution window.

The correlation coefficient of the model for average tree height is 0.377, with a standard error of 1.1024 m, for average diameter at breast height(DBH) is 0.422, with a standard error of 1.8684 cm, for volume per hectare is 0.556, with a standard error of 11.8606 m^3/ha.This work is still refining according to the needs of forestry production sector.

Keywords: Forest structure parameters, Multi-source, NDTI, Texture