Overview of Vegetation Parameter Estimation Techniques using SAR Polarimetry and Interferometry

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It is important to estimate forest parameters using remote sensing data to understand the impacts of global climate changes on terrestrial ecosystems. Usual forest parameters are biomass, basal area, tree density, tree height, and trunk diameter. These parameters are not independent and some of them are related by allometric equations. This paper presents advantages and limitations of SAR polarimetry and interferometry techniques for estimating forest parameters.

Even though many researchers reported various algorithms to estimate forest parameters using polarimetric SAR data, they may not be applied to all types of forests without additional information on the forest type and environmental conditions. This limitation comes from the fact that radar measurements depend on the tree structure, incidence angle, and environmental conditions. The backscattering cross section also saturates as forest parameters, such as biomass, increase. Therefore, these polarimetric algorithms are most suitable for monitoring the level of regrowth especially when time series data are available. We will examine both absolute and relative polarimetric parameters. Absolute polarimetric parameters are polarimetric backscattering cross sections and eigenvales and relative parameters include the HH and VV correlation coefficient, entropy, anisotropy, and radar vegetation index.

Forest parameters also have been estimated using SAR interferometry. Specifically, the interferometric correlation coefficient has been used to estimate the angular range of volume scattering. Since the correlation coefficient depends on both radar interferometry related parameters and volume scattering, the amount of decorrelation due to volume scattering must be isolated to estimate the tree height. We will compare and contrast polarimetric and interferometric approaches to understand their advantages and limitations using NASA/JPL AIRSAR data.

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