INTERFEROMETRIC AND POLARIMETRIC SCATTERING CHARACHERISTICS OF FOREST CANOPIES

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Mapping forest types and estimating their structural attributes is the first step to understanding the distribution of forest above ground biomass and carbon content in tropics. Synthetic Aperture Radar (SAR) backscatter and interferometric measurements at low frequency (L- and P-band) over tropical forests have shown longer penetration in forest canopy and higher sensitivity to forest stem volume and biomass. In this study, we present a physically based model approach in simulating the foliage penetration and scattering of various forest structural components. Extinction coefficient along the forests vertical structure controls SAR polarimetric and interferometric measurements. By using the wave theory approach and the structural data collected from field surveys, the heterogeneity of forest canopy is included in the model by introducing analytical expressions for the crown size and shape, gap geometry, and the canopy roughness. Radar measurements collected at a site in neotropical forest of La Selva in Costa Rica were used to examine the performance of the model and to analyze its behavior in terms of forest structural parameters such as basal area, height, vertical distribution of leaf area, and the above ground biomass. Once the significance of structural parameters and their contributions to the extinction coefficient are determined, the model results were used to test the hypothesis that radar backscatter and interferometric cross-correlation respond to different aspects of vegetation structure. Can interferometric measurements at low frequencies recover the vertical structure of the forest canopy? Comparison with field and radar measurements is used to provide quantitative tests of the hypothesis and the sources of uncertainties.

Keywords: SAR, Backscatter, Interferometry, Forest Structure

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