ERRORS IN TROPICAL-FOREST STRUCTURE PARAMETERS ESTIMATED FROM REPEAT-TRACK POLARIMETRIC INSAR AT L-BAND

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1. INTRODUCTION

Tropical forests contain approximately 50% of the Earth's aboveground forested biomass. They represent a particularly challenging target for structural remote sensing. Proposed and existing spaceborne sensors will make repeat-track polarimetric interferometric SAR (PolInSAR) measurements at L-band, and the goal of this paper is to explore the error budget for estimated structural parameters such as height, moments, and full profiles.

2. TROPICAL FOREST DATA AND STRUCTURE ESTIMATION MODES

Repeat-track data taken at La Selva Biological Station with AirSAR in Costa Rica will be used to test various model assumptions in the structure-estimation process. We will attempt three modes of structure estimation: 1) Tree height will be estimated using a uniform, random-volume-over-ground (RVOG) model. 2) Without assuming RVOG, we will attempt to estimate profile moments—means, standard deviations, skewnesses—from few-baseline PolInSAR by isolating the vegetation contribution to the PolInSAR complex cross correlation. 3) From multiple-baseline PolInSAR, with vertical wavelengths (2π/the vertical wave number) ranging from 5 to 80 m, we will estimate vegetation profiles. All estimation results will be compared to existing vegetation profiles estimated at C-band from InSAR [1], estimated from LVIS lidar [2], and estimated from field measurements.

3. TEMPORAL DECORRELATION MODELING MODES

Special attention will be paid to the error induced by temporal decorrelation, which arises from changes in the scene between the epochs of PolInSAR data acquisition required to synthesize a baseline. We will address temporal decorrelation in three modes: 1) Height, moment, and profile errors resulting from temporal decorrelation without any corrective modeling will be evaluated. 2) Various means of preaveraging the repeat-track data to reduce the effect of temporal decorrelation will be examined. 3) Temporal decorrelation will be modeled as a "coherence-only" effect on the vegetation volume only [3] and estimated along with the tropical-forest structural parameters. The consequences of ignoring the ground decorrelation and the feasibility of trying to estimate it along with the volume decorrelation will be explored. Errors on time scales from a few minutes to 3 days will be tested.

4. DETAILED PHYSICAL MODELING OF THE GROUND RETURN

For the most part, we will concentrate on the third mode above of addressing temporal decorrelation. We will explore two methods for estimating temporal decorrelation parameters along with structural parameters. In the first, we will not make any assumptions as to the nature of the ground contribution, i.e. whether it is from direct ground scattering or ground-trunk or ground-volume scattering, as in [4]. In the second approach, we will attempt to specify the dominant ground contribution and model it explicitly in terms of ground dielectric and roughness parameters. In both approaches, "zero-baseline" polarimetry will be added to the PolInSAR data to try to enhance structure parameter accuracy. However, preliminary tests suggest that polarimetry does not strengthen the structural parameter estimates for the first method mentioned above—in which the scattering mechanism from the ground is not specified.

5. ACKNOWLEGEMENT

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6. REFERENCES

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