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Abstract

Title: Canopy reconstruction from interferometric SAR

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Interferometric Synthetic Aperture Radar (InSAR) is investigated as a method for 3D tree mapping. When operational, the method may be important for monitoring forests with a persistent cloud cover such as tropical rain forests. The problem of crown displacement due to lay-over in a vegetation with a large vertical variation in scatterer height is studied. It is shown that crown displacements can be corrected for, by using coherence. An analytical expression for the coherence is derived which can be used for crown position corrections. The model is validated and shown to be consistent with observations. The water cloud model has been extended with interferometric phase, coherence and crown geometry. This model is used to simulate realistic InSAR images of a 3D forest canopy using measurements of 1064 trees. It is validated by comparing observed with simulated image statistics. The normalised second intensity moment, coherence histogram and coherence autocorrelation in range direction are used for this purpose. Results indicate a good agreement at C-band for an extinction coefficient of 0.3 per meter. Two image transforms are derived based on Gaussian scattering assumptions. These transforms may be used for automated canopy reconstruction. Finally, the simulation method and the intensity image transform are used to study the effect of InSAR system parameters on the position accuracy.