Explore biophysical information of radar and lidar data using theoretical models

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ABSTRACT

The use of lidar and radar instruments to measure forest structure attributes such as height and biomass are being considered for future Earth Observation satellite missions. Large footprint lidar makes a direct measurement of the heights of scatterers in the illuminated footprint and can yield information about the vertical profile of the canopy. Synthetic Aperture Radar (SAR) is known to sense the canopy volume, especially at longer wavelengths and is useful for estimating biomass. Interferometric SAR (InSAR) has been shown to yield some forest canopy height information. There is much interest in exploiting these technologies separately and together to get important information for carbon cycle and ecosystem science. More detailed information of the electromagnetic radiation interactions within forest canopies is needed and backscattering models can be of much utility here. Our three-dimensional (3D) incoherent radar backscattering model was modified to simulate coherent returns. The modified model was tested using the forest stem map and PALSAR InSAR data in Howland, Maine. The modified radar model and a 3D lidar waveform models then were used to investigate the use of large footprint lidar, SAR and InSAR for characterizing realistic forest scenes. The tree height indices derived from lidar waveform and heights of InSAR phase centers were compared. Results will address the possible synergies between lidar and radar data in terms of forest structural information.

Key words: radar, InSAR, backscatter models, vegetation canopy, Lidar waveform