Bistatic Scattering from Forests with Underlying Rough Surfaces

Can Suer*, Roger H. Lang
Department of Electrical and Computer Engineering,
George Washington University,
800 22nd St NW, Washington, DC, 20052, USA
suer@gwu.edu, lang@gwu.edu

A backscattering model from a forest with an underlying rough surface will be extended to account for bistatic scattering. The forest is modeled by discrete scatterers such as lossy dielectric cylinders representing trunks, branches and needles and lossy dielectric discs representing leaves. A Distorted Born Approximation (DBA) has been used to compute the backscatter. Results show that the radar returns consist of a direct or volume scatter term, a direct reflected or double bounce contribution and a surface scatter term. The main contribution to the double bounce is from trunks. The incident wave is secularly reflected from the trunk and then from the average surface. The average surface reflection coefficient is modified by a rough surface factor that gets smaller as the surface roughness increases. When the surface is sufficiently rough, Lang [2004] showed that the double bounce term is replaced by the waves scattered from the trunk and then from surface fluctuations (correctly oriented surface facets).

The present work will extend the model to include the bistatic scattering case. The behavior of the double bounce term for scattering angles close to the backscatter direction will be discussed for both P and L band frequencies. The size of the roughness will be related to direct reflected contributions for the average surface and from surface fluctuations. In addition, the case of forward specular reflection from the trees will be discussed. Bistatic models will be run using Howland forest tree data collected by the George Washington University and NASA personnel in 1989 -90.