MODELING AND SIMULATION OF WAVE SCATTERING FROM MULTI-SCALE SURFACES

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It is apparent that most naturally occurring surfaces, land or sea, contain more than one scale of roughness. On the other hand, modeling studies of backscattering from these surfaces rarely deal with more than two scales of roughness. The purpose of this study is to investigate how the different scales of roughness in multi-scale randomly rough surfaces respond to backscattering at different frequencies and look angles.

This study is carried out through both numerical simulation and analytical modeling on Gaussian-distributed and Gaussian-correlated, two-scale and three-scale, randomly rough surfaces. In the numerical simulation, the method of moments (MoM), also known as moment method, is applied. In the analytical modeling, the integral equation surface-scattering model (IEM) is applied. The numerical simulation results are shown to compare well with surface model predictions. To provide points of reference, single-scale calculations of each individual scale of roughness are also provided.

It is observed from these studies that (1) at low frequencies, the total backscattering is similar to, but is at a higher level than that based on the large scale alone in a multi-scale rough surface; (2) at intermediate frequencies, the backscattering at small angles of incidence tends to follow that of the large-scale roughness, and at large angles of incidence, it tends to follow that of the small-scale roughness. The two different angular trends due to the difference in roughness scales are less obvious for a three-scale than a two-scale surface, and (3) at high frequencies (except for near normal incidence), backscattering is dominated and can be explained by the backscattering from the small-scale roughness.

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2. F - Wave Propagation and Remote Sensing

3. (a)

4. C - Contributed Paper

5. No special instructions