# Backscattering from Martian Regolith Layer over an Underlying Half Space of Water/Ice

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Abstract

The use of SAR to detect buried ice at shallow depths under the Martian surface is explored. An electromagnetic model consisting of a dielectric layer that represents the Martian regolith, with an underlying half space of water/ice, is considered. The top surface of the regolith and the regolith /ice interface are assumed to be rough. It is also assumed that throughout the regolith, small basalt particles are randomly distributed. Backscattering from vertical or horizontal polarized waves incidence at P-band and L-band frequencies are considered. The problem is simplified by assuming that the fractional volume of scatterers is small. The roughness, in addition, is assumed to satisfy the Kirchhoff assumptions. The features of the backscatter power are examined as a function of polarization, incident angle, fractional volume of scatterers, depth of regolith and roughness of the top and bottom surfaces.

The total backscattered power can have many components in a complex model such as this one. Four of the strongest components are considered here. First, the direct backscatter from the top surface is evaluated; second, power transmitted through the average upper surface and backscattered from the lower rough surface is analyzed. The other two components are due to scattering from the basalt particles in the layer. The first of these is direct or volume backscatter from the particles. The second term is scatter from the particles to the regolith/ice interface, and the secular reflection from its average surface back to the radar. The particle scattering will be treated by the Distorted Born Approximation (DBA) under the assumption that the particles are small compared to wavelength and the fractional volume of particles is small.

Two of these four waves interact with the regolith/ice interface and thus can be used to sense the presence of the ice. Backscattering from the upper surface can hide the regolith/ice effects. The regolith consists of sandy dry material but it is assumed to have a small loss. This loss can attenuate the signal returning from the regolith/ice boundary and thus the regolith layers of several meters in thickness only, are considered. The talk will focus on what medium parameters are needed for ice detection