RADAR SOUDER ECHO FROM STRATIFIED MEDIA
WITH ROUGH INTERFACES AND SIMULATION OF LUNAR EXPLORATION

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1. INTRODUCTION

Spaceborne high frequency (HF) radar sounder is an effective tool for investigation of subsurface structure of stratified media. The primary strategy for radar sounder detection of subsurface structure is through the time delay and intensity difference of the nadir echoes from the surface and subsurface (see Fig. 1). It is important to fully understand electromagnetic wave propagation, scattering and attenuation through the stratified media with rough interfaces for information retrieval of the media physical properties and layering structure. Based on Kirchhoff approximation of rough surface scattering and ray tracing of geometric optics (see Fig. 2), an effective numerical approach of radar echo simulation from layering structure with rough interfaces is developed.

This study is especially focused on radar sounder technology for lunar media/surface exploration. Following the lunar surface feature, the topography of mare and highland surface is generated (see Fig. 3), and the triangulated network is applied to making digital elevation of lunar surface for numerical scattering calculations and range image simulation (see Fig. 4). Scattering from the lunar surface and subsurface are numerically calculated. Radar echo image with the radar range is produced (see Figs. 5,6), and its dependence upon the surface parameters is discussed.
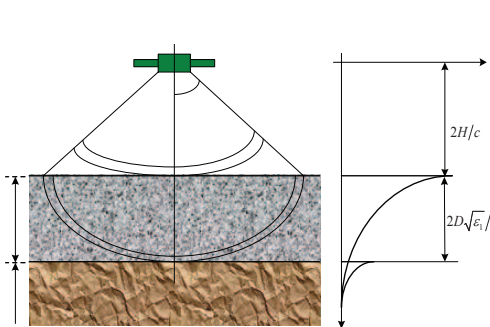

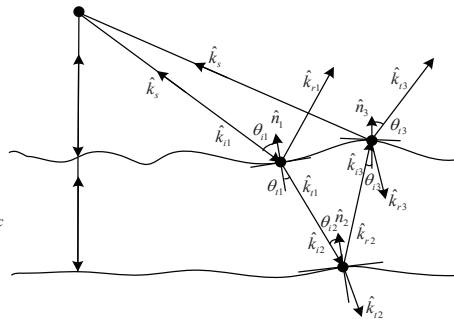Figure 1. Radar sounder principle for exploration of stratifiied media.

Figure 2. A model for scattering from rough interfaces in ray tracing approach
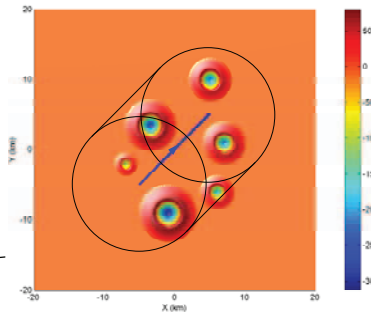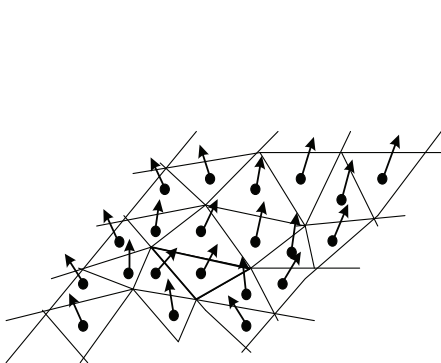

Figure 3. Mare and highland rough surface

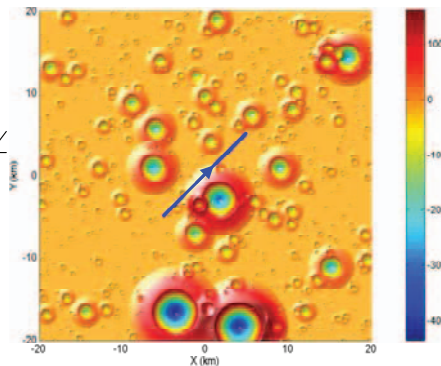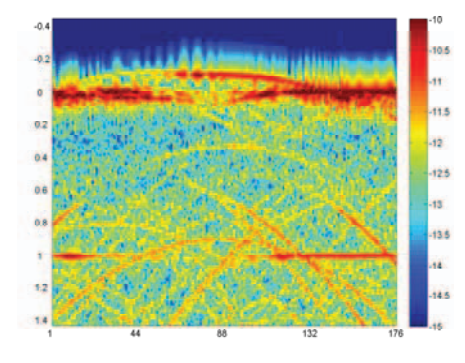Figure 4. Triangulated network making

Figure 5. Lunar surface exploration

Figure 6. Range image of radar echo simulation.

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