Polarimetric Investigation of a Two Surface Layer Structure using L-band PALSAR data

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Abstract

The use of fully polarimetric SAR (Synthetic Aperture Radar) in two layer surface probing can reveal facts about the regolith surface and subsurface geometric and dielectric characteristics. In this sense an analytical scattering model of a two layer structure, with small scale roughness, had been proposed [1]. The model intends to extract information about the subsurface permittivity, with a side looking SAR at a frequency, which is low enough for penetrating the upper layer. The model takes into account the distributed nature of surface and subsurface. Upper layer properties are required to be within a certain range, e.g. relatively low permittivity and small roughness, such that it is possible to receive enough backscattered signal which contains information about the subsurface. The recovery of the sub-surface physical properties is performed by using quad-pol data acquired at two or more incident angles.

The model is evaluated at two-layer structures. In this paper we focus our analysis on frozen lakes imaged by ALOS PalSAR Quad and/or Dual-pol mode. The upper layer consists of ice and the lower is water. The ice water interface provides high reflectivity because of the strong dielectric contrast between the two media. The influence of this interface had already been noticed by comparing the back scattered power from floating ice and grounded ice [2]. Therefore it is a good candidate for evaluating the model's performance. Further adjustment of the model is necessary regarding the surface and subsurface description, due to the different spatial properties of the interface for different sites. Other effects might influence the propagating electromagnetic wave like the crystal structure of the ice and the bubbles that might be present in the ice layer. We present the analysis of ALOS PalSAR data and discuss the inversion performance.

[1] Polarimetric SAR Investigation for a Two Layer Structure, *Noora Al-kahachi* ; Konstantinos P. Papathanassiou, EUSAR 2010
[2] RADARSAT backscatter characteristics of ice growing on shallow sub-Arctic lakes, Churchill, Manitoba, Canada, Claude R. Duguay, Terry J. Pultz, Peter M. Lafleur and D´eborah Drai, Hydrol. Process. Vol. 16, pp. 1631–1644 (2002)