MICROWAVE REMOTE SENSING AND RETRIEVAL OF SEA ICE PARAMETERS WITH MULTIYEAR DATA AND RADIATIVE TRANSFER THEORY

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The use of microwave remote sensing to retrieve physical data of the polar region is a feasible solution in monitoring Antarctica. However, this depends on accurate analysis and interpretation of satellite radar data before the technology can be implemented successfully. In view of this, a forward and inverse microwave scattering model for sea ice for the purpose of radar backscatter prediction and analysis as well as sea ice thickness retrieval based on radar backscatter data is developed. The developed forward model is based on the Radiative Transfer Theory with Dense Medium Phase and Amplitude Correction Theory (RT-DMPACT) with the addition of the Levenberg-Marquardt Optimization algorithm in the inverse model. In this paper, the applicability of the model is investigated by using input data from ground truth measurements carried out in Ross Island, Antarctica together with radar backscatter data extracted from RADARSAT 1 satellite images under different conditions. Firstly, an analysis of the sensitivity of the forward model towards varying sea ice thickness shows that the use of HH polarization, C-band radar backscatter data and the single layer scattering model is suitable for monitoring of sea ice. This is followed by a theoretical analysis of the inverse model and lastly, the sea ice thickness retrieval of first year sea ice for the years 2005 to 2007 using the model and satellite data. The estimated sea ice thickness is compared with the ground truth measurement data to verify its accuracy. The results have shown the correct estimation of the sea ice thickness within 0.2m to 1.7m using the inverse model with single polarization active microwave remote sensing.