32nd URSI GASS, Montreal, 19-26 August 2017

Comparison of Theoretical and Experimental Brightness Temperatures for Snow on Terrain and Snow on Lake Ice

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Extended Abstract

Microwave radiometer measurements of seasonal snow cover provide information on the relationship between the brightness temperature and snow characteristics. Brightness temperature depends on weather history and, hence, long-term ground-based measurements are most useful. The outcome can be used to improve snow emission models and algorithms for retrieval of snow characteristics, especially snow water equivalent (SWE), from space-borne microwave radiometer data. Characteristics of snow on ice-covered lakes may substantially differ from those for snow on terrain. These effects show up in the brightness temperature of the snow/lake ice/water system. Due to the modest spatial resolution of space-borne radiometers, investigation of the brightness temperature behavior of snow on lake ice can be only done with airborne radiometers. In lake-rich regions, accounting for the effect of lakes to the satellite-derived brightness temperature pixels improves accuracy of SWE retrieval. Two experimental multi-frequency radiometer data sets are discussed: A tower-based campaign of terrestrial seasonal snow and a multiyear airborne research program of snow on lake ice. The two data sets were obtained in southern Finland. In this paper the overall behavior of the brightness temperature during the ground-based radiometer campaign of terrestrial snow and the airborne radiometer research program for snow on lake ice is discussed and selected results are compared with theoretical values. The comparisons suggest that the HUT snow emission model can predict with reasonable accuracy the brightness temperature of seasonal snow cover at frequencies up to 37 GHz before the start of the melt/freeze cycle. Problems for modeling are introduced by the surface structure (clustering) of refrozen snow and wet internal snow layers.