

Project acronym: TreeCan-RT

Project title: Validating microwave radiative transfer models of tree canopies in wintertime

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Discipline: Earth Sciences & Environment

Station(s): SOD-PALLAS (Finland)

Passive microwave instruments are a key tool for snow cover and snow mass observation at regional to hemispheric scales. However, in forested regions tree canopies attenuate microwave emission from the ground beneath contributing additional emission from the canopy itself. Therefore, the emission signature from the below-canopy snow is moderated by the emission from the forest canopy above. Since forest landscapes are prevalent regionally, especially at mid-latitudes, retrieval of snow water equivalent in forests is a key challenge in the estimation of snow properties from microwave observations. Radiative transfer (RT) model studies of vegetation canopy have revealed detailed physical mechanisms of the emission process. However, due to the lack of ground observations, these models are validated only at a few locations making their applicability at global scales challenging. Local-scale experiments that focus on snow and vegetation RT processes can provide significant insights for model behaviour.

The primary aim of this research is to evaluate the effect of canopy transmissivity on the microwave emission from a forest landscape during fall-winter using RT models and field measurements, and to quantify the performance of model parameterization strategies. This study will also evaluate environmental variables that control snow metamorphism in the canopy and on the ground. The research will be conducted at an established field site operated by the Finnish Meteorological Institute's Arctic Research Station at Sodankylä. This site is unique since it has an installed and operational suite of PM instruments for observing snow and tree-canopy targets through the fall-winter time.