# Brightness Temperatures of Snowpack from Microwave Radiative Transfer Models (RTM) by using Two Separate Drivers: 1) Snow Physics Model Outputs, and 2) *in situ* Snowpit Stratigraphy

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**ABSTRACT**

This paper evaluates different brightness temperature (Tb) from three microwave radiative transfer models (RTM) of snowpack simulated by 1) snow physics model outputs, and 2) *in situ* snow stratigraphy observations. A set of evaluations is conducted by simulating the RTM (HUT among three RTMs) with the output of a snow physics model driven by actual weather forcing in a coupled simulation. Outputs of this coupled model include snowpack physical properties and Tbs. Another part of Tb simulation is also included with RTMs driven by *in situ* snowpit stratigraphy observations. The snow physics outputs from the coupled case are compared against *in situ* snow stratigraphy measurements from the European Space Agency Nordic Snow Radar Experiment (NoSREx) 2009-2012. And, both RTM and *in situ* driven Tb simulations are compared against ground-based microwave observations also at NoSREx. The paper suggests a temporarily divisional approach to interpret microwave Tb to relate snow conditions along the snow year, e.g. Phase 1~4, from accumulation to melt. For three consecutive years, 2009-12, the *in situ* driven Tbs have 21.0 K Root Mean Squared Error (RMSE), while the coupled simulations have 24.7 K RMSE. Particularly, the water year 2011 is divided into 4 Phases. In the Phase 3 in 2011, 12.2 K and 6.3 K RMSEs are achieved from *in situ* and coupled cases, respectively. Such an RMSE improvement (6.3) from the coupled case in the Phase 3 is made after isolating the dry snow period and excluding diurnal melting snow conditions.

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