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Validating snow surface radiative transfer models between 89 and 243GHz using airborne observations over Arctic tundra

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Satellite microwave radiances in atmospheric sounding bands, such as the 183GHz water vapour band, are an important source of data for Numerical Weather Prediction. However, these observations are frequently discarded in polar regions as they are also sensitive to the surface, and there is large uncertainty in the background surface emissivity which depends on the microphysical properties of the snowpack. We evaluate simulations of brightness temperature and emissivity from the Snow Microwave Radiative Transfer (SMRT) model for Arctic tundra snow at frequencies between 89 and 243GHz to assess the potential of being able to assimilate observations at key sounding frequencies, such as 183GHz. In-situ measurements of the surface snowpack were collected for 36 snow pits in Trail Valley Creek, near Inuvik, Canada during the March 2018 Measurements of Arctic Cloud, Snow, and Sea Ice nearby the Marginal Ice Zone (MACSSIMIZE) campaign, a collaboration between the Met Office, Northumbria University, Edinburgh University and the Universite de Sherbrooke. These snowpack measurements provide realistic microphysical snow properties as input to SMRT. We present the evaluation of SMRT simulations against surface-based radiometer observations and airborne observations taken with the Microwave Airborne Radiometer Scanning System (MARSS) and International Submillimetre Airborne Radiometer (ISMAR) on the Facility for Airborne Atmospheric Measurements (FAAM) BAe 146 research aircraft.