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Application of a coupled microwave, energy and water transfer model to relate passive microwave emission from bare soils to near-surface water content and evaporation

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Abstract. The paper examines the stability of the relation between microwave emission from the soil and the average near-surface water content in the case of relatively smooth, bare soils, and then considers the extent to which microwave radiometry can be used to estimate the effective surface resistance to vapour transfer, which is also related to the near-surface water status. The analysis is based on the use of a model (MICRO-SWEAT) which couples a microwave radiative transfer model with a SVAT scheme that describes the exchanges of water vapour, energy and sensible heat at the land surface. Verification of MICRO-SWEAT showed good agreement (about 3K RMSE) between predicted L band (1.4 GHz) brightness temperature over soils with contrasting texture during a multi-day drydown, and those measured using a truck-mounted radiometer. There was good agreement between the measured and predicted relations between the average water content of the upper 2 cm of the soil profile and the brightness temperature normalised with respect to the radiometric surface temperature. Some of the scatter in this relationship was attributable to diurnal variation in the magnitude of near-surface gradients in temperature and water content, and could be accounted for by using the physically-based simulation model. The influence of soil texture on this relationship was well-simulated using MICRO-SWEAT. The paper concludes by demonstrating how MICRO-SWEAT can be used to establish a relationship between the normalised brightness temperature and the surface resistance for use in the prediction of evaporation using the Penman-Montheith equation.

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