Mathematical modelling of surface resistances and evapotranspiration rates at agricultural sites

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A b s t r a c t: A three-layer one-dimensional steady-state Soil-Vegetation-Atmosphere Transfer (SVAT) model for simulations of interrelations between the water regime of homogeneous plant canopies and the structure of their energy balance has been developed and tested. The verification of the model was carried out through experimental data referring to various field crops. This model was used for an estimation of the canopy resistance and surface fluxes in fields with rye, spring barley, winter wheat and uncut grass. The surface resistance values varied in a wide range among the fields. Values of the surface resistance on the selected day of 8^{th} June 1994 averaged over the period between 6 a.m. and 6 p.m. ranged between 0.36 s cm^{-1} for dense and closed rye canopy to 1.14 s cm^{-1} in the case of the field with sparse spring barley. Daily totals of evapotranspiration varied from 3.40 m day^{-1} in spring barley stand to 5.44 mm day^{-1} in the field with winter wheat. The relationship between the transpiration and surface resistance was found and quantitatively expressed. It was found out that the canopy conductance of 1.2 cm s^{-1} may be taken as the threshold value of the canopy conductance, below which its impact on transpiration is significant and above it negligible.

Key words: SVAT model, canopy resistance, surface resistance, transpiration, evapotranspiration, field crops

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