SOIL EVAPORATION ESTIMATION: A COMPARISON OF APPROACHES

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A simple empirical model for soil evaporation (3), which requires only two experimentally determined soil input parameters, was compared to a more complex theoretically based routine (1) which forms part of a plant-soil water model (2).

METHODS

Simulations were carried out on a loam soil with initial water content 0.35 m3/m3, under a potential evapo-transpiration rate of 0.493 mm/day, or under real weather conditions of 1987 in Armidale.

RESULTS AND DISCUSSION

Evaporation over time for a single drying event was estimated using the theoretical model, and used to calibrate Ritchie's model. The form of the curves was similar, with accumulated stage 2 evaporation by the numerical method being nearly linearly related to the square root of time, as is assumed in Ritchie's method. Using the fitted parameters from the single drying event, Ritchie's model predicted an annual evaporation for Armidale of 843 mm, compared to 809 mm from the numerical model.

An oversimplification in Ritchie's method is that when rain falls during stage 2 of the evaporation cycle, evaporation does not return to stage 1 until the profile is refilled. In reality, stage 1 evaporation starts as soon as the surface soil is wet or when the rainfall is greater than the potential evapo-transpiration. Simulations showed that under some conditions this could lead to an underestimate of evaporation rate. Another limitation is that the model should be started when the profile is wet to field capacity to a depth which is greater than 50 cm, so the initial value of the accumulated stage 1 evaporation, *E1*, can be set to zero. Simulations with the numerical model showed that when the wetted depth is less than 50 cm, *E1* is nearly linearly related to the wetted soil depth, *D*, and the initial value of *E1* can be approximately related to the upper limit of accumulated evaporation in stage 1, *E1UL , by:*

E1 = *E1UL* (1 D / 50) (D<50 cm)

Thus, the wetting depth can be input as a less restrictive initial condition in partially wetted soils. The relationship was found to hold for both a loam and a clay soil. Use of Ritchie's approach provides a simpler means of estimating soil evaporation than a theoretically based model, and can yield similar results.

REFERENCES

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