NOTES AND CORRESPONDENCE

Comments on "Energy Budgets for Three Small Plots—Substantiation of Priestley and Taylor's Large-Scale Evaporation Parameter"

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Thompson (1975) presents a discussion of energy budget measurements made over three cover types in eastern Arizona. Small-scale plots have been used and the land surfaces were unsaturated. Thompson effectively advances three theses, which we summarize as follows:

1) That the potential evaporation is characterized by a ratio LE/R of 1.0. Here LE is the latent heat flux, s the slope of the saturation vapor pressure-temperature curve, γ the psychrometer constant, R the net radiation flux, G the soil heat flux, and $\alpha = LE/[s(R-G)/(s+\gamma)]$.

2) His Fig. 1 supports a value of 1.26 for Priestley and Taylor's proportionality factor α for potential evaporation conditions (Priestley and Taylor, 1972).

3) That equilibrium evaporation LE_{EQ}, i.e., $\alpha = 1.0$, does not reasonably approximate actual evaporation from "fairly dry surfaces."

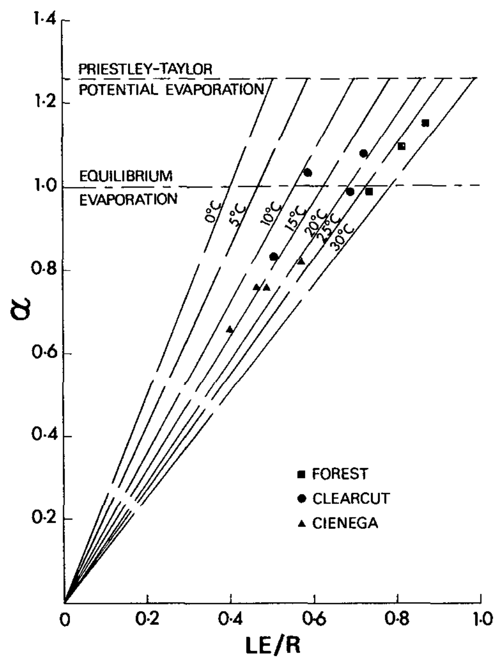

Fig. 1. The temperature dependence of the relationship between α and LE/R superimposed on experimental data of Thompson (1975).

However, if we make the reasonable approximation that on a daily basis G approaches zero, it is possible to superimpose on Thompson's Fig. 1 lines expressing his Eq. (7) (the Priestley and Taylor expression) as a function of temperature. This is done in our Fig. 1. It should be noted that the experimental data seem to lie close to the lines appropriate to the daytime temperatures quoted for forest and cienega. Our Fig. 1 further demonstrates that the value of α equal to 1.26 can be achieved over a wide range of values of LE/R, depending on temperature. This suggests that conclusion 1) above is unwarranted, although there is no doubt that trend of the data is toward an intersection with $\alpha = 1.26$ at $LE/R = 1.0$. Since the superimposed field, and also an analysis of the concepts behind the Priestley-Taylor suggestion that α equals 1.26 for well-watered land areas, both support the idea that there should be no unique relationship between LE/R and α, this intersection merely reflects the limited data set.

In fact, Thompson provides evidence that the cienega data are from a relatively well-watered environment, while the forest sites were under greater water stress. We therefore conclude that since the forest sites show α values between 1.0 and 1.18 and cienega sites values between 0.66 and 0.82, the forest may indeed behave as a Priestley-Taylor surface and it does appear that a value of α equal to 1.0 is obtained for dryer periods. The data also suggest that the cienega value of α at potential evaporation conditions is significantly less than 1.26 and may be as low as 0.85–0.90.

In summary, we feel that Thompson's theses must be regarded as questionable.

REFERENCES

Priestley, C. H. B., and R. J. Taylor, 1972: On the assessment of surface heat flux and evaporation using large-scale parameters. *Mon. Wea. Rev.*, **100**, 81–92.

Thompson, J. R., 1975: Energy budgets for three small plots—substantiation of Priestley and Taylor's large-scale evaporation parameter. *J. Appl. Meteor.*, **14**, 1399–1401.