FIELD INVESTIGATIONS OF EVAPORATION FROM A BARE SOIL

by

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As members of the Final Examination Committee, we certify that we have read the dissertation prepared by Steven Roy Evett

entitled FIELD INVESTIGATIONS OF EVAPORATION FROM A BARE SOIL

and recommend that it be accepted as fulfilling the dissertation requirement for the Degree of Doctor of Philosophy.

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Final approval and acceptance of this dissertation is contingent upon the candidate's submission of the final copy of the dissertation to the Graduate College.

I hereby certify that I have read this dissertation prepared under my direction and recommend that it be accepted as fulfilling the dissertation requirement.

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STATEMENT BY AUTHOR

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SIGNED:__________________________________

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ABSTRACT

Selected components of the water and energy balances at the surface of a bare clay loam were measured at 57 locations in a 1 ha field. Spatial and temporal variability of these components were also studied. Components included evaporation, irrigation, moisture storage, sensible heat flux and long wave radiation. Sub-studies were conducted on irrigation uniformity under low pressure sprinklers; and, on steel versus plastic microlysimeters (ML) of various lengths.

An energy balance model of evaporation, requiring minimal inputs, was developed and validated giving an r^2 value of 0.78. Model improvements included an easy method of accurately estimating soil surface temperature at many points in a field, and an empirically fitted transfer coefficient function for the sensible heat flux from the reference dry soil. The omission of soil heat flux and reflected shortwave radiation terms was shown to reduce model accuracy.

Steel ML underestimated cumulative evaporation compared to plastic ML at 20 and 30 cm lengths. Cumulative evaporation increased with ML length. The 10 and 20 cm ML were too short for use over multiple days but 30 cm ML may not be long enough for extended periods. Daily net soil heat flux for steel ML averaged 44% higher than that for both plastic ML and undisturbed field soil.

Christiansen's uniformity coefficient (UCC) was close to 0.83 for each of 3 irrigations when measured by both catch cans and by profile water contents. But UCC for the change in storage due to irrigation averaged only 0.43 indicating than the high uniformity of profile water contents was more due to surface and subsurface redistribution than to the uniformity of application.

Profile water contents and catch can depths were time invariant across at least 3 irrigations. Midday soil surface temperatures and daily evaporation were somewhat less time invariant. Variogram plots for evaporation and surface temperature showed mostly random behavior. Relative variograms represented well the spatial variability of both catch can depths and profile water contents. A strong link was demonstrated between the time invariance of a variable and the usefulness of kriging on that variable.