The Environmental Dependent Passive Flux Meter: A Numerical Model Assisted Design

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The degree of deep infiltration in the vadose zone is an important measurement to obtain for many applications and studies in the field of agriculture, containment management, and groundwater recharge. However, a simple and effective technology for direct water flux measurements has been elusive-many are associated with large margins of error. A previous study demonstrated the use of correct materials as well an added evaporation prevention design that can minimize the instrument errors. In this study, the flux meter design of wick length, divergent pipe length, and pipe diameter were studied systematically with a numerical model. Different flux schemes were applied to the flux meter with various designs under various soil environments. The numerical results demonstrated that the design of the flux meter is dependent on all the parameters described above. A long wick length is particular useful for fine soil and dry climate while the long divergent pipe can help to stabilize the vertical flow fields, thus preventing convergent and divergent flows. The large diameter of the pipe can also improve the flux measurements. In this study, the use of numerical model to assist the design will greatly increase our success for more accurate flux measurement by taking the local soil type and climate environment into consideration. While the passive flux meter is not able to react to changes in the surrounding environment, its low cost and simple design has the advantage of producing precise and accurate flux measurements with some assistance from numerical models. Three soil types were used in this study to demonstrate the fundamental difference of the flux meter design.

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