
Dear Editor:

It is nice to see a paper in JEQ on improving soil water-flux measurements. Masarik et al. (2004) provide an interesting extension of previous work by Brye et al. (1999) related to the so-called AETL (automatic equilibrium tension lysimeter). The AETL is a device designed to automatically collect soil water at tensions similar to those found in the surrounding soil. Under such conditions divergence or convergence of flow is minimized and the collected water should be representative of true pore water concentrations. In theory, the drainage water is captured at flux rates similar to the actual soil-water flux. The major contribution of the Masarik paper is a proposed way to continuously monitor drainage, using an ECH2O (Decagon Devices, Pullman, WA) capacitance probe as a stage recorder placed in the collection pan of their AETL unit. As the water level in the collection pan rises, the capacitance probe output voltage changes in a predictable (near-linear) fashion. The ECH2O probe data can then be converted to a water volume (per unit cross-section) and subsequently reported in millimeters of water. Thus, for a given period of time, water flux can be estimated.

The authors suggest that their AETL units are superior to PCAPs (passive-capillary wick lysimeters) for drainage (water flux) measurements in the vadose zone for several reasons. First, PCAPs control the drainage at a nearly fixed tension, so if the soil is very conductive and drainage is occurring at some elevated tension, above that of the passive wick, flow can diverge around the lysimeter and the unit may undersample the drainage water. If, on the other hand, the soil-water tension in the PCAP is greater than the soil, the drainage water can converge and the PCAP may oversample. In contrast, AETL units are designed to control the tension between the collection zone and that external to the lysimeter so that the tension is essentially the same outside and inside the lysimeter. Second, Masarik et al. (2004) indicate that PCAPs have relatively small diameters (<1000 cm²) while the AETL units are generally larger (>1000 cm²) and thus will capture more water. Finally, they suggest that the PCAPs require backfilling of the soil, which they assert is a “serious flaw” in many studies that require drainage from undisturbed soil profiles, a problem that AETLs claim to avoid.

I wish to clarify several issues regarding PCAP-type water fluxmeters. First, the PCAP units that are commercially available from Decagon Devices (e.g., Drain Gauge) (www.decagon.com) are also auto-siphons, an auto-siphon drains the collection volume of approximately 45 mL and the process repeats itself until the ECH2O probe captures both the stage and the auto-siphon discharge events such that very precise measurements (i.e., much less than 1 mm water resolution) can be made. The water fluxmeter of Sledge Sales has a tipping bucket approximately 5-mL resolution (<0.2 mm water).

The second issue is related to application. Automated lysimeters are used in undisturbed soils. In a manner similar to the AETL installation, PCAP lysimeters have been installed in undisturbed soils for years (see Boll et al., 1992; Loucks et al., 2002). The Drain Gage water fluxmeter can be installed in the soil in a manner similar to PCAP units and AETL units by caving out a hole, digging the unit into place. While many fluxmeters have been installed in very coarse soils, where disturbance is not a major issue, they have also been installed in undisturbed soils in a side-by-side fashion with AETLs. Depth of placement may at some sites be sensitive, but in areas where soils and water tables are low, it is relatively easy to permit it, this should not be a serious limitation. It should also be mentioned that AETLs are not easily installed in soils with low structure (e.g., coarse sands or soil contents) and installing any collection device can be done with PCAPs in “undisturbed” soil is still an art form.

Another issue is the size of the capture area. Passive-capillary wick lysimeters are not limited to 346 cm², as stated by Masarik et al. (2004), but can be almost any size. The PCAP units of tension control. In addition, hysteresis, which is significant in the heat dissipation units (HDUs) used by the authors for sensing tensions have a bubbling pressure of 100 cm so they are completely insensitive in the range of tension control. In addition, hysteresis, which is not factored into the control scheme. It is apparent oversampling of drainage by Masarik et al. (2004; Fig. 3), where drainage is shown to be initiated by precipitation, could be due to the lack of tension control, wetting (intense rain) periods. The wet-end problem might be overcome by using tensiometer-type controllers, which can be used to control drainage, but this means that the soil is wet (intense rain) periods.