Response to “Comments on ‘Field Calibration of a Capacitance Water Content Probe in Fine Sand Soils’”

The authors thank the writer for his time, effort, and constructive comments. Permittivity is the preferred method of developing a universal calibration for a wide range of capacitance sensors involving changes in frequency. The manufacturer of the sensors used in this study uses a calibration based on scaled counts. Buss (1993) and Paltineanu and Starr (1997) developed calibrations for these sensors on several soil types based on scaled counts.

It was our experience that the calibration supplied by the manufacturer resulted in readings of soil water content ~0.02 cm$^3$ cm$^{-3}$ lower than gravimetric sampling. Likewise, the Paltineanu and Starr calibration was 0.005 to 0.01 cm$^3$ cm$^{-3}$ higher. The soils in this study have field capacities of 0.05 to 0.09 cm$^3$ cm$^{-3}$, making an error of 0.005 to 0.02 cm$^3$ cm$^{-3}$ highly significant.

The goal of this paper was to perform a single stage calibration under field conditions for the sensors used in our studies. The soil types used are all fine sand soils, very homogeneous in nature, and similar in most characteristics. The calibration resulting from this study provides soil water content values which are more representative of gravimetric content values in low water-holding sandy soils.

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References


Comments on “Artifacts Caused by Collection of Soil Solution with Passive Capillary Samplers”

The paper by Goyne et al. (2000) focuses on artifacts caused by the collection of soil solution with passive capillary samplers (PCAPS). They conclude that using PCAPS is not suitable for aqueous geochemical studies of dilute soil solutions, mainly because acid-washed PCAPS reduced Al concentrations and increased pH and concentrations of Ca, Na, and Si relative to zero-tension samplers. We believe that the authors cannot attribute unequivocally these differences in solution chemistry to leaching and weathering of PCAPS fiberglass wicks because they sampled two different categories of soil solutions, one at zero tension and the other one at 5.4 kPa (PCAPS). The two samplers collected different fractions of soil solution with different residence times in the soil and thus chemical composition (Marquès et al., 1996). We believe also that the concluding statements by Goyne et al. (2000) cannot be extrapolated for all soil geochemical studies. The PCAPS technique can be valid to collect soil solutions, as reported by us in forest acid soils on loess in Belgium (Brahy et al., 2000; Brahy, 2000). In our study (1995–1998), all samples from the two first sampling dates were discarded because some of them presented large pH values (6.1–8.3) and large Na$^+$ concentrations (1.1–8.2 mmol L$^{-1}$). These values rapidly decreased in the subsequent samples and reached values similar to the ones presented in Table 2 (Brahy et al., 2000). After 4 mo in our forest soils, the PCAPS seemed to interfere very little with the pH, the organic compounds, and the major cations and anions of the solution. The following observations support this assessment:

(i) Although we can not compare the composition of the soil solutions extracted with distinct sampling techniques, the concentrations we measured were quite similar to those measured in other European loessic soils under forest (Bredemeier et al., 1990; Van der Salm and De Vries, 2000).

(ii) In our soil solutions, the concentration of Si, Al, and the sum of the concentrations of alkali and alkali-earth cations (Na$^+$ + K$^+$ + Ca$^{2+}$ + Mg$^{2+}$ mmol L$^{-1}$) were positively and strongly correlated with the concentration of NO$_3$ ($R = 0.66, 0.92$, and $0.78$, respectively; $n = 100$). It is well known that in acid brown forest soils, the production of nitric acid has a major impact on the dissolution of aluminosilicates and the mobilization of Al, alkali, and alkali-earth cations (Berthelin et al., 1990). The fiberglass wicks do not adsorb or desorb NO$_3$ (Holder et al., 1991). Therefore, the correlations we measured support the fact that PCAPS interfered very little with Al, Si, Na, Ca, K, and Mg.

(iii) In addition to soil solution samplers, we used cation-exchange resin and test-vermiculite inserted in situ to study soil weathering processes. The ion accumulation on the resin and the transformation of the test-vermiculite are both in excellent agreement with the composition of the soil solutions (Brahy et al., 2000; Brahy, 2000). For example, the relatively large Mg amount sorbed by the resin in the AB horizon of the podzolized Cambisol is consistent with the large Mg concentration in the solution (Fig. 1). This large Mg concentration has been related to the weathering of Mg-bearing phyllosilicates depleted of Al interlayers in complexing environments (Brahy et al., 2000). We believe that the major discrepancies between our results and the results presented by Goyne et al. (2000) could be because of both the kind and the duration of the experiment and the sampling method.

Abbreviations

PCAPS, passive capillary samplers.