Using the Simplified Falling Head Technique to Determine the Saturated Hydraulic Conductivity of a Sieved Loam Soil Used Repeatedly

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**Abstract.** An experiment with a homogeneous soil is expected to yield stable saturated hydraulic conductivity, Ks, data between replicates since the variability typical of real soils is minimized. Little is known on the dependence of the Ks measurements on the reuse of the same soil mass.

The Simplified Falling Head (SFH) technique was applied to verify if reusing the same mass of a loam soil passed through a 2 mm sieve induced changes in the measured Ks values. The same soil was used for eight repeated determinations of Ks. Fifteen soil columns (diameter = 9.3 cm; height = 12.5 cm) were prepared on each date.

Three groups of results were broadly obtained. In particular, the first three datasets (R0, R1 and R2), developed with a nearly fresh soil material, yielded relatively stable and high means of Ks (66.9-75.6 mm/h). Stable means of Ks were also obtained with the last three datasets (R5, R6 and R7) but in this case Ks settled on nearly 2.0-2.5 times lower values (30.4-32.3 mm/h) as compared with the first three datasets. Finally, Ks decreased continuously from the R2 (66.9 mm/h) to the R5 (32.3 mm/h) datasets. Variability of Ks stabilized to small values (coefficient of variation = 8.6-10.4%) for the last five datasets. The soil became progressively finer as the number of reuses increased since the mean weight diameter, MWD, of the soil particles decreased from 0.63 mm before the first use (R0) to 0.36 mm after the seventh reuse (R7). The means of Ks increased with MWD.

Therefore, the soil particle size distribution varied as the same soil mass was reused and the SFH experiment was able to capture the impact of this change on determination of Ks. A limited number of reuses of a soil mass never used before should not be expected to appreciably affect determination of Ks. However, the data obtained with a fresh soil material can be higher and more variable than those obtained with additional reuses of the same soil mass. The highest repeatability of the SFH experiment and the lowest variability of the Ks values is expected when the soil mass has been previously used several times. In conclusion, a fresh soil should not be compared with an intensively used soil. If the objective of an investigation is to ensure homogeneity conditions as much as possible, the recommendation is to use a soil that has already been subjected to many wetting and drying cycles. Reporting the history of the used soil in the investigations dealing with saturated hydraulic conductivity of sieved and repacked soil is recommended.