Quantification of the influence of different Mini Disk Infiltrometer (MDI) suction settings when measuring infiltration across various soil types

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Abstract

Defining the infiltration characteristics of an area is beneficial for understanding soil compaction, determining soil health, and measuring the rate of surface water infiltration, which is needed for hydrological modelling. Single and double ring infiltrometers (SRI, DRI) are commonly used to determine infiltration characteristics in the field, however these are frequently impractical due to the required water volume, the weight and the intrusiveness of measurement, hindering the ease of replication. The Mini Disk Infiltrometer (MDI) offers a lightweight, portable and non-intrusive method of measuring infiltration, however no previous research has explained the influence of changing the tension settings on the collected infiltration data. To address this gap, this novel study tested the relationship between infiltration data collected using all tension settings of the Mini Disk Infiltrometer (MDI), against infiltration data collected using a 100mm Single Ring Infiltrometer (SRI). Three soil textures (sand, silt and clay) were collected from different geographical areas of the UK and deposited within the experimental facility designed for this study. Controlled infiltration measurements were taken with both the MDI and the SRI for each soil type, to further define the impact of MDI tension settings on derived infiltration, in comparison to the SRI. For the first time, the results show that the MDI tension setting of 0cm most closely replicated the findings of the SRI across all soils, which was supported through applying the Nash and Sutcliffe Efficiency (NSE) analysis. The accuracy with which the MDI replicated the infiltration of the SRI reduced as tension increased. Consequently, the previously assumed ideal tension setting of 2 cm, as defined by the MDI handbook and used in previous research, does not offer an accurate representation of derived infiltration.

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